# Sylen OWF

## Sediment Dispersal modelling

Svea Vind Offshore

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**Appendix**

# 1. Introduction

Sylen OWF has appointed NIRAS to quantify the impact on the dispersal of sediment in the construction phase.

During the construction of the wind farm, installation activities such as seabed preparations and cable burial may involves dredging at the foundation location and jetting of the cables to bury them safe for fishing activities, anchors, etc. This will potentially release sediments to the water resulting in excess sediment concentrations and when the sediments settle excess sedimentations rates.

The effects on the physical environment are analysed using numerical models.

# 2. Scope of Work

The purpose of the sediment dispersion study is to present the potential impact of sediment dispersal due to dredging, jetting etc. during the construction of the wind farm.

# 3. Abbreviation

| | |
|---|---|
| Current direction | Going towards |
| GBS | Gravity Based Structure |
| IAC | Inter array cable |
| MP | Monopile |
| OSS | Offshore substation |
| OWF | Offshore Wind Farm |
| TP | Transition piece, substructure |
| Wave direction | Coming from |
| Wind direction | Coming from |
| WTG | Wind turbine generator |

# 4. Summary

The main objective of this study is to investigate sediment dispersion during the construction phase. For this purpose, two types of numerical models were used:

1) A 3D hydrodynamic model to simulate water level, currents, salinity, and temperature.
2) A sediment model to simulate the spreading and deposition of sediments stirred up during the construction.

Prior to assessing the sediment dispersal, the hydrodynamic model was calibrated using publicly available water level, salinity, and temperature data from Sweden and Finland.

While the final wind farm layout is still open, the impact is investigated based on a case with 347 20 MW turbines and 8 offshore substations all on gravity-based substructures expected to be constructed over a period of 2 years each with 2 phases.

## 4.1. Baseline and representative year

The Sylen OWF is located in the south-western part of the Bothnian Sea, approximately 120 kilometres north of the narrowest zone of the Åland Sea.

The hydrographic conditions for Sylen OWF and the southern part of the Bothnia Bay (based on SMHI's 3D model, (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022) (Copernicus, Baltic Sea Physics Reanalysis 4x4km, 2022)) are characterised by a relatively low salinity (4.5-6.5 PSU). The interannual variability is so pronounced that no clear seasonal pattern is discernible.

Sea surface temperature varies from 0-2°C during the winter to over >20°C in July and August. Temperature is strongly stratified during the summer with a thermocline (zone of maximum temperature gradient) at around 10-30m depth. Between September and October, the water may warm up to 12-15° over the entire depth. The water depths at Style OWF is between 40 to 60 m.

Ice cover spreads from north to south starting in December and reaches a maximum extent in March, with the entire length of the west coast of Finland covered with ice. From June, the entire Gulf of Bothnia is ice-free again.

Due to the absence of tides, water level variations are mostly driven by variations at the Åland boundary, wind and pressure differences and account for ±100 cm around their average during the year.

Currents are generally weak (around 0.1 m/s), and mostly driven by wind as well as temperature and salinity differences. The strongest currents occur in the summer months. The average circulation in the Bothnian Sea is counter clockwise, which generally leads to a southward current along the Swedish coast. However, this large-scale pattern is interrupted by local eddies.

Based on data from SMHI's 3D model of the Baltic Sea the year-to-year variations were investigated and the year 2022 was found to be close to an average year and thus to be used as a baseline for description of the potential impact. In general, the year-to-year variation is small and unlikely to impact the conclusion.

## 4.2. Sediment dispersal

For the purpose of investigating the sediment spreading the following four types of sources were considered:

1) Dredging of the gravity-based substructures and offshore substations with a dredge capacity of 1000m$^3$/hour with 5% spill dispersed just above the seabed (released 2 meters over the seabed). The coarse sediment fraction settles next to the GBS (Gravity Base Structure, or the WTG and the OSS), and the finer ones are available for transport in the surrounding waters.
2) 10% of the total dredged sediments are assumed to overflow from the barge and are released at the surface and available for transport in the surrounding waters.
3) Burial of the inter array cable via jetting of a 1.5 x 2 m trench whereof 100% the sediments are assumed to be brought into suspension and released 2 m over the seabed.
4) Burial of the export cable via jetting of a 1.5 x 2 m trench whereof 100% the sediments are assumed to be brought into suspension and released 2 m over the seabed.

It is assumed that the construction will be conducted during two seasons with two phases per season each. In total, 2 419 914 m$^3$ sediment (including coarse material) are released (15% close to the surface and 85% at the bottom). Due to the composition of the soil, the amount of fine sediment (finer than sand) accounts to 46% in season 1 and to 40% in season 2.

**Sediment concentrations:** As a result of the significantly larger volumes released near the seabed,

- the greatest concentrations occur near the seabed (e.g. 1000 mg/l is reached or exceed during 6 hours over an area of 195 ha in season 1, and on 4 ha in season 2),
- the sediment reaches the greatest extent close to the seabed (e.g. 10mg/l is reached or exceeded during season 1 on an area of > 43,000 ha),
- and the duration in which a certain concentration is reached or exceeded is the longest close to the sea-bed (the concentration of 10 mg/l is reached or exceeded for a maximum 15 days, season 1).

Due to the larger proportion of fine sediment released in the first season, the concentrations, the affected area and duration tend to be greater in season 1.

**Sedimentation:** The sedimented sediments originate from the dredging of the gravity-based substructures and the offshore substations and the burying of the inter-array and export cables using jetting. The resulting sediment heights are most pronounced along the inter-array and export cables (maximum 30 mm, density 1,650 kg/m$^3$), where the largest amount of sediment is released. Sedimentation of at least 1 mm can be expected over an area of 19,365 ha (season 1), respectively 18,139 ha (season 2). Sedimentation > 0.01 mm extends approximately 38 kilometres to the south and 24 kilometres to the south-west (season 1).

# 5. Methodology

To estimate the dispersal of sediment two types of numerical models are used:

1) A 3D hydrodynamic model to simulate water levels, currents, salinity and temperature.
2) A sediment model to simulate the dispersal and deposit of the sediments dispersed due to the installation.

Before any evaluation of potential impacts the base model is calibrated toward the and publicly available water level, salinity and temperature data from Sweden and Finland.

Based on 10 years of data the Baseline is described and a representative period is identified and used for the simulation of the constriction and operation phase.

Bathymetric data for the model domain are extracted from the Baltic Sea Bathymetry Database (BSBD, last updated on 16/10/2017 (HELCOM, 2017)) which is based on modelled data from the countries around the Baltic Sea and is delivered as a grid with 500 meter resolution. Freely available boundary data of water level conditions will be applied at the boundary towards the Baltic Sea (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022) combined with wind fields and air pressure at the surface of the model domain. Wind data is obtained from ECMWF, ERA5 (ECMWF, 2022).

Two models will be set up:

1) A general model of the Gulf of Bothnia (regional model) and
2) A detailed model covering the same extent as the regional model, but with a better spatial (vertical and horizontal) resolution in the vicinity of the project area.

### 5.1.1. Hydrodynamic model

MIKE 3 HD FM (Hydrodynamics) is a hydrodynamic model with a flexible mesh. Based on tidal, current, salinity and temperature inputs along the open boundaries together with the meteorological conditions at the sea surface, the model simulates tide, current speed and direction, temperature, and salinity throughout the model domain across the water column. The benefit of a flexible mesh is the possibility of using varying sizes of the mesh across the domain. Therefore, the focus area can have a high resolution, and areas further away can have a coarser resolution. This makes the model run faster, with a minor impact on the simulation results.

### 5.1.2. Sediment model

MIKE 21/3 PT (Particle Tracking) is a so-called Lagrangian model which over time considers both the position and properties of the particles e.g., keeping track of the particle position in both x, y- and z-direction according to the local current field. This is the opposite of a Eulerian model which does this cell-wise where e.g. the concentration will be an average of the volume over each cell. This type of model is extremely sensitive to the model resolution both horizontally and vertically, whereas the Lagrangian approach is independent of cell sizes.

The selection of MIKE 21/3 PT for modelling the sediment dispersal is due to the nature of the plumes created by dredging, drilling, ploughing, and jetting. The plumes are initially narrow and occur in various water column depths. This is difficult to describe in a traditional model e.g., MIKE 21 MT (Mud Transport) mesh while maintaining a reasonable calculation time.

To assess the quantity and duration of spillage, it is important to understand the construction activities. Will they be carried out simultaneously or will they be carried out independently at short intervals from each other? This will have an impact on the modelling study as in the former scenario, a higher quantity of sediments will be spilled in a shorter duration and in the latter scenario, spillage will occur in smaller quantities but repeatedly at certain intervals.

# 6. Background data

This chapter presents the background data used in the numerical modelling and the description of the seabed geology, oceanographic and hydraulic conditions for the wind farm. This includes project specifications, metocean data, soil data and bathymetric data.

## 6.1. Layout, Project description

### 6.1.1. Wind farm Layout

The layout of Sylen Offshore Wind Farm is illustrated in Figure 6.1. The footprint covers an area of 524 km$^2$, the total number of turbines for the 20 MW case is 347, there are 8 offshore substation, 465 km infield cables and 163 km export cable in the economical zone.

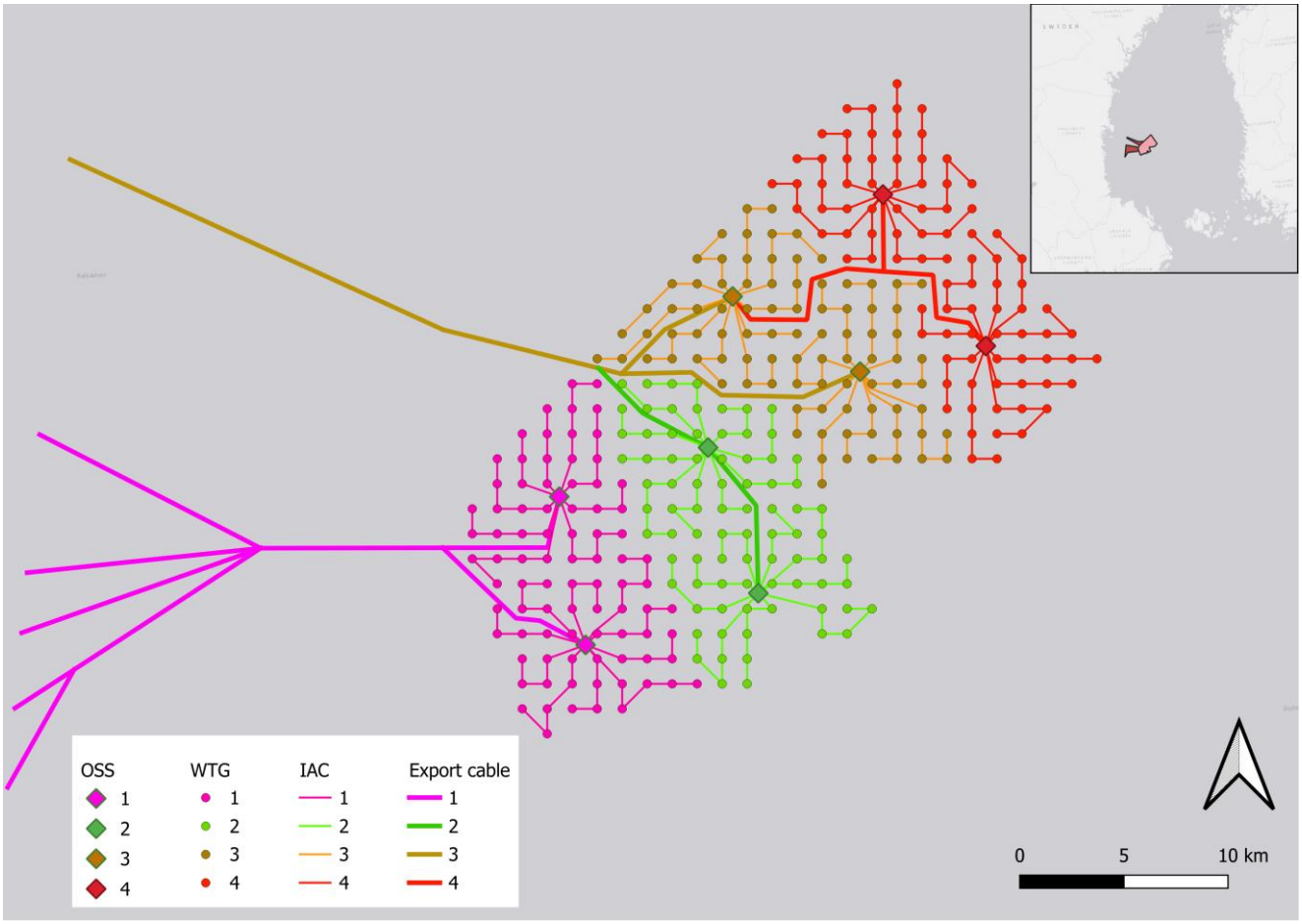



*Figure 6.1: Sylen, wind farm layout coloured according to the phase.*

### 6.1.2. Sediment sources - Construction Phase

The considered cases are as listed Table 6-1 based on the use of GBS that requires levelling/excavation of the seabed prior to installation. Afterwards are the cables between foundations first surfaced laid on the seabed and then jetted down to 2 metres. Similar with the export cables.

The sediment spills from these activities are assumed to be:

- Levelling/ excavation 5% of the fines released 2 m above the seabed.
- Overrun from the barge discharging another 10% of the fines at the surface.
- Jetting of the export and inter-array cables where all the sediment in the trench is brought into suspension releasing some of the fine sediments 2 m above the seabed i.e. 100%.

Where the fines are defined as the sediment with a grain size smaller than 0.25 mm i.e. fine sand, silt and clay. Coarser sediment is for the jetting assumed to settle in the trench and for the dredging not to released. It is assumed that the construction will be conducted in two simultaneous phases during two different seasons (phases 1 and 2 will be constructed during season 1, phases 3 and 4 during season 2).

### 6.1.3. Dimensions and gross sediment spill

In Table 6-1 the dimensions of the supporting substructures to be used for the modelling are listed per phase and installation season.

*Table 6-1: Substructure dimensions inclusive spill percentage and gross spill.*

| Case | - | 25MW GBS Season 1, Phase 1 | 25MW GBS Season 1, Phase 2 | 25MW GBS Season 2, Phase 3 | 25MW GBS Season 2, Phase 4 | Total |
|---|---|---|---|---|---|---|
| **Capacity** | **MW/Unit** | **25** | **25** | **25** | **25** | |
| Substructure | - | GBS | GBS | GBS | GBS | |
| Capacity, total | MW | 2,150 | 2,050 | 2,225 | 2,250 | 8,675 |
| Nos | # | 86 | 82 | 89 | 90 | 347 |
| Bottom diameter, base | m | 45 | 45 | 45 | 45 | |
| Top diameter, base | m | 8 | 8 | 8 | 8 | |
| Drilling/dredging depth | m | 5 | 5 | 5 | 5 | |
| Spill percentage, dredging | % | 5% | 5% | 5% | 5% | |
| Spill percentage, overrun | % | 10% | 10% | 10% | 10% | |
| Vol. to be removed | $m^3$/pos. | 9,817 | 9,817 | 9,817 | 9,817 | |
| Total drilled/dredged vol. | $m^3$ | 844,303 | 805,033 | 873,755 | 883,573 | 3,406,665 |
| Spill, gross foundation | $m^3$ | 126,645 | 120,755 | 131,063 | 132,536 | 511,000 |
| Length infield cable | m | 112,947 | 111,036 | 121,311 | 120,113 | 465,407 |
| Trench 1.5x2m, Dispersed | $m^3$ | 338,841 | 333,108 | 363,933 | 360,339 | 1,396,221 |
| Spill percentage | % | 100% | 100% | 100% | 100% | |
| Spill gross | $m^3$ | 338,841 | 333,108 | 363,933 | 360,339 | 1,396,221 |
| Spill, gross infield cable | $m^3$ | 338,841 | 333,108 | 363,933 | 360,339 | 1,396,221 |
| Length export cable | m | 80,768 | 14,406 | 47,205 | 20,674 | 163,053 |
| Trench 1.5x2m, Dispersed | $m^3$ | 242,304 | 43,218 | 141,615 | 62,022 | |
| Spill percentage | % | 100% | 100% | 100% | 100% | |
| Spill gross | $m^3$ | 242,304 | 43,218 | 141,615 | 62,022 | 489,159 |
| Spill, gross export cable | $m^3$ | 242,304 | 43,218 | 141,615 | 62,022 | 489,159 |
| No. OSS | # | 2 | 2 | 2 | 2 | 8 |
| Bottom diameter, base | m | 55 | 55 | 55 | 55 | |
| Dredging depth | m | 5 | 5 | 5 | 5 | |
| Spill percentage, dredging | % | 5% | 5% | 5% | 5% | |
| Spill percentage, overrun | % | 10% | 10% | 10% | 10% | |
| Vol. to be removed | $m^3$/pos. | 11,879 | 11,879 | 11,879 | 11,879 | 47,517 |
| Spill, gross OSS | $m^3$ | 3,564 | 3,564 | 3,564 | 3,564 | 14,255 |
| Spill, gross | $m^3$ | 711,354 | 500,645 | 640,175 | 558,461 | 2,410,635 |
| Spill, net | $m^3$ | 489,412 | 344,444 | 440,440 | 384,221 | 1,658,517 |

## 6.2. Bathymetry data

The water depths in the model are based on the Baltic Sea Bathymetry Database (BSBD, last updated on 16/10/2017 (HELCOM, 2017) presented in Figure 7.1 (together with the mesh).

## 6.3. Observations

Observational data are used for model calibration. Figure 6.2 provides an overview of the locations of the measuring points for the individual parameters.

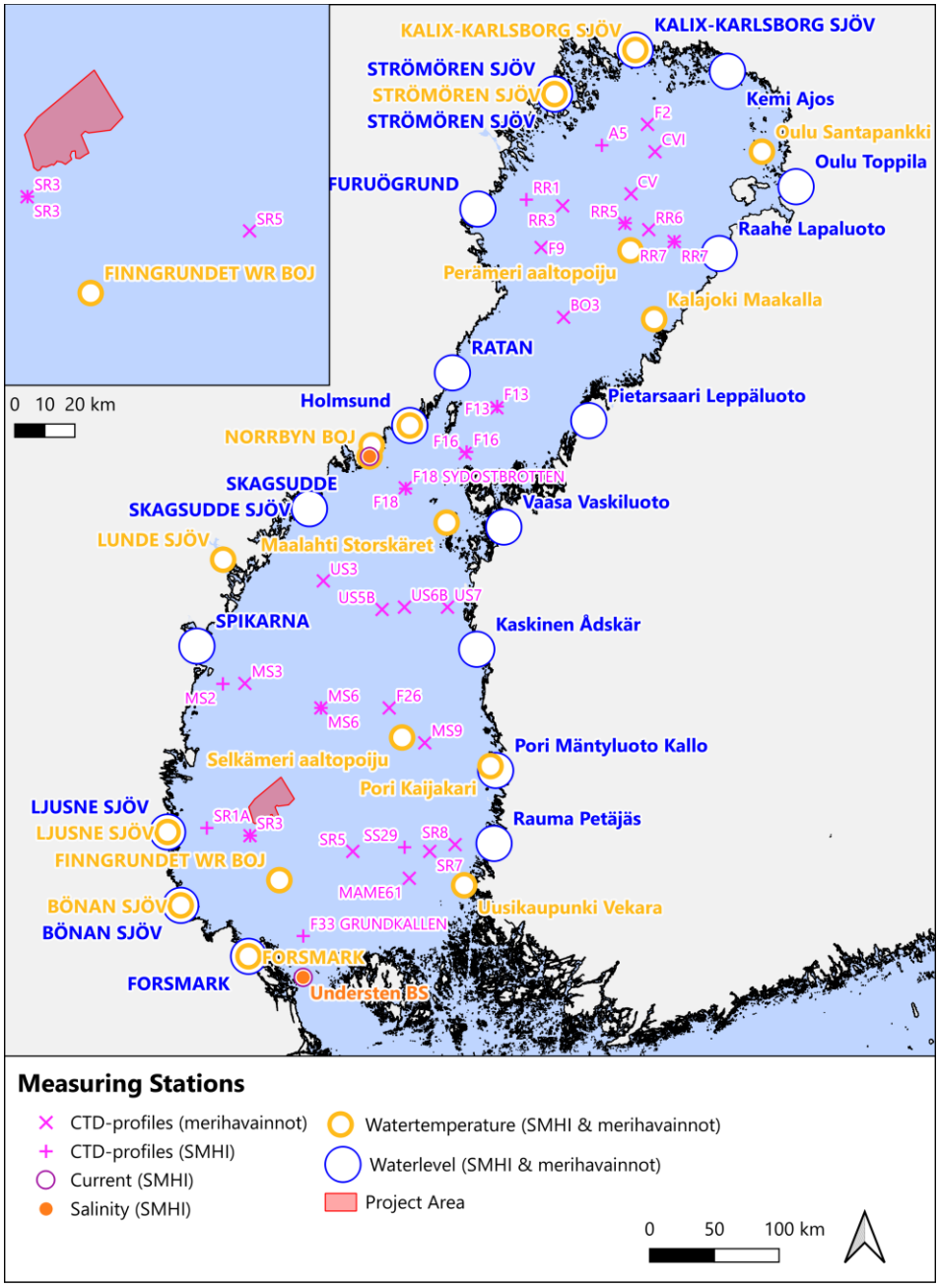



*Figure 6.2: Location of water level, current, water temperature, and salinity monitoring stations used for calibration and validation of the hydrodynamic model.*

### 6.3.1. Water levels

Water levels with an hourly resolution have been obtained from the SMHI (Swedish) and the FMI (Finish) stations (see table in Appendix 10), extracted for the period available. The locations of the water level stations are displayed in Figure 6.2. Due to the large number of available stations, the water level variations are discussed using two stations located in the immediate vicinity of the project (Figure 6.2). Water levels for these stations are displayed in Figure 6.3 to Figure 6.4, showing a maximum variation of ± 1.00 m around a mean of approximately 0 m. No dominant tidal pattern is evident.

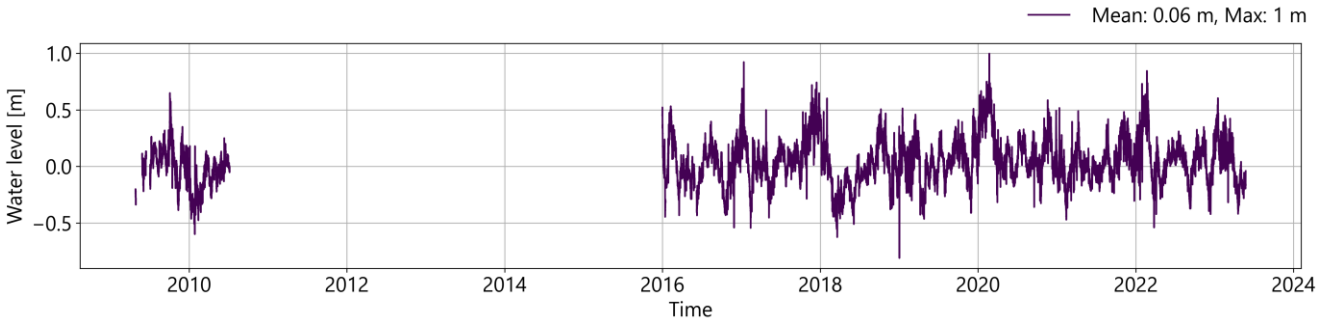



*Figure 6.3: Measured water level at LJUSNE SJÖV (SMHI-Station).*

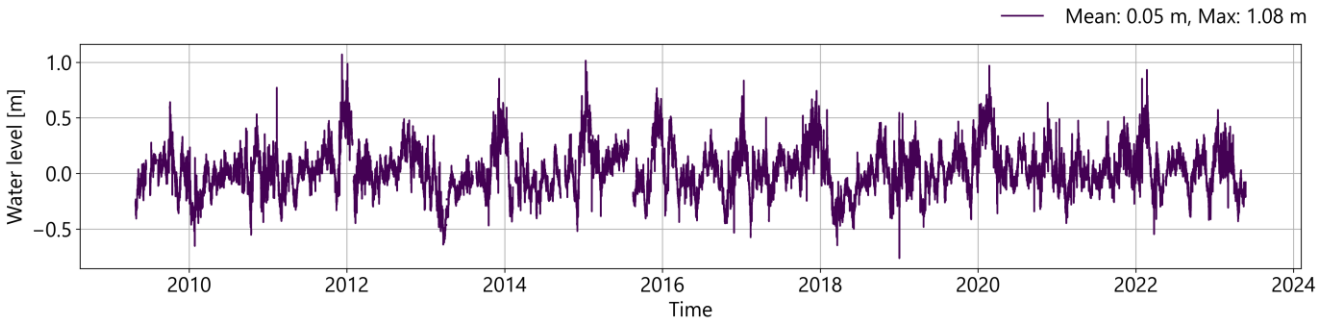



*Figure 6.4: Measured water level at BÖNAN SJÖV (SMHI-Station).*

### 6.3.2. Currents

Current speeds and directions with an hourly resolution have been obtained from the following SMHI stations (Table 6-2)

- NORRBYN BOJ between 1 and 41 m depths for the period 2016-2021 (Figure 6.5 and Figure 6.6) and
- Understen BS at 217-219 m depth for the year 2021 (Figure 6.7 and Figure 6.8).

*Table 6-2: Current measuring stations used in the present study.*

| Name | ID | Lat | Long | Source |
|---|---|---|---|---|
| **NORRBYN BOJ** | 33021 | 63.4990 | 19.8044 | SMHI |
| **Understen BS** | 33038 | 60.2715 | 19.9302 | SMHI |

**Speed:** The speeds recorded at the measurement station Understen BS, Figure 6.7 & Figure 6.8, with a mean of approx. 20 cm/s are significantly higher than at NORRBYN, Figure 6.5 & Figure 6.6, with means< 10 cm/s. This is due to the location of the measuring stations. While Understen BS is located in the narrows of the Åland Sea at least 13 km from the coast, NORRBYN BOJ is located further north, in a wider section approximately 3 kilometres from the coast.

**Direction:** A dominant current in the north, north-east direction can be identified at the measuring station Understen BS. In contrast, the flow direction at NORRBYN BOJ is evenly distributed, with a slight trend towards the east, increasing with depth.

Both measuring station are not suited for the model calibration due to their location (immediate proximity to the open model boundary (Understen BS) or to the coast (NORRBYN BOY)).

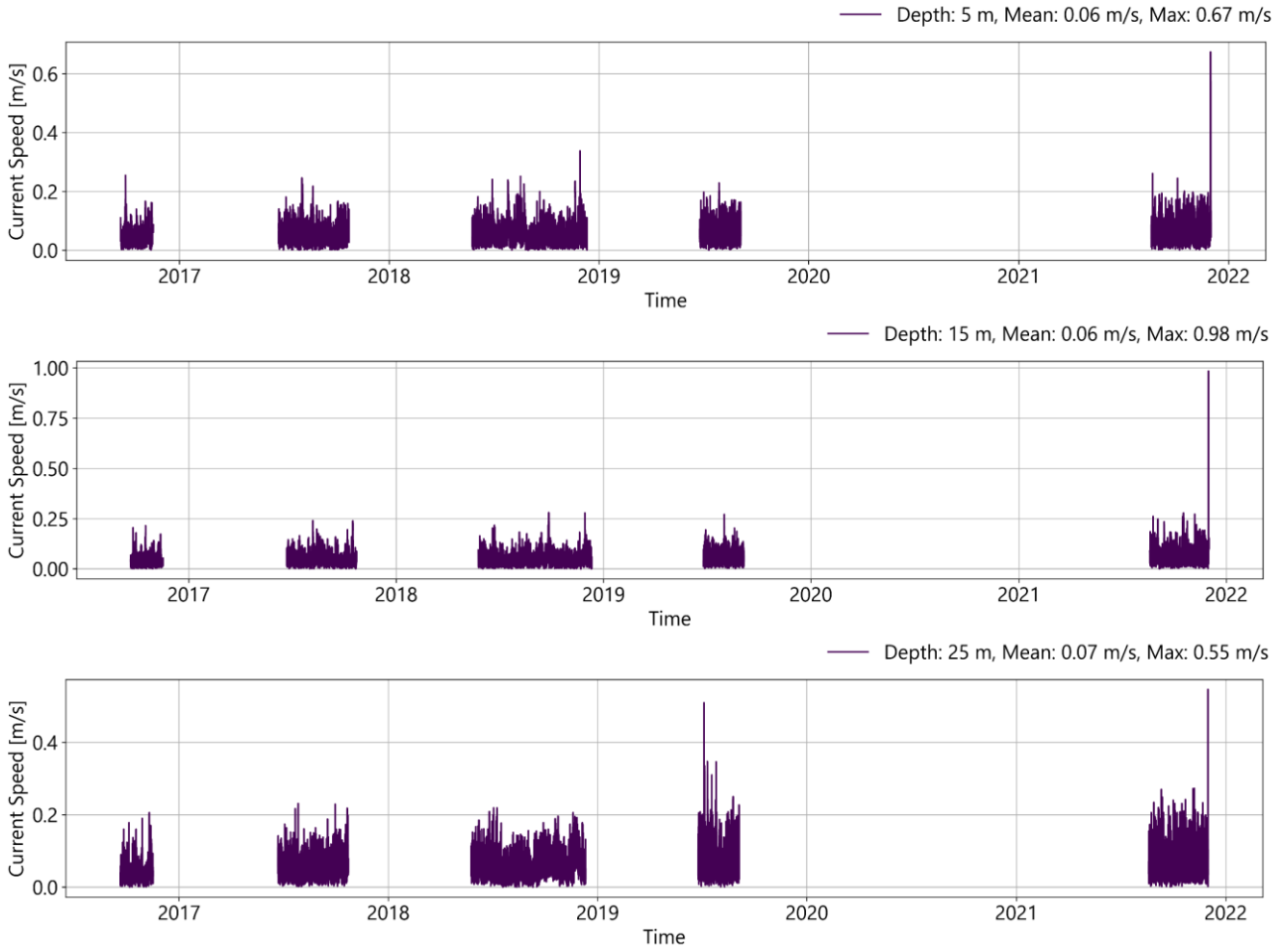



*Figure 6.5: Measured current speed at NORRBYN at 5 m, 15 m, and 25 m depth (from top to bottom).*

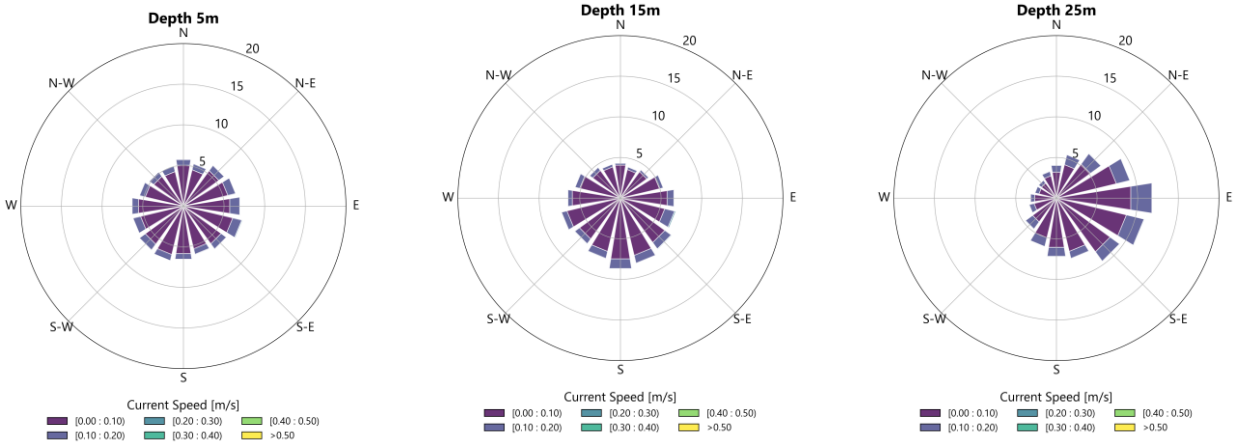



*Figure 6.6: Measured current direction at NORRBYN at 5 m, 15 m, and 25 m depth (from left to right).*

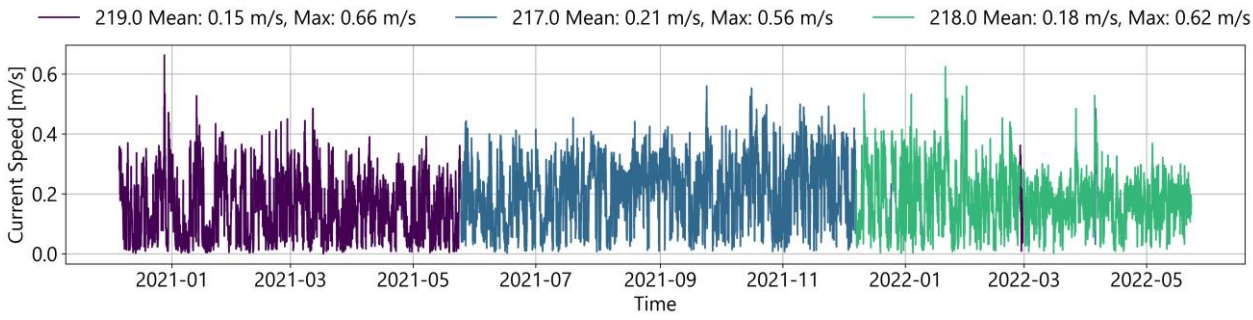



*Figure 6.7: Measured current speed at Understen BS between 217 and 219 m.*

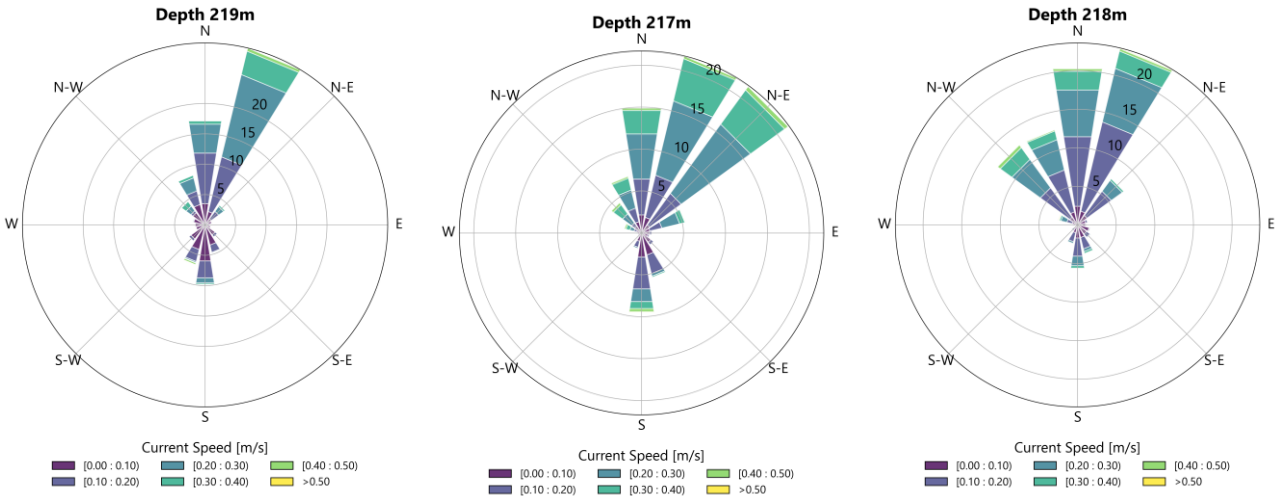



*Figure 6.8: Measured current direction at Understen BS between 217 m and 219 m (the corresponding time period of the measurment is depicted in Figure 6.7).*

### 6.3.3. Salinity

Salinity data with an hourly resolution have been obtained from the SMHI stations NORRBYN BOJ (lat: 63.499, long: 19.8044, depth: 7 m) for the period 2016-2021 (Figure 6.9) and Understen BS (lat: 60.2715, long: 18.9302 depth: 220 m) for the year 2021 (Figure 6.10). Despite the large data gaps, the following two patterns are recognisable:

- Spatial pattern tending towards lower salinity in the northern area (as there are no strong vertical variations, see chapter 6.3.4).
- Annual pattern with tendency towards lower salinity between February and April.

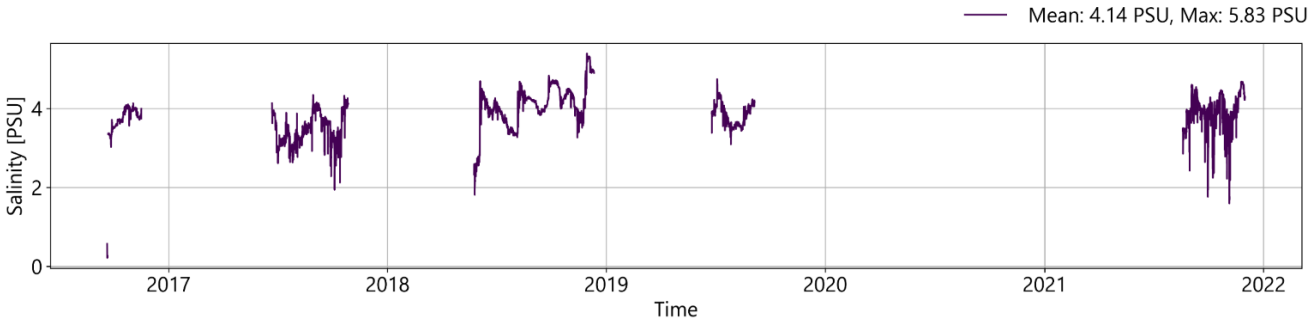



*Figure 6.9: Measured salinity at NORRBYN BOJ at 7 m (SMHI-Station).*

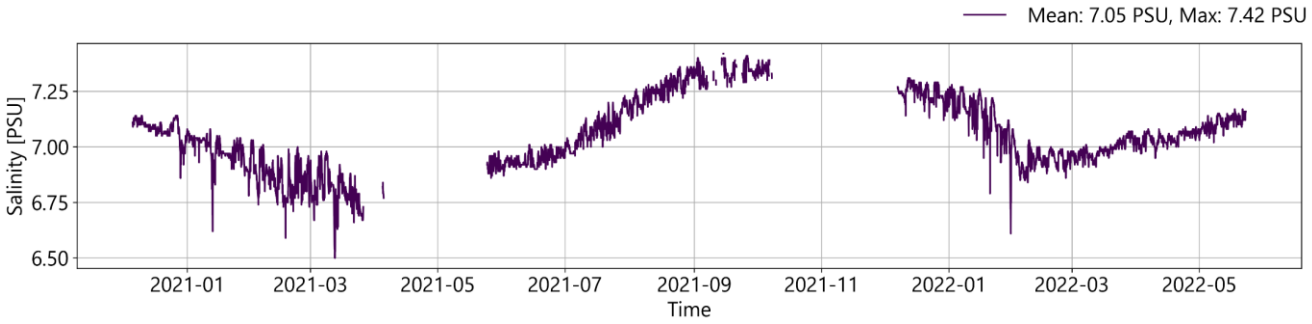



*Figure 6.10: Measured surface salinity at Understen BS at 220 m (SMHI-Station).*

### 6.3.4. Vertical Profiles (CTD) Measurements of Salinity

Publicly available vertical salinity profiles have been downloaded from SMHI (Swedish) and Merihavainnot.fi (an open-access marine data service maintained by the Finnish Environment Institute (SYKE)). Out of the approximately 230 available monitoring stations, 14 Swedish and 25 Finish (partly overlapping) stations were considered in more detail and used for model verification (see table in Appendix 11).

Due to the large number of available stations, salinity profiles and their temporal evolution are discussed based on the example of two stations only; F2 (Figure 6.11) and SR5 (Figure 6.12) in the northern (Bothnian Bay) and southern (Bothnian Sea) parts, respectively (see Figure 6.2). While the temporal and vertical variations are small regardless of location, there is a significant difference in salinity between the two stations. Similar to the surface salinity, lower salinity concentrations are measured at the station further north (F2, Figure 6.11), where almost no halocline is evident. In contrast, there is a clear halocline between 50 m and 80 m at SR5.

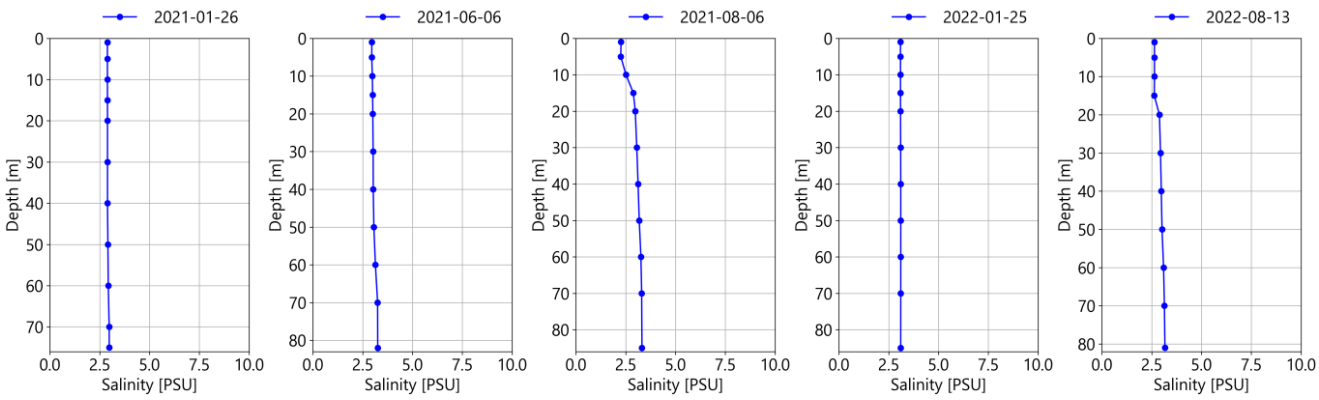



*Figure 6.11: Measured Salinity profile at station F2 (source: merihavainnot.fi, location see Figure 6.2).*

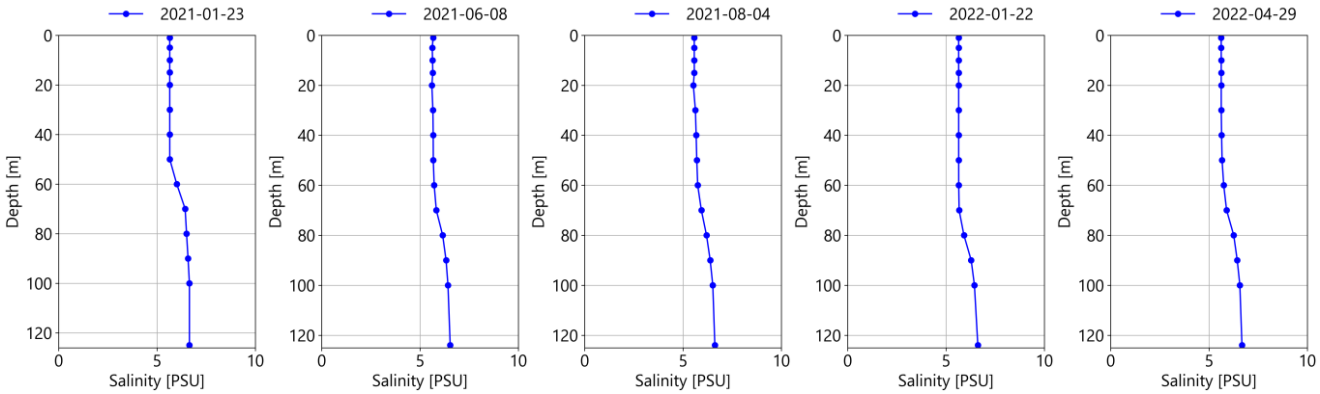



*Figure 6.12: Measured Salinity profile at station SR5 (source: merihavainnot.fi, location see Figure 6.2).*

### 6.3.5. Water temperature

Surface temperature with an hourly resolution have been obtained from 9 SMHI (Swedish) and 7 FMI (Finish) stations (see table in Appendix 12). The locations of the surface temperature stations are displayed in Figure 6.2. Due to the large number of available stations, the temporal surface temperature variations are discussed based on two locations, located either in the northern part (STRÖMÖREN SJÖV Figure 6.13) or in the southern part (LJUSNE SJÖV, Figure 6.14).

Significant annual fluctuations can be observed at both stations. While the measured minimum and maximum temperatures are at both stations varying between 0° and approx. 25°, the northern station (KALIX-KARLSBORG SJÖV Figure 6.13) shows a clearly longer period (approx. November to May) during which the surface temperatures stands at around 0°. At the southern station (LJUSNE SJÖV, Figure 6.14), the surface temperature is only around 0° for about 3 months (January-March) explaining the 1.5° higher annual mean value.

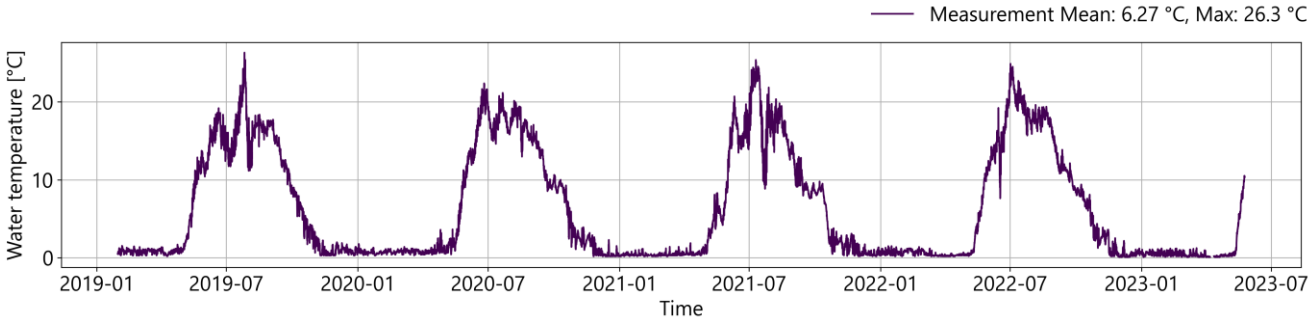



*Figure 6.13: Measured surface water temperature at STRÖMÖREN SJÖV (SMHI-Station).*

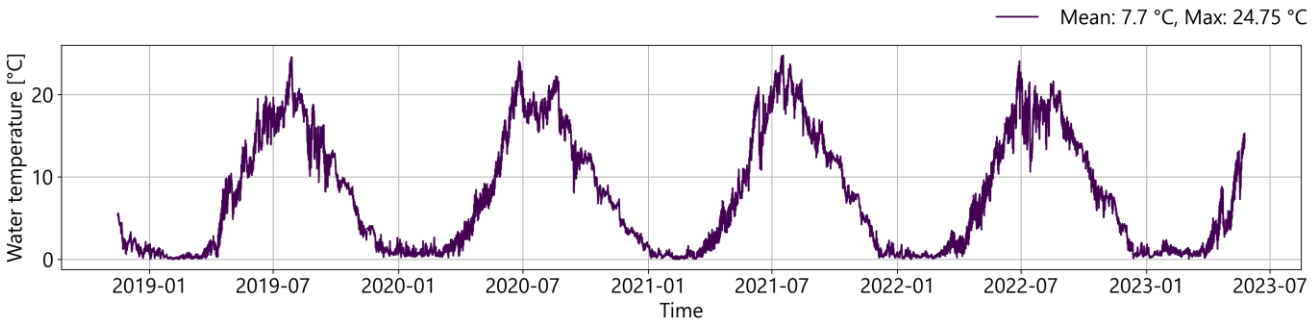



*Figure 6.14: Measured surface water temperature at LJUSNE SJÖV (SMHI-Station).*

### 6.3.6. Vertical Profiles (CTD) Measurements of Temperature

Temperature profiles are available at the same locations as salinity (see table in Appendix 11 and Figure 6.2). As with the salinity, due to the large number of available stations, the temperature profiles and their temporal evolution are discussed for two stations only, namely F2 and SR5 (in the northern and southern part respectively, see Figure 6.2).

The measurements of the temperature profiles (in contrast to the vertical profiles of salinity) show seasonal and vertical fluctuations in temperature at both stations. While the vertical variations in temperature are relatively small in January, there is a thermocline visible between 10-30 m in August. Comparing the two stations, it can be seen that the water at station SR5 (in the southern part) tends to be warmer, while the surface temperature at F2 fluctuates more.

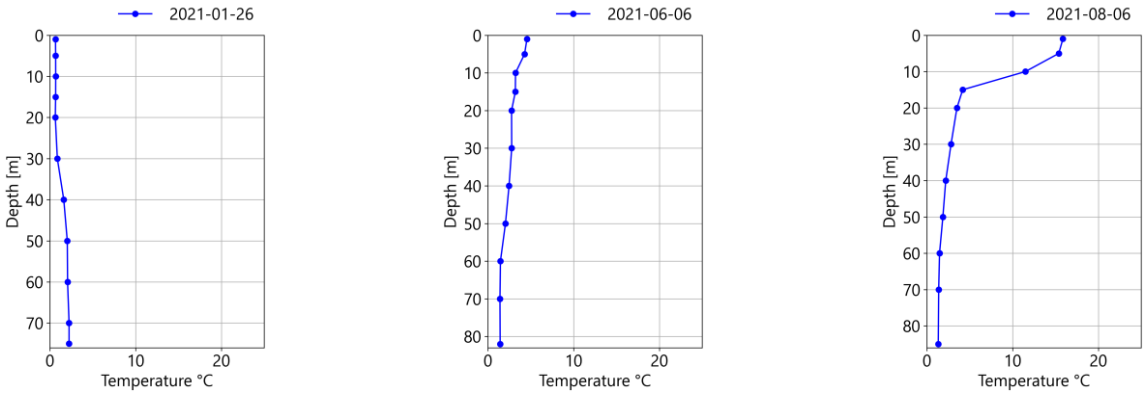



*Figure 6.15: Measured temperature profile at station F2 (source: merihavainnot.fi, location see Figure 6.2).*

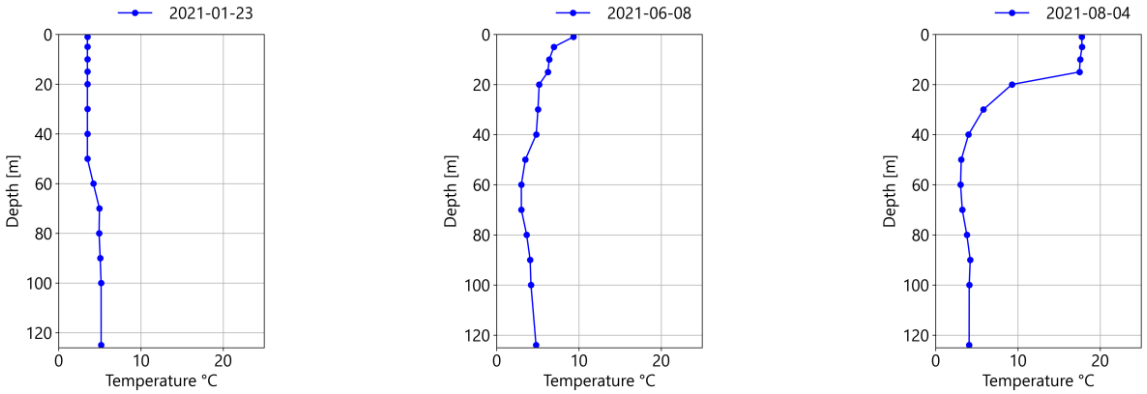



*Figure 6.16: Measured temperature profile at station SR5 (source: merihavainnot.fi, location see Figure 6.2).*

## 6.4. Hydrodynamic data from models

### 6.4.1. Water levels

Data from the 2km by 2km SMHI 3D Baltic Sea model are used at the Åland Sea boundary conditions to feed the MIKE model (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022) and (Copernicus, Baltic Sea Physics Reanalysis 4x4km, 2022).

### 6.4.2. Currents

To identify a representative year for simulating impacts on hydrodynamics and sediment dispersal, SMHI 3D Baltic Sea model results at Sylen OWF (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022) and (Copernicus, Baltic Sea Physics Reanalysis 4x4km, 2022) are presented in Appendix 2, Appendix 7 and Appendix 8.

### 6.4.3. Salinity and Temperature

For initialisation and to feed the model at the boundary, data from SMHI's numerical model of the Baltic Sea are used, (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022) and (Copernicus, Baltic Sea Physics Reanalysis 4x4km, 2022).

Data from selected years are presented in Appendix 3 to Appendix 6.

## 6.5. Wind, Air Pressure, Air Temperature, Net long and short-wave radiations

Atmospheric data in the form of instantaneous wind speed at 10 mMSL in x and y-directions, air pressure at the surface, air temperature at 2 m above the surface, relative air humidity, and net long and short-wave radiation at the surface have been extracted from ECMWF (ECMWF, 2022). The data have a horizontal resolution of 0.25 degrees and a temporal resolution of 1 hour.

## 6.6. Sea ice

The presence of sea ice is based on data produced by SMHI, (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022) and (Copernicus, Baltic Sea Physics Reanalysis 4x4km, 2022) as ice thickness and concentration (Figure 6.17 and Figure 6.18). As the figures illustrate, the ice cover spreads from north to south starting in December and reaches a maximum extent in March, with the entire length of the west coast of Finland covered with ice. From June, the entire Gulf of Bothnia is ice-free again. The project area is not affected by long-lasting ice cover (at least in 2021).

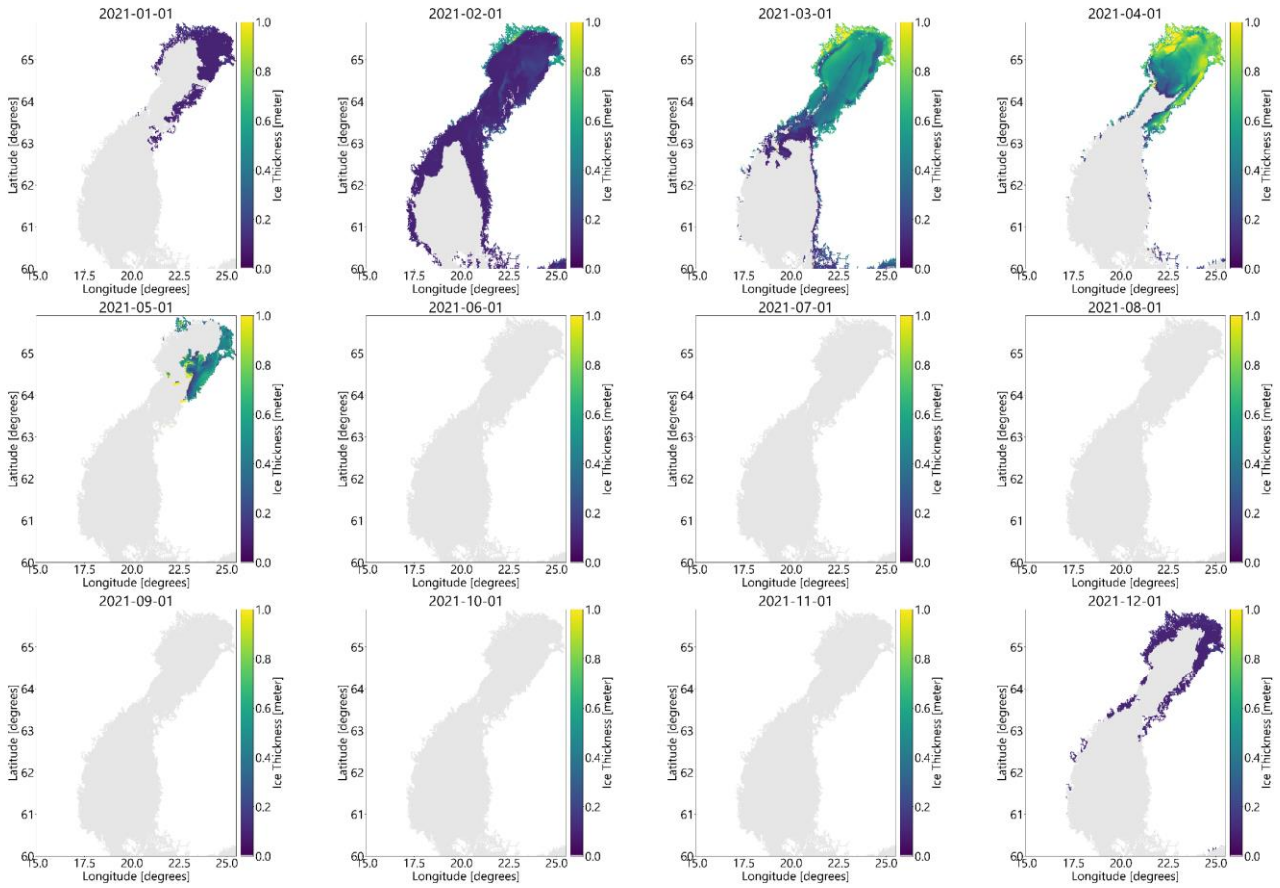



*Figure 6.17: Temporal evolution of the ice thickness in during the year of 2021.*

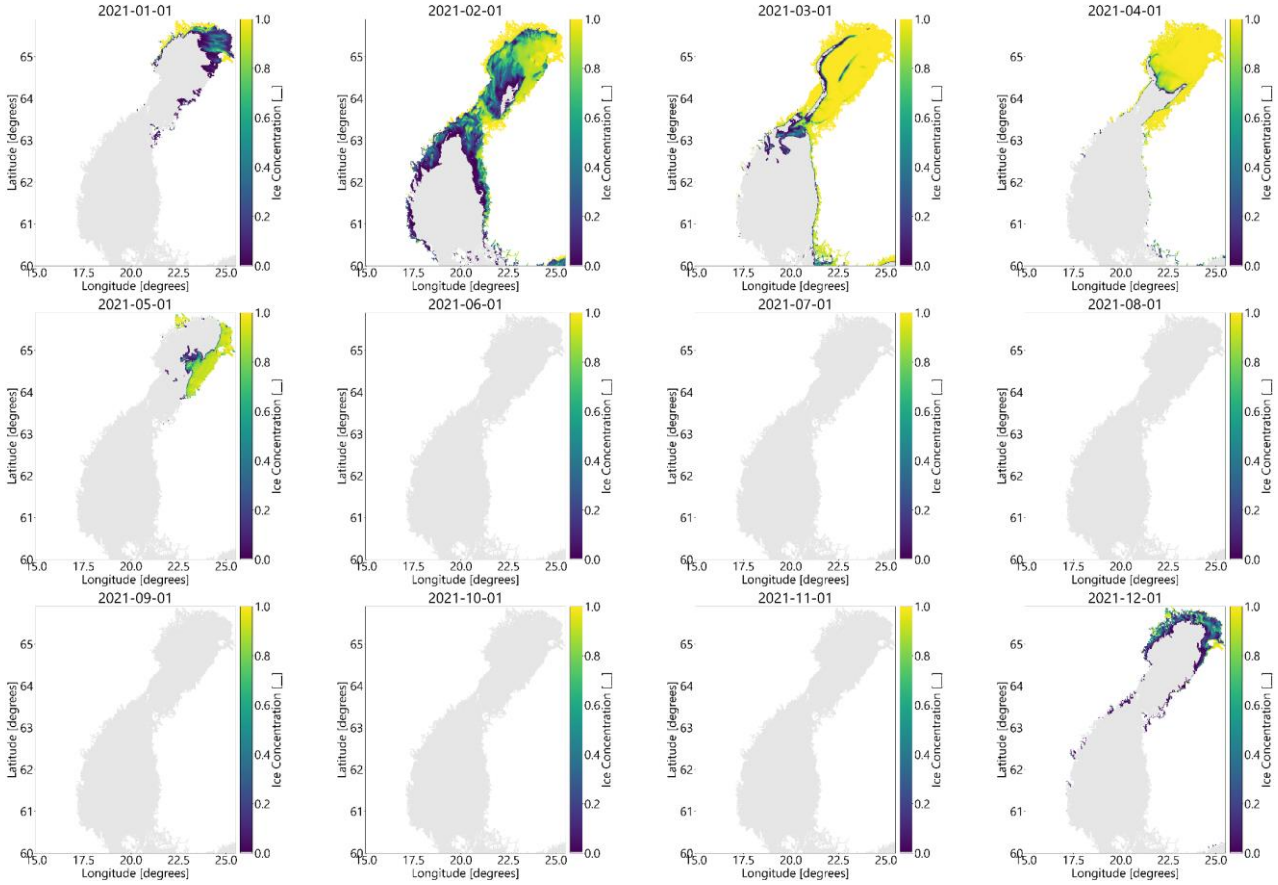



*Figure 6.18: Temporal evolution of the ice concentration during the year of 2021.*

## 6.7. Run-off

The following major freshwater discharges (average discharge greater than 100m$^3$/s) to the Gulf of Bothnia are used as input to the model:

- Kokemäenjoki (Harjavalta station, lat: 61.34, long: 22.11; Finland)
- Oulujoki (Merikoski station, lat: 65.023, long: 25.47; Finland)
- Iijoki (Raasakka station, lat: 65.33, long: 25.41; Finland)
- Kemijoki (Taivalkoski station, lat: 65.93, long: 24.71; Finland)
- Tornionjoki (Karunki station, lat: 66.03, long: 24.02; Finland)
- Kalixälven (lat: 65.8, long: 23.25; Sweden)
- Luleälven (lat: 65.56, long: 22.05; Sweden)
- Piteälven (lat:65.30, long: 21.44; Sweden)
- Skellefteälven (lat: 64.71, long: 21.18; Sweden)
- Umeälven (lat: 63.74, long: 20.36; Sweden)
- Ångerman (lat: 63.03, long: 17.78; Sweden)
- Indalsälven (lat: 62.5, long: 17.5; Sweden)
- Ljungan (lat: 62.28, long: 17.4; Sweden)
- Ljusnan (lat: 61.2, long: 17.13; Sweden)
- Dalälven (lat: 60.62, long: 17.49; Sweden)

For the Swedish rivers, modelled and station-corrected daily discharges and temperatures have been obtained from the SMHI VattenWebb platform for the years 2020-2023. For the Finnish rivers, observed daily discharges have been obtained from the Finnish environmental institute Ymparisto, and water temperatures have been assumed similar to those of the Swedish river at the closest latitude. The discharges and temperatures of the main rivers are shown in Figure 6.20 and Figure 6.22, respectively, the total river discharge in Figure 6.21 and their location in Figure 6.19.

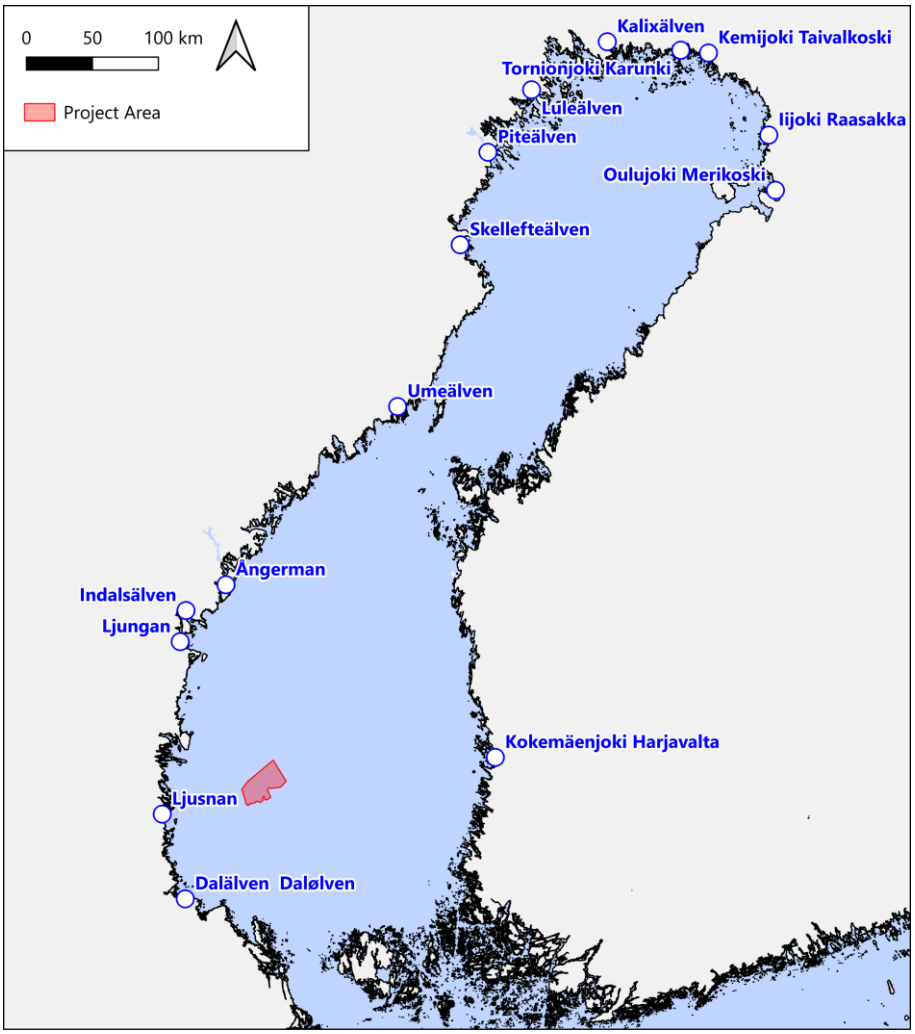



*Figure 6.19: Location of the main rivers included in the model.*

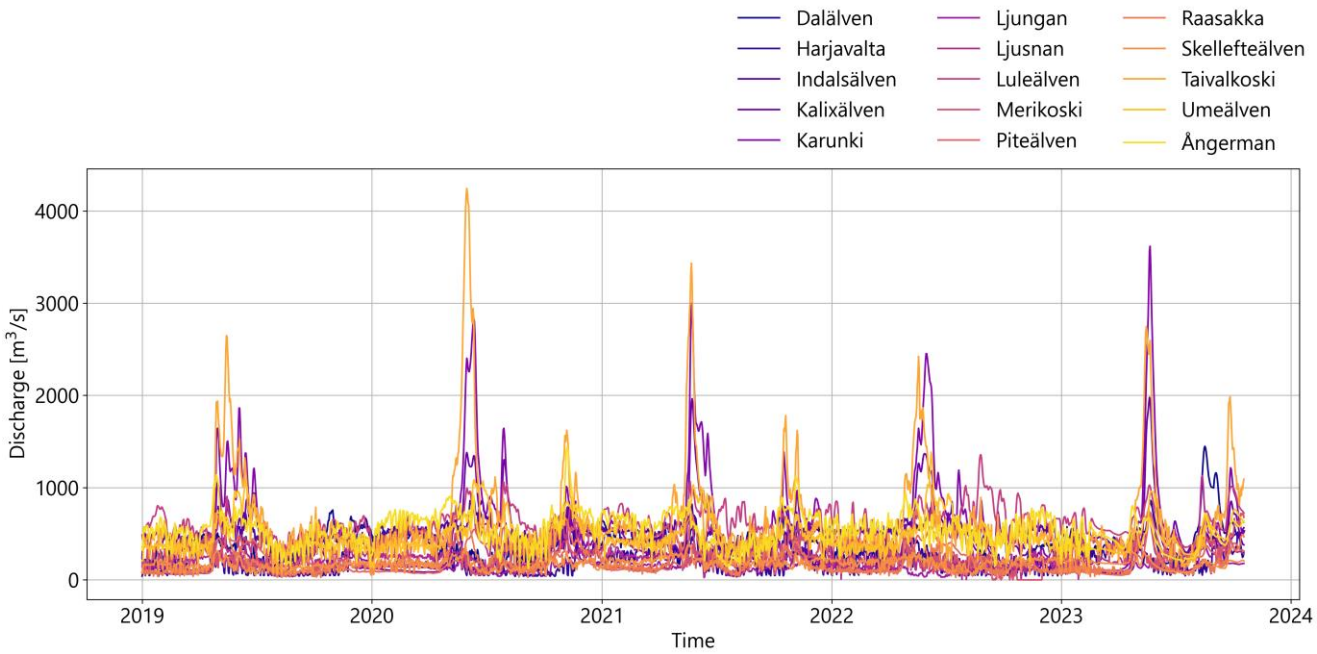



*Figure 6.20: Daily discharges [$m^3/s$] for the main rivers considered in the model.*

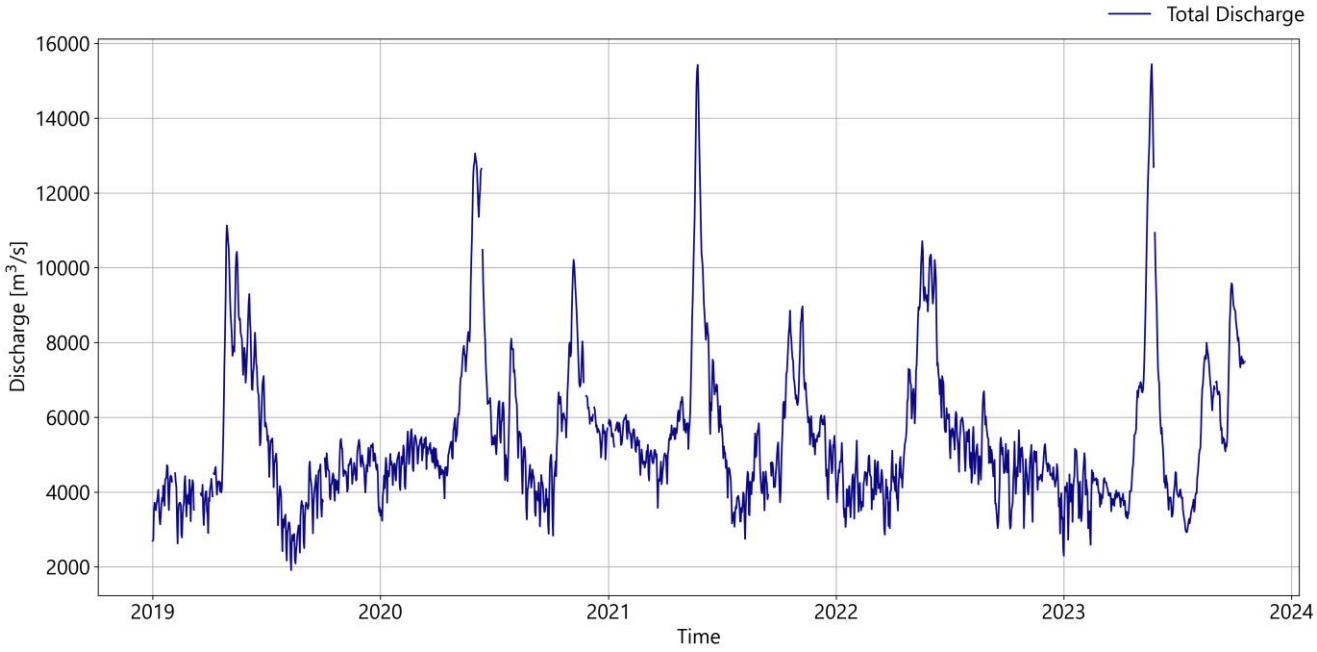



*Figure 6.21: Total river discharge [$m^3/s$] into the model.*

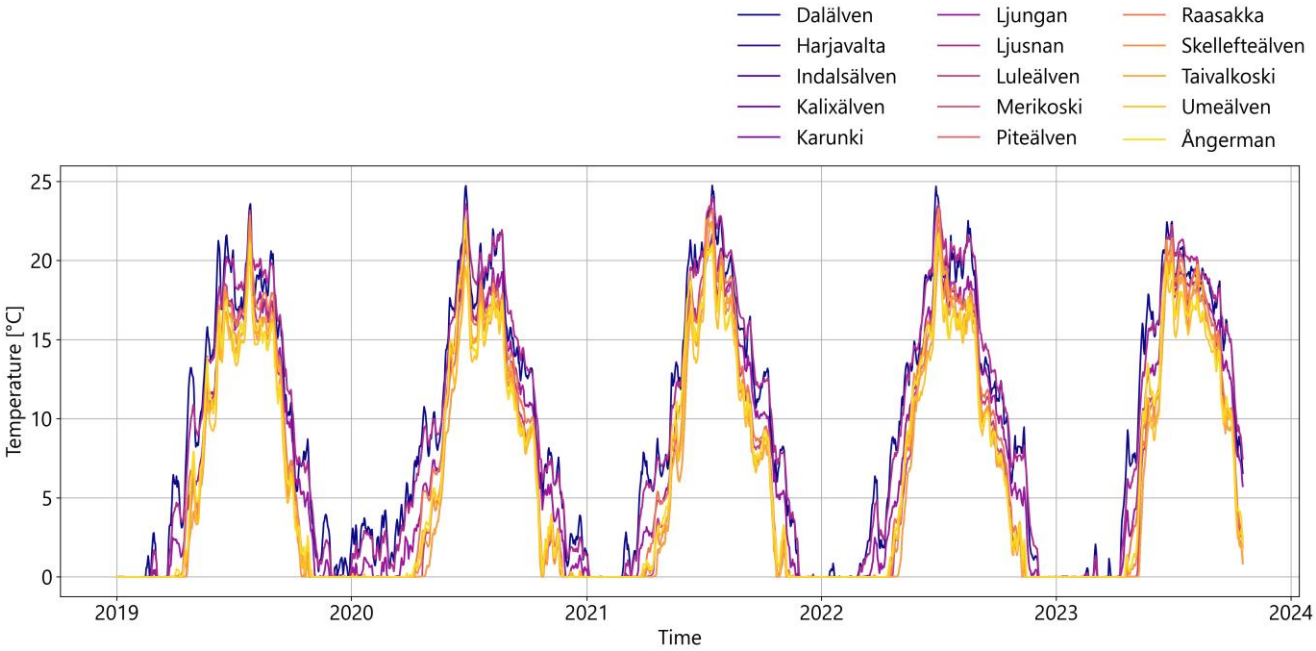



*Figure 6.22: Daily water temperatures [°C] for the main rivers considered in the model.*

## 6.8. Surficial sediments, seabed geology

The general image of the surficial sediments present in the wind farm and the surrounding area is based on data provided by the client as grains sieves analyses, Appendix 1, and backscatter data, Figure 6.23.

The seabed within the wind farm and along the export cable is classified into 2 categories. For each of the categories, the grain size distribution for the spill sources located in that category is represented by an average value based on the grain sieve data from the Sylen OWF representing the same category.

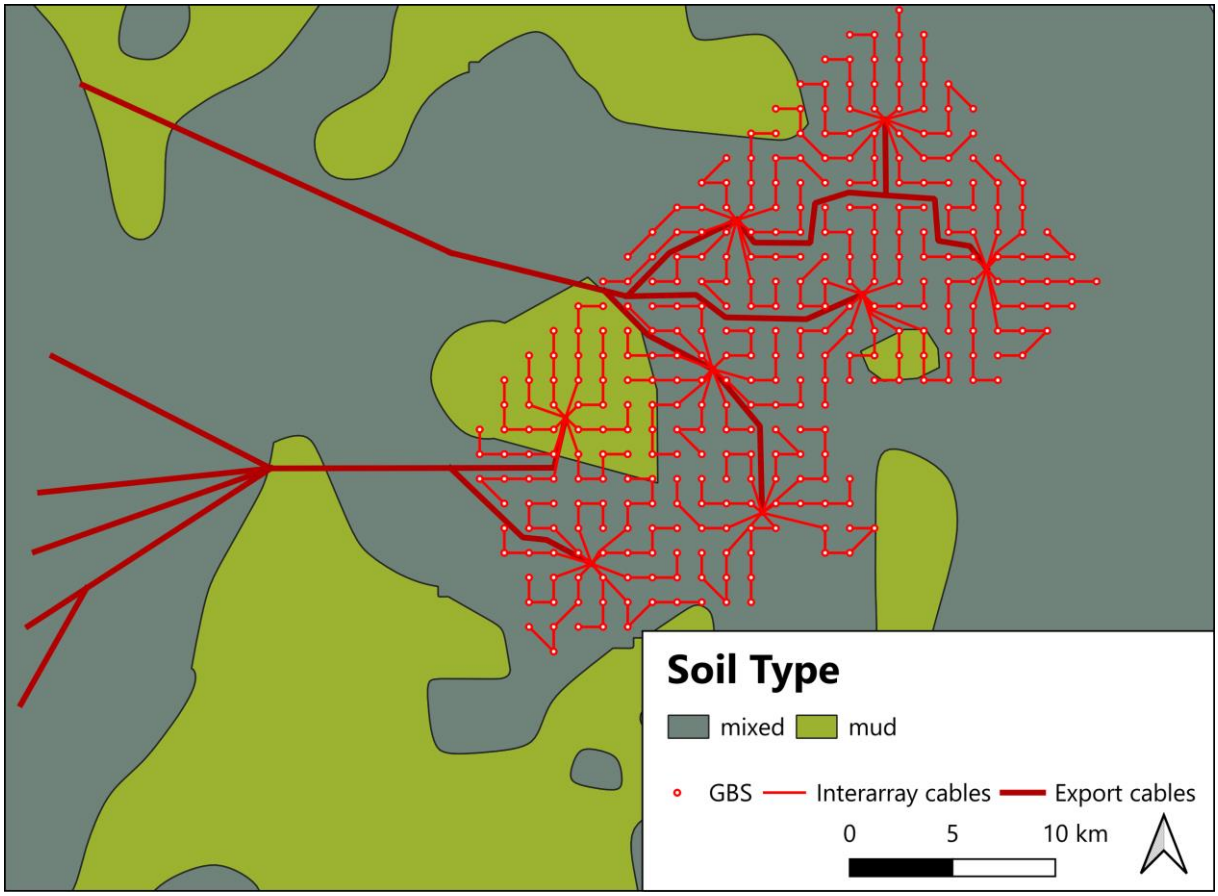



*Figure 6.23: Interpretation of surficial sediments from backscatter data.*

## 6.9. Baseline description

The Sylen OWF is located in the south-western part of the Bothnian sea, approximately 120 kilometres north of the narrowest zone of the Åland Sea.

Hydrographic conditions at the Sylen OWF southern part of the Bothnia Bay are characterised by a relatively low salinity (4.5-6.5 PSU). Salinity varies within and also between years (Appendix 5 and Appendix 6), with the generally higher values presented in Appendix 6 probably due to the different resolution. The interannual variability is so pronounced that no clear seasonal pattern is discernible.

Water temperature varies from 0°C during the winter to up to >22°C occurring in July and August. According to the SMHI model results (Appendix 3 and Appendix 4) the water temperature dropped below 0° for a maximum of two months (February and Mach) in 2010, 2011, 2013 and 2018, with the cooling extending a maximum depth of 25 m (2010). Since 2019, no temperatures below 0° have been documented. Temperature is strongly stratified during the summer with a thermocline (zone of maximum temperature gradient) around 10-30 m depth. Between September and October, the water may warm up to 12-15° over the entire depth.

Due to the absence of tides, water level variations are mostly driven by variations at the Åland boundary, wind and pressure differences and amount to ±100 cm around their average during the year. Currents are generally weak, around 0.15m/s at the surface (maximum of 0.5m/s) and less than 0.07m/s below 30m, and mostly driven by wind as well as temperature and salinity differences. The strongest currents occur in the summer months

(May to August, especially July see Appendix 2). The average circulation in the Bothnian Sea is counter clockwise, which generally leads to a southward flow along the Swedish coast. This large-scale pattern is interrupted by local eddies, which is why no dominant flow direction is recognisable in the flow roses (Appendix 7 and Appendix 8).

# 7. Hydrodynamic 3D model (Regional & Local)

## 7.1. Bathymetry and mesh

### 7.1.1. Regional model

To account for regional circulation patterns, the regional 3D hydrodynamic model encompasses the whole Gulf of Bothnia (see Figure 7.1, Bothnian Sea and Bothnian Bay). The boundary with the Baltic Proper is located at the narrowest zone of the Åland Sea. The regional model is used for calibration and validation of the hydrodynamic processes, and to force the local pressure model (see below). To maintain reasonable simulation times, the model has a relatively coarse horizontal resolution (16 $km^2$). The mesh constitutes of 12,934 elements and 7,486 nodes. To capture temperature and salinity stratification, which are more pronounced in the surface layer, the water column is divided into 15 vertical elements for depths up to 30 meters (hybrid sigma layers), giving a minimum vertical resolution of 3 meters. The part of the water column deeper than 30 meters is described using constant depth layers of 12 meters. The bathymetry in the Gulf of Bothnia varies between 0 meter at the coast to 250 meters for the north-western Bothnian Sea.

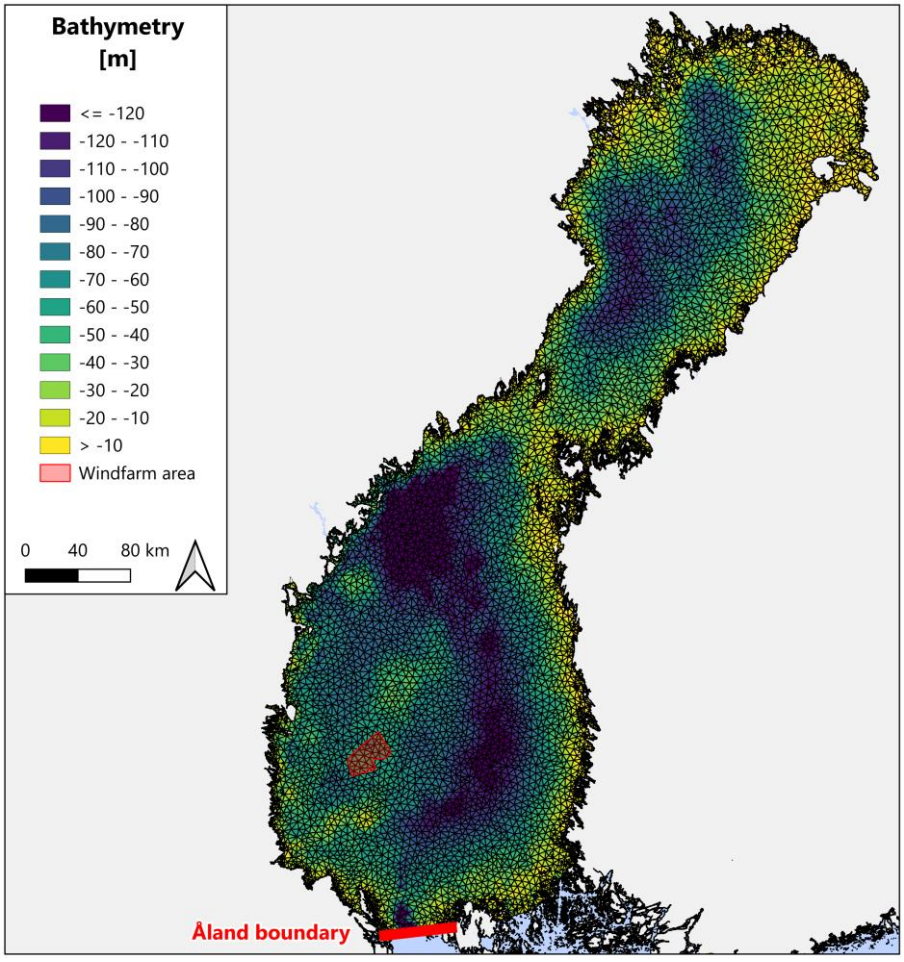



*Figure 7.1: Mesh and associated bathymetry (MSL) of the regional model*

### 7.1.2. Local sediment model

To model sediment dispersal (Figure 7.2), the local sediment model represents the same area as the regional model with the difference that the vertical resolution instead of a combination of sigma and z-layer only consist

of sigma-layers to avoid artificial sediment traps due to the z-layers. The model consists of 50,539 elements and 26,318 nodes, and its vertical resolution is 21 sigma layers spanning over a depth of -73.5 m.

The local model has a varying horizontal resolution, continuously increasing towards the windfarm area and the export cables (from 16 km$^2$ to 4 km$^2$ given a distance of more than 50 km, 15 km respectively). In the area within a distance of 15 km the resolution is increased to 0.5km$^2$. Along the export cables and within the wind-farm area, where the impacts of sediment dispersal are expected to be the strongest, the maximum cell size is set to 0.09km$^2$. The sediment model is forced by the same boundary data as the regional model.

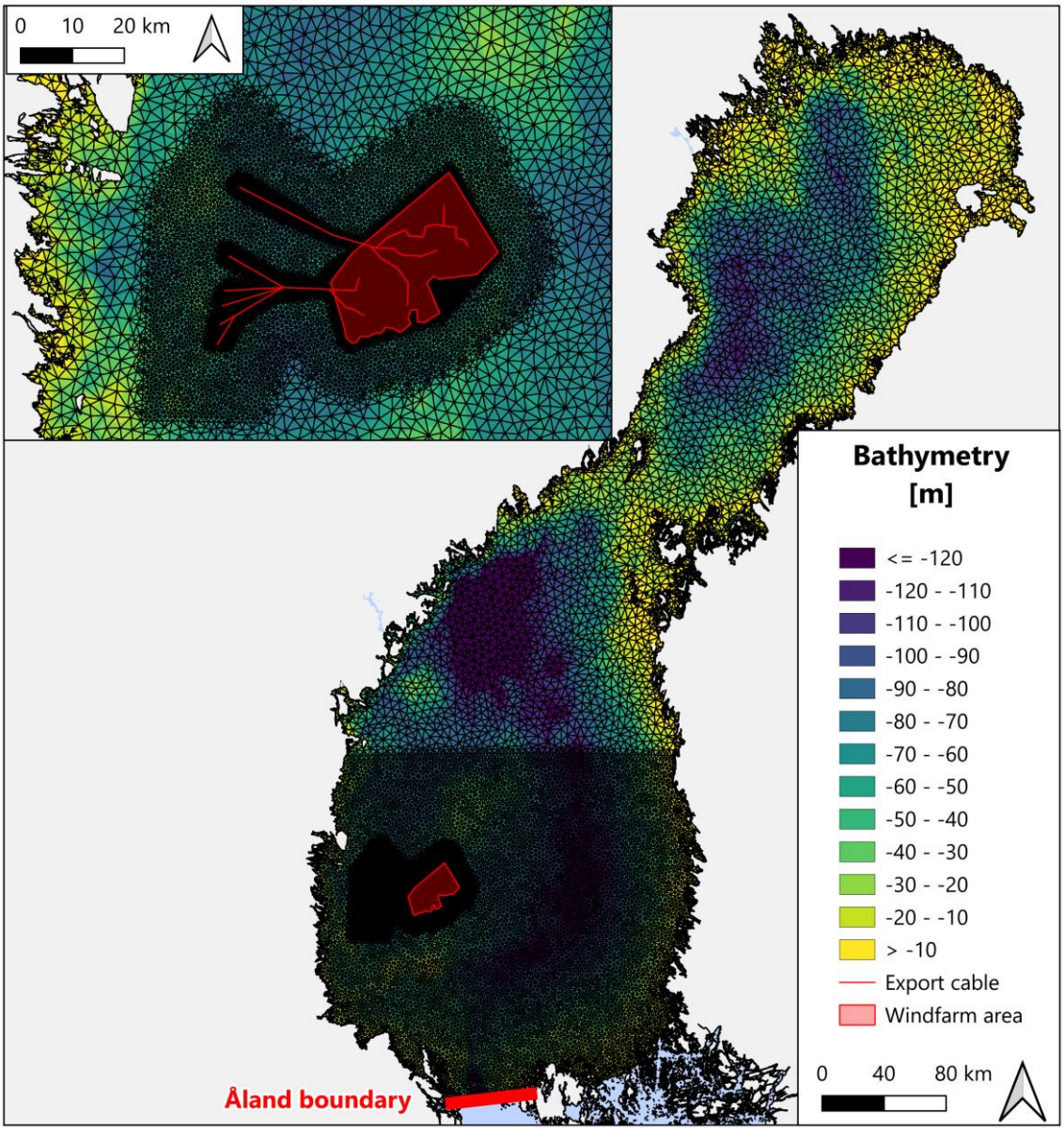



*Figure 7.2: Zoom of the mesh and associated bathymetry of the local sediment model for analysis of sediment dispersal.*

## 7.2. Boundary data

The regional model at the open boundary towards the Baltic Sea is forced with modelled SMHI data regarding salinity, temperature, and water level. At the surface, ECMWF's ERA5 wind data in the form of wind fields, air pressure, precipitation and evaporation, and sea ice concentration and thickness from the Baltic SMHI model

are considered. Heat exchange with the atmosphere has been taken into account via data from ECMWF's ERA5 of net short and longwave radiation, air temperature and humidity at the sea surface. Forcings from the catchment are also considered through the freshwater discharges temperatures from the major rivers listed in chapter 6.7.

To minimize the spin-up period the model is for the first time-step initialized with salinity, temperature and surface elevation from the Baltic Sea SMHI model.

## 7.3. Model setup and calibration

The regional model is forced at the southern boundary using specified water levels, and salinity and temperature profiles from the Baltic SMHI model. Water levels have been calibrated by adjusting the wind friction coefficients to get a reasonable agreement with observation data.

To account for salinity and temperature stratification, the vertical eddy viscosity is resolved using the k-ε turbulence model. Salinity and temperature profiles have been calibrated against available measurements within the project area by adjusting the vertical and horizontal dispersion coefficients, and surface temperatures have been calibrated through the light extinction coefficient determining the depth of the light penetration in the water column.

## 7.4. Identification of a representative period

Based on modelled temperature, salinity and currents at Sylen OWF from SMHI Baltic Sea model, presented in Appendix 2, Appendix 3 to Appendix 8, and a simplified particle tracking analyses based on the horizontal currents of the SMHI Baltic Sea model (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022), shown in Appendix 9, an average year is identified by comparing yearly conditions.

Interannual variations are generally small for temperature, but significant for salinity and current. There is a general counter-clockwise circulation pattern in the Bothnian Sea, but this is disturbed by local eddies. There is a clear seasonal pattern in the modelled particle trajectories (Appendix 9), with stronger transport in the winter months and less dispersion in the summer months (May - August).

The year 2022 has been chosen as a representative year as it follows the general increase in salinity end of spring and the lower surface salinity end of summer as well as the seasonal pattern in modelled particle trajectories, Appendix 9. Temperature is highest in late summer with a thermocline going down to 15 meters. Thermocline depth in this area varies between 10-30 m, so that 15m is on the lower side and indicates slightly reduced vertical mixing.

Comparison between modelled currents by the 2km by 2km and 4km by 4km SMHI models indicate increased current speeds and more evenly spread direction components in the finer version. The average magnitude of the current is in general around than 0.1 m/s with an anti-clockwise circulation (Appendix 2). Within the project area, currents flow in general southwards.

The year 2022 experiences anti-clockwise currents circulation aligned with the general variations in the current pattern. On that background the year 2022 was chosen to investigate the effects of the wind farm on hydrodynamics and of its construction on sediment spreading.

## 7.5. Verification

The verification of the regional model is based on the comparison of the simulated and measured, publicly available data from 2021. The following parameters are taken into account:

- Observed water levels.
- Observed timeseries of surface temperature and salinity.
- Observed CTD measurements.

Due to the inappropriate location of the current measuring stations (distance to the project area, close vicinity to the shore or the boundary), a comparison of the measured and simulated currents is not carried out.

### 7.5.1. Water levels

The visual comparison of the calculated water levels with the observed water levels in 2021 (Figure 7.3 to Figure 7.5, as well as entire overview of all stations in Appendix 13 demonstrates good agreement for all stations in the period mid-May and mid-November with correlation coefficients varying between 0.89 - 0.95 (July in Appendix 13) and between 0.92-0.97 (September in Appendix 13).

While the agreement between calculated and measured water levels at the southwestern stations (FORSMARK, BÖNAN SJÖV(Figure 7.3), LJUSNE SJÖV, SPIKARNA, SKAGSUDDE SJÖV (see Appendix 13) is comparably good over the entire year with correlation coefficients between 0.93 -0.95 (Table 7-1), lower correlation coefficients are observed at the remaining stations.

The visual comparison (Appendix 13) reveals an underestimation of the water levels by the model between December and May. The further north or east the station lies, the more pronounced the difference is. For example, the calculated water levels at the RATAN station in March show a mean error of -0.39 m (Figure 7.4), while those at the STRÖMÖREN SJÖV (Figure 7.5) station show a mean error of -0.76 m (see Appendix 13). As shown by the comparison of the location of stations with ice cover (Figure 6.17 and Figure 6.18), there is a correlation between ice cover and low water levels in the model compared to the measurements (as the difference occurs mainly at stations and in the period when ice cover is documented). The underestimation can be explained by the fact that ice thickness is not included in water levels in MIKE.

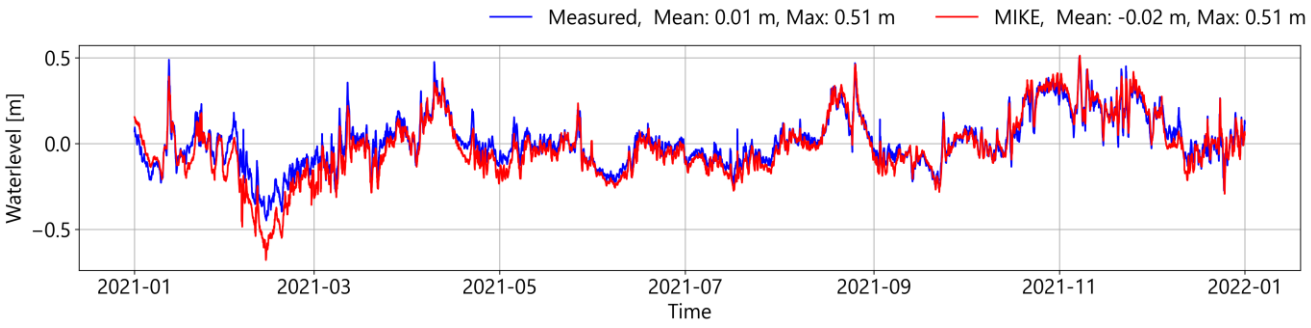



*Figure 7.3: Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for BÖNAN SJÖV (SMHI-Station).*

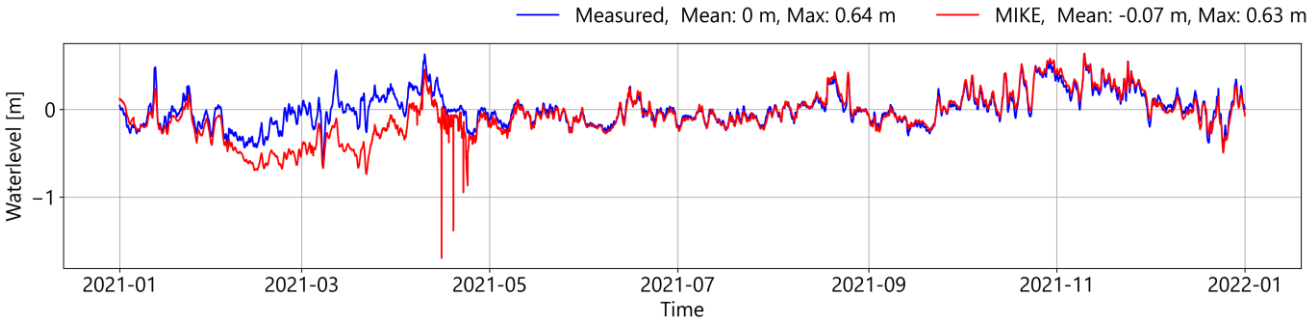



*Figure 7.4: Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for RATAN (SMHI-Station).*

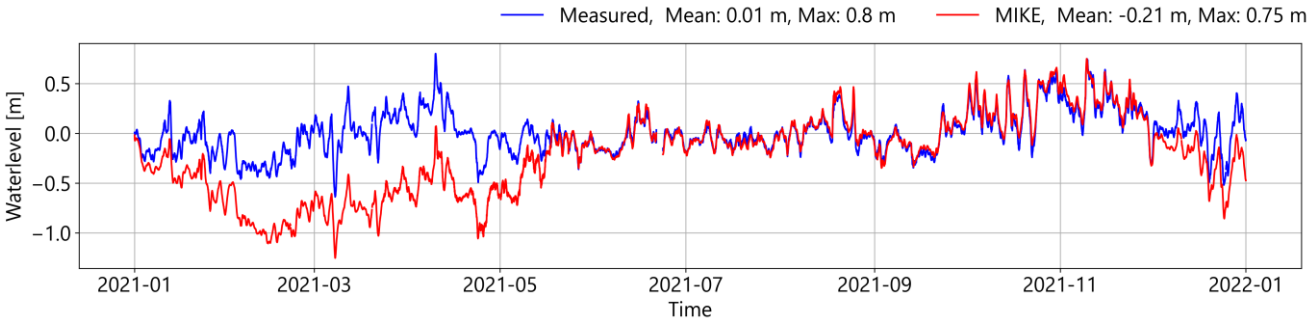



*Figure 7.5: Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for STRÖMÖREN SJÖV (SMHI-Station).*

*Table 7-1: Performance Metrics of the HD-Model in respect to the Water levels (over 2021).*

| Name | ME [m] | MAE [m] | RMSE [m] | Std. of Residuals [m] | Correlation Coefficients [-] |
|---|---|---|---|---|---|
| **FORSMARK** | -0.01 | 0.04 | 0.06 | 0.06 | 0.95 |
| **BÖNAN SJÖV** | -0.03 | 0.05 | 0.06 | 0.06 | 0.95 |
| **LJUSNE SJÖV** | -0.04 | 0.06 | 0.07 | 0.06 | 0.94 |
| **SPIKARNA** | -0.04 | 0.05 | 0.07 | 0.06 | 0.96 |
| **SKAGSUDDE SJÖV** | -0.05 | 0.06 | 0.09 | 0.08 | 0.93 |
| **Holmsund** | -0.10 | 0.11 | 0.18 | 0.16 | 0.81 |
| **RATAN** | -0.07 | 0.10 | 0.17 | 0.15 | 0.80 |
| **FURUÖGRUND** | -0.18 | 0.20 | 0.33 | 0.27 | 0.66 |
| **STRÖMÖREN SJÖV** | -0.22 | 0.25 | 0.37 | 0.30 | 0.65 |
| **KALIX-KARLSBORG SJÖV** | -0.17 | 0.21 | 0.33 | 0.29 | 0.67 |
| **Kemi Ajos** | -0.11 | 0.18 | 0.28 | 0.25 | 0.69 |
| **Oulu Toppila** | -0.13 | 0.20 | 0.29 | 0.26 | 0.69 |
| **Raahe Lapaluoto** | -0.11 | 0.17 | 0.28 | 0.26 | 0.65 |
| **Pietarsaari Leppäluoto** | -0.09 | 0.13 | 0.21 | 0.19 | 0.76 |

### 7.5.2. Salinity

The model performance with respect to the temporal evolution of the salinity is presented on the basis of the available measurement data at the surface from the stations NORRBYN BOJ and Understen BS (see locations in Figure 6.2). While the salinity at the southern station (Understen BS, Figure 7.6) tends to be underestimated by the model (mean error of -0.61 PSU, see Table 7-2), the model overestimates the salinity at the northern station NORRBYN BOJ (Figure 7.7 and Table 7-2, mean error of +0.79 PSU). Due to the temporally incomplete measurement data and the sparse spatial distribution of the measurement sites, the significance of the comparison is limited and in view of the large number of CTD measurements, a detailed analysis of the temporal evolution of the salinity at these two stations is dispensed with.

*Table 7-2: Performance Metrics of the HD-Model in respect to the salinity (over 2021, given the measurement periods available).*

| Name | ME [PSU] | MAE [PSU] | RMSE [PSU] | Std. of Residuals [PSU] | Correlation Coefficients [-] |
|---|---|---|---|---|---|
| **NORRBYN BOJ** | 0.79 | 0.79 | 0.89 | 0.41 | 0.44 |
| **Understen BS** | -0.61 | 0.61 | 0.63 | 0.17 | 0.63 |

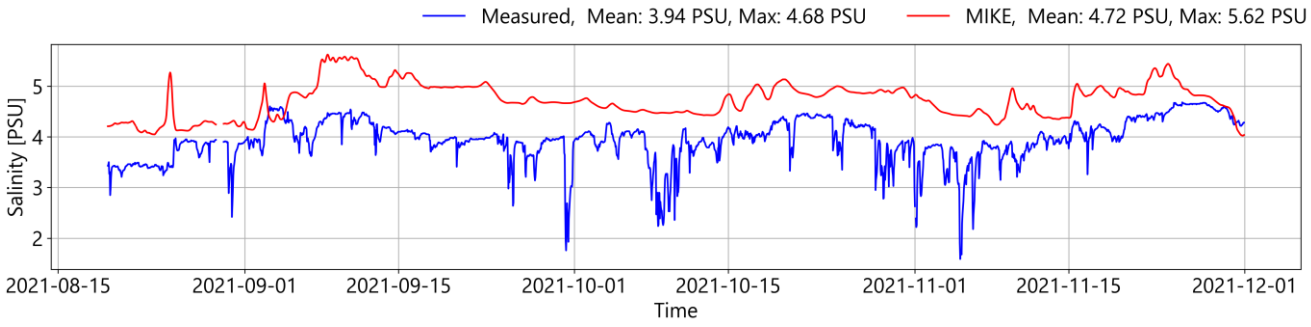



*Figure 7.6: Comparison between observed salinity (blue line) and modelled salinity (red line) for NORRBYN BOJ (SMHI-Station).*

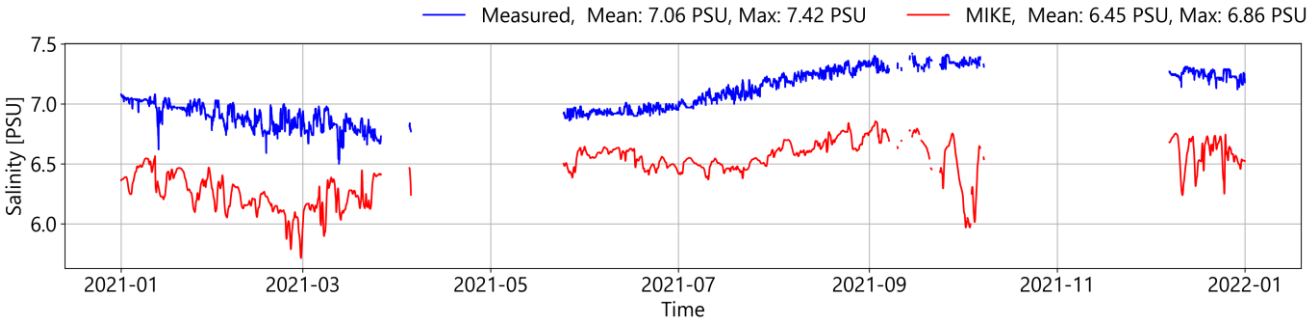



*Figure 7.7: Comparison between observed salinity (blue line) and modelled salinity (red line) for Understen BS (SMHI-Station).*

### 7.5.3. Salinity Profiles

The comparison of the calculated and measured vertical salinity profiles (Figure 7.8 and Figure 7.9, as well as figures in Appendix 14) indicates good agreement for the majority of the profiles. The slight stratification occurring towards summer can be reproduced with the model. However, the MIKE model tends to overestimate the salinity at the measuring points to the north (as already observed in chapter 7.5.2) (e.g. compare Figure 7.8 (located in the south) vs. Figure 7.9 (located in the north).

Observed discrepancies in water depth can be explained by the grid resolution. The regional model is based on a coarse mesh (to shorten the computation time), which leads to an averaging out of local lows.

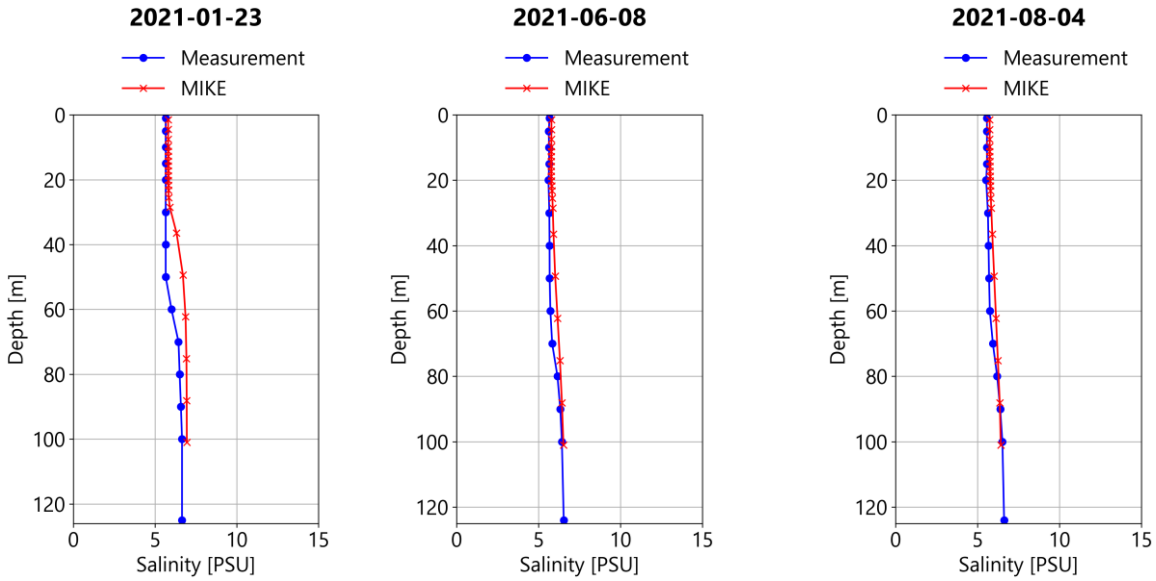



*Figure 7.8: Comparison between modelled and measured salinity profiles at location SR5 (source: merihavainnot.fi, location see Figure 6.2).*

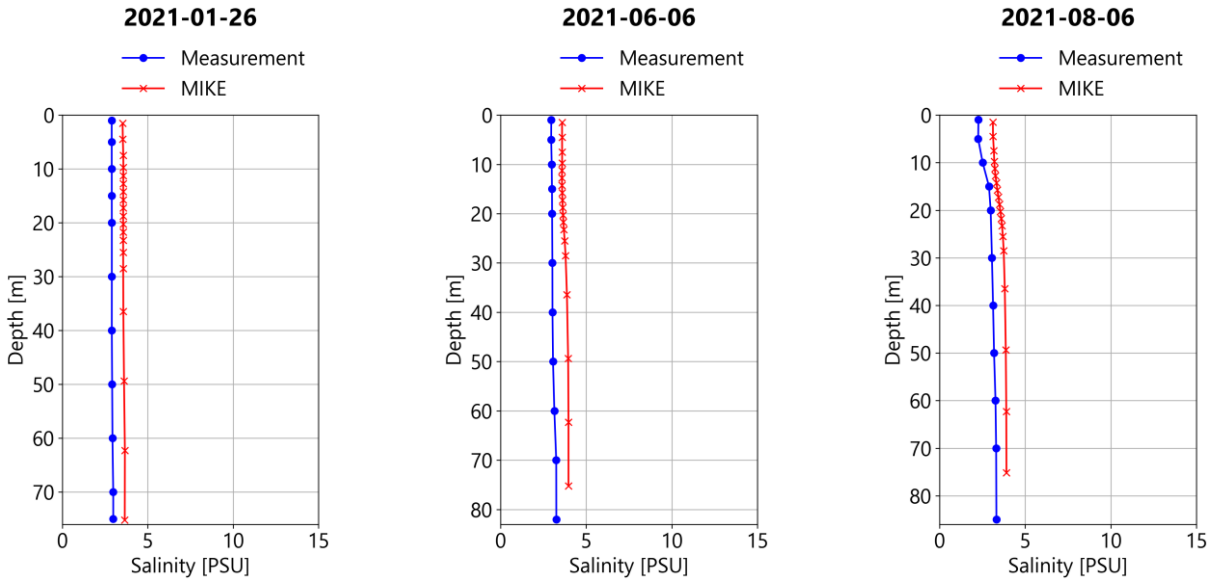



*Figure 7.9: Comparison between modelled and measured salinity profiles at location F2 (source: merihavainnot.fi, location see Figure 6.2).*

Station SR3 lies only about 10 kilometres south of the planned wind farm (see Figure 6.2). Measurements at this location are therefore well suited to assess the model quality in the project area. The comparison (Figure 7.10) reveals a general good agreement of the salinity by the model, regardless of depth.

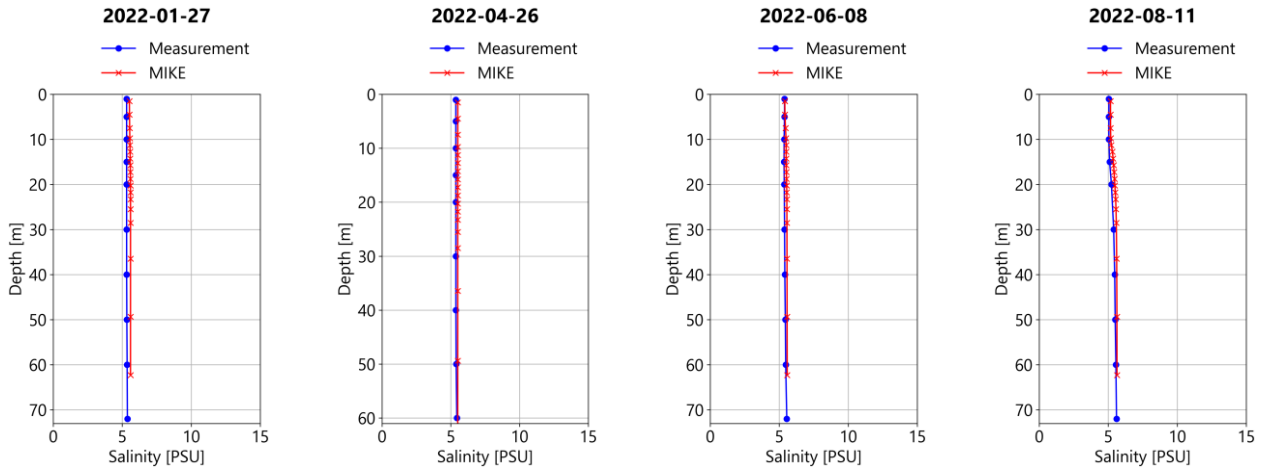



*Figure 7.10: Comparison between modelled and measured salinity profiles at location F2 (source: merihavainnot.fi, location see Figure 6.2).*

### 7.5.4. Water temperature

For the evaluation of the MIKE model with regard to the surface temperature, 17 measuring stations are available (Figure 7.11 and Figure 7.12 and Appendix 15). The surface temperatures calculated with the model, with correlation coefficients between 0.90-0.99 and a mean error -2.5 to +1.0° (Table 7-3, Figure 7.11 and Figure 7.12), agree well with the (partly incomplete) measured values, regardless of spatial location and season.

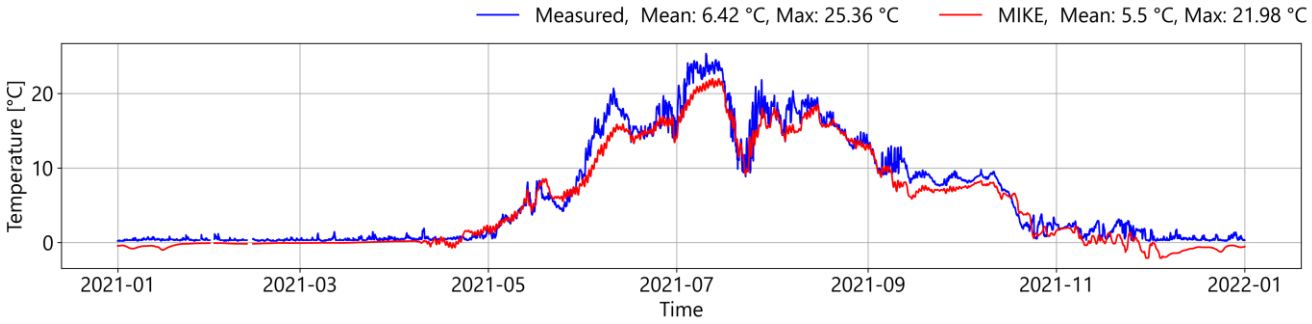



*Figure 7.11: Comparison observed surface water temperature (blue line) and modelled surface water temperature (red line) for KALIX-KARLSBORG SJÖV (SMHI-Station).*

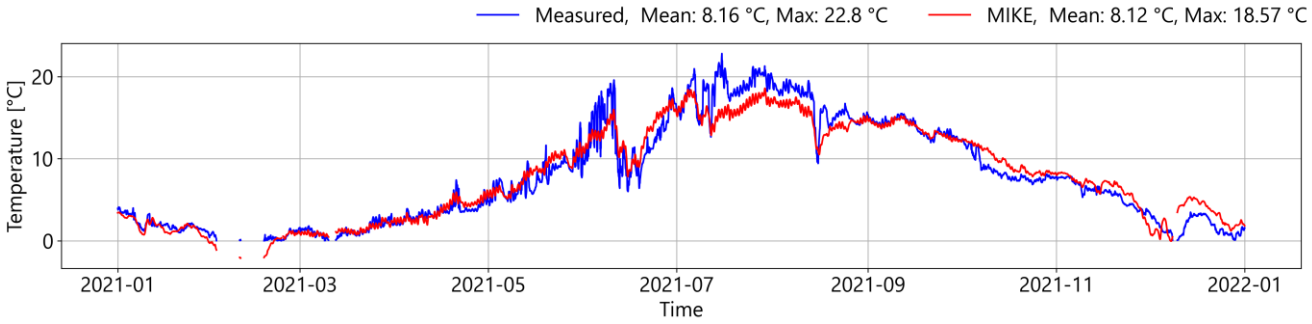



*Figure 7.12: Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for BÖNAN SJÖV (SMHI-Station).*

*Table 7-3: Performance Metrics of the HD-Model in respect to the surface temperature (over 2021).*

| Name | ME [°C] | MAE [°C] | RMSE [°C] | Std. of Residuals [°C] | Correlation Coefficients [°C] |
|---|---|---|---|---|---|
| **FORSMARK** | -0.74 | 0.99 | 1.29 | 1.05 | 0.99 |
| **BÖNAN SJÖV** | -0.05 | 1.08 | 1.48 | 1.47 | 0.97 |
| **FINNGRUNDET WR BOJ** | 0.34 | 0.81 | 1.12 | 1.07 | 0.98 |
| **LJUSNE SJÖV** | -0.29 | 1.02 | 1.55 | 1.53 | 0.98 |
| **NORRBYN SST** | -0.13 | 0.99 | 1.43 | 1.43 | 0.97 |
| **NORRBYN BOJ** | 0.96 | 1.17 | 1.40 | 1.02 | 0.95 |
| **Holmsund** | -2.48 | 2.50 | 2.74 | 1.15 | 0.99 |
| **STRÖMÖREN SJÖV** | -0.60 | 1.58 | 1.79 | 1.69 | 0.98 |
| **KALIX-KARLSBORG SJÖV** | -0.92 | 1.15 | 1.51 | 1.20 | 0.99 |
| **Oulu Santapankki** | -0.12 | 0.68 | 0.98 | 0.97 | 0.98 |
| **Perämeri aaltopoiju** | 0.50 | 1.12 | 1.46 | 1.38 | 0.96 |
| **Kalajoki Maakalla** | 0.70 | 1.57 | 2.06 | 1.94 | 0.92 |
| **Maalahti Storskäret** | 0.15 | 1.04 | 1.36 | 1.35 | 0.96 |
| **Selkämeri aaltopoiju** | 0.19 | 0.83 | 1.21 | 1.20 | 0.98 |
| **Pori Kaijakari** | -0.24 | 1.59 | 2.14 | 2.13 | 0.90 |
| **Uusikaupunki Vekara** | -0.32 | 1.13 | 1.60 | 1.57 | 0.94 |

### 7.5.5. Temperature Profiles

Not only does the comparison of the over 60 modelled and measured vertical temperature profiles (in Appendix 16) demonstrate the model's capability to reproduce the temporal evolution of the water temperature in the Gulf of Bothnia, but it also reveals an overall satisfactory reproduction of the vertical profiles. Despite the general good agreement between modelled and measured profiles, the following limitations of the model can be observed:

- overestimation of stratification (i.e. overestimation of the warming of the upper water layers, underestimation of the mixture respectively) in June ( e.g. F26, MS3, F18, BO3, RR3, CV, CVI, F2 (e.g. Figure 7.13))
- underestimation of the water depth, which is warmed in August (affecting mainly southern sites, e.g. F26 (Figure 7.14))
- overestimation of the water depth, which is warmed in August (affecting mainly northern sites, e.g. US7, CV (Figure 7.15) and RR7).

Observed discrepancies in water depth can be explained by the grid resolution. The regional model is based on a coarse mesh (to shorten the computation time), which leads to an averaging out of local lows.

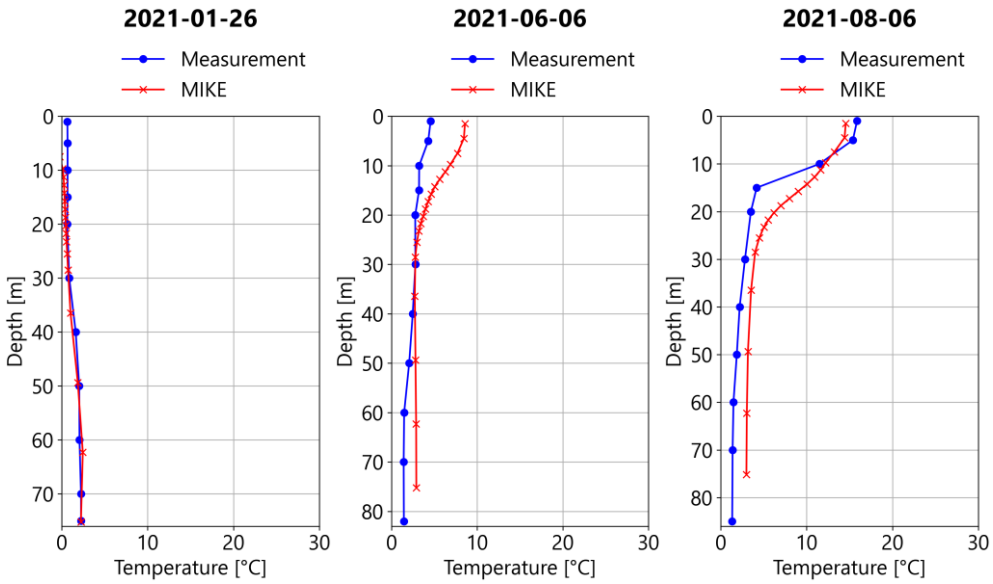



*Figure 7.13: Comparison between modelled and measured temperature profiles at location F2 (source: merihavainnot.fi, location see Figure 6.2).*

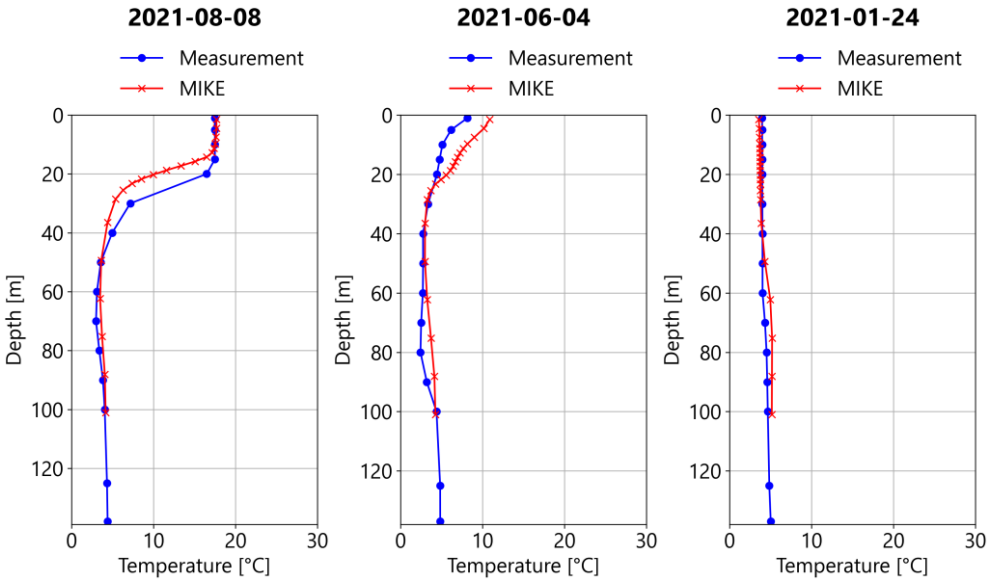



*Figure 7.14: Comparison between modelled and measured temperature profiles at location F26 (source: merihavainnot.fi, location see Figure 6.2).*

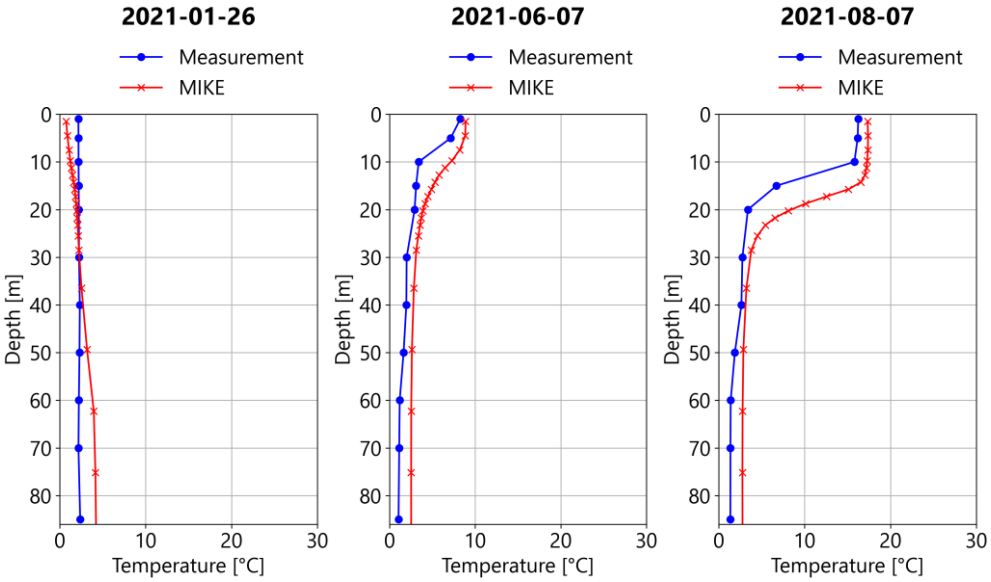



*Figure 7.15: Comparison between modelled and measured temperature profiles at location CV (source: merihavainnot.fi, location see Figure 6.2).*

Aligned with the salinity, the model quality in the project area is assessed by comparing the measured and calculated temperature profiles at station SR3 (Figure 7.16). The seasonal variation in 2022 can be represented with the model.

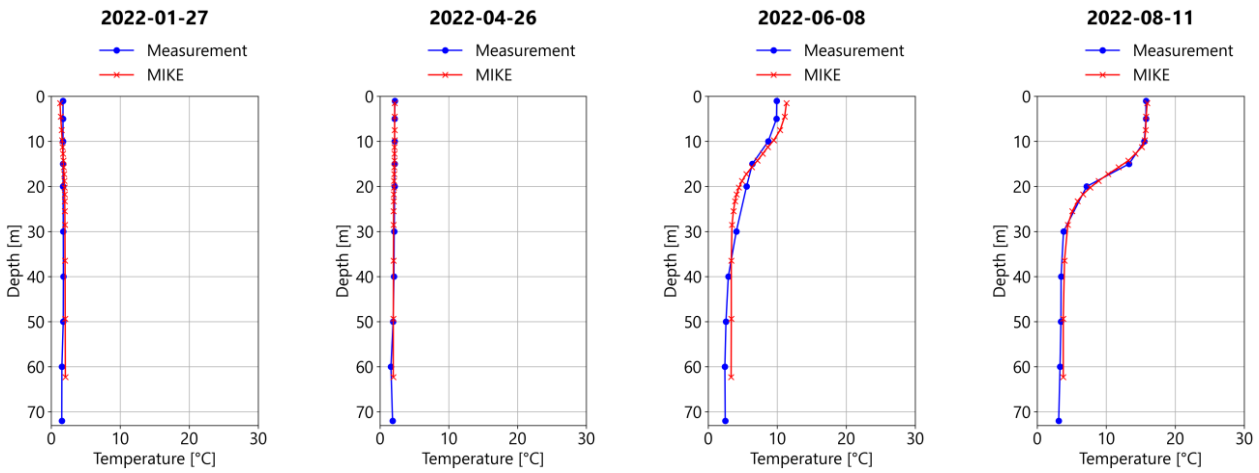



*Figure 7.16: Comparison between modelled and measured temperature profiles at location SR3 (source: merihavainnot.fi, location see Figure 6.2).*

# 8. Sediment dispersal model

The input to the sediment model is described in the first three sections of this chapter and the outcome of the model in the last two sections.

## 8.1. Sediment sources and spill program

One case (25MW) with four types of sources is considered:

1) Dredging of the gravity-based substructures and offshore substations with a dredge capacity of 1000m$^3$/hour with 5% spill dispersed just above the seabed (released 2 meters over the seabed). The coarse sediment fraction settles next to the GBS (Gravity Base Structure, or the WTG and the OSS), and the finer ones are available for transport in the surrounding waters.
2) 10% of the total dredged sediments are assumed to overflow from the barge and are released at the surface and available for transport in the surrounding waters.
3) Burial of the inter array cable via jetting of a 1.5 x 2 m trench whereof 100% the sediments are assumed to be brought into suspension and released 2 m over the seabed.
4) Burial of the inter array cable via jetting of a 1.5 x 2 m trench whereof 100% the sediments are assumed to be brought into suspension and released 2 m over the seabed.

Each of the 347 WTGs can generate 25MW and the GBS has a base slab with a diameter of 45m, yielding an excavation of 9,817 m$^3$ for each GBS. The installation program is described Table 8-1, starting with the dredging of the GBS and offshore substations, and parallel installation of the foundations and laying of the inter array cables (IAC) and redundancy cables. It is assumed that the construction will be conducted in two simultaneous phases during two seasons or years (four phases in total).

*Table 8-1: Installation program for the 25MW case, starting April 1st and ending around 23 weeks later, September 6th (per season or year).*

| 25MW GBS Season 1, Phase 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Activity** | **Amount** | **Unit** | **Capacity** | **Unit** | **Days** | **Start** | **End** |
| 1 OSS, installation | 2 | # | 7.00 | days/(FOU+topside) | 14 | 2030-04-01 | 2030-04-15 |
| 1 OSS, dredging | 23,758 | m3 | 500 | m3/hour+0.5 day/OSS | 3 | 2030-04-01 | 2030-04-03 |
| 1 GBS installation | 86 | # | 1.00 | days/FOU + 0.5 day/FOU | 129 | 2030-04-28 | 2030-09-04 |
| 1 GBS seabed preparation | 844,303 | m3 | 500 | m3/hour + 1 day/FOU | 156 | 2030-04-01 | 2030-09-04 |
| 1 Infield cable, laying + pull in | 112,947 | m | 300 | m/hour + 6 hours/pull in | 37 | 2030-07-29 | 2030-09-04 |
| 1 Infield cable, burial | 112,947 | m | 150 | m/hour + 6 hours/WTG | 53 | 2030-07-15 | 2030-09-06 |
| Export cable, laying | 80,768 | m | 300 | m/hour | 11 | 2030-04-15 | 2030-04-26 |
| Export cable, burial | 80,768 | m | 150 | m/hour | 22 | 2030-04-20 | 2030-05-12 |
| 25MW GBS Season 1, Phase 2 | | | | | | | |
| **Activity** | **Amount** | **Unit** | **Capacity** | **Unit** | **Days** | **Start** | **End** |
| 1 OSS, installation | 2 | # | 7.00 | days/(FOU+topside) | 14 | 2030-04-01 | 2030-04-15 |
| 1 OSS, dredging | 23,758 | m3 | 500 | m3/hour+0.5 day/OSS | 3 | 2030-04-01 | 2030-04-03 |
| 1 GBS installation | 82 | # | 1.00 | days/FOU + 0.5 day/FOU | 123 | 2030-04-27 | 2030-08-28 |
| 1 GBS seabed preparation | 805,033 | m3 | 500 | m3/hour + 1 day/FOU | 149 | 2030-04-01 | 2030-08-28 |
| 1 Infield cable, laying + pull in | 111,036 | m | 300 | m/hour + 6 hours/pull in | 36 | 2030-07-23 | 2030-08-28 |
| 1 Infield cable, burial | 111,036 | m | 150 | m/hour + 6 hours/WTG | 51 | 2030-07-09 | 2030-08-30 |
| Export cable | 14,406 | m | 300 | m/hour | 2 | 2030-04-15 | 2030-04-17 |
| Export cable, burial | 14,406 | m | 150 | m/hour | 4 | 2030-04-20 | 2030-04-24 |

| 25MW GBS Season 2, Phase 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Activity** | **Amount** | **Unit** | **Capacity** | **Unit** | **Days** | **Start** | **End** |
| 1 OSS, installation | 2 | # | 7.00 | days/(FOU+topside) | 14 | 2030-04-01 | 2030-04-15 |
| 1 OSS, dredging | 23,758 | m3 | 500 | m3/hour+0.5 day/OSS | 3 | 2030-04-01 | 2030-04-03 |
| 1 GBS installation | 89 | # | 1.00 | days/FOU + 0.5 day/FOU | 134 | 2030-04-29 | 2030-09-09 |
| 1 GBS seabed preparation | 873,755 | m3 | 500 | m3/hour + 1 day/FOU | 162 | 2030-04-01 | 2030-09-09 |
| 1 Infield cable, laying + pull in | 121,311 | m | 300 | m/hour + 6 hours/pull in | 39 | 2030-08-01 | 2030-09-09 |
| 1 Infield cable, burial | 121,311 | m | 150 | m/hour + 6 hours/WTG | 56 | 2030-07-17 | 2030-09-11 |
| Export cable, laying | 47,205 | m | 300 | m/hour | 7 | 2030-04-15 | 2030-04-21 |
| Export cable, burial | 47,205 | m | 150 | m/hour | 13 | 2030-04-20 | 2030-05-03 |
| 25MW GBS Season 2, Phase 4 | | | | | | | |
| **Activity** | **Amount** | **Unit** | **Capacity** | **Unit** | **Days** | **Start** | **End** |
| 1 OSS, installation | 2 | # | 7.00 | days/(FOU+topside) | 14 | 2030-04-01 | 2030-04-15 |
| 1 OSS, dredging | 23,758 | m3 | 500 | m3/hour+0.5 day/OSS | 3 | 2030-04-01 | 2030-04-03 |
| 1 GBS installation | 90 | # | 1.00 | days/FOU + 0.5 day/FOU | 135 | 2030-04-29 | 2030-09-11 |
| 1 GBS seabed preparation | 883,573 | m3 | 500 | m3/hour + 1 day/FOU | 164 | 2030-04-01 | 2030-09-11 |
| 1 Infield cable, laying + pull in | 120,113 | m | 300 | m/hour + 6 hours/pull in | 39 | 2030-08-03 | 2030-09-11 |
| 1 Infield cable, burial | 120,113 | m | 150 | m/hour + 6 hours/WTG | 56 | 2030-07-19 | 2030-09-13 |
| Export cable | 20,674 | m | 300 | m/hour | 3 | 2030-04-15 | 2030-04-17 |
| Export cable, burial | 20,674 | m | 150 | m/hour | 6 | 2030-04-20 | 2030-04-25 |

## 8.2. Sediment type

The expected types of sediments are defined along the cables per 200 m section and at the substructures according to the sediment classification based on the backscatter data in combination with sediment samples for Sylen OWF (see Figure 8.1 and Appendix 1). Each sediment type is spatially associated with the sediment samples and an average grain size distribution per sediment type is calculated as described in chapter 6.8.

The sediment model is an add-on to the hydrodynamic thus current data and water level data are transferred by time step for advective transport of the sediment and deposition/resuspension of near-bottom sediments.

The sediment model itself contains information as follow:

1) The sediment types are split into 6 categories based on grain sizes and settling velocities, Table 8.2.
2) Coarse sediment is not modelled as this settles close to the source.
3) For erosion a critical shear stress e.g., 0.3 $N/m^2$ (DHI/IOW Consortium, 2013).
4) Dispersion both horizontal and vertical.
5) A description of the sediment source in time and space.

*Table 8.2: Sediment categories and settling velocities (DHI/IOW Consortium, 2013) used for the modelling of the sediment dispersal.*

| Type | coarse | fine sand | coarse silt | medium silt | fine silt | Clay |
|---|---|---|---|---|---|---|
| **Settling velocity** | **-** | **15.0 mm/s** | **2.90 mm/s** | **0.560 mm/s** | **0.070 mm/s** | **0.030 mm/s** |
| **d, mean** | **-** | **0.130 mm** | **0.040 mm** | **0.0130 mm** | **0.0040 mm** | **0.0010 mm** |
| **d, minimum** | **-** | 0.060 mm | 0.020 mm | 0.0060 mm | 0.0020 mm | 0.0000 mm |
| **d, maximum** | **-** | 0.200 mm | 0.060 mm | 0.020 mm | 0.0060 mm | 0.0020 mm |
| **mud** | 1.7% | 14.3% | 11.3% | 3.7% | 16.3% | 52.7% |
| **mixed** | 39.4% | 23.2% | 10.6% | 4.6% | 6.7% | 15.5% |

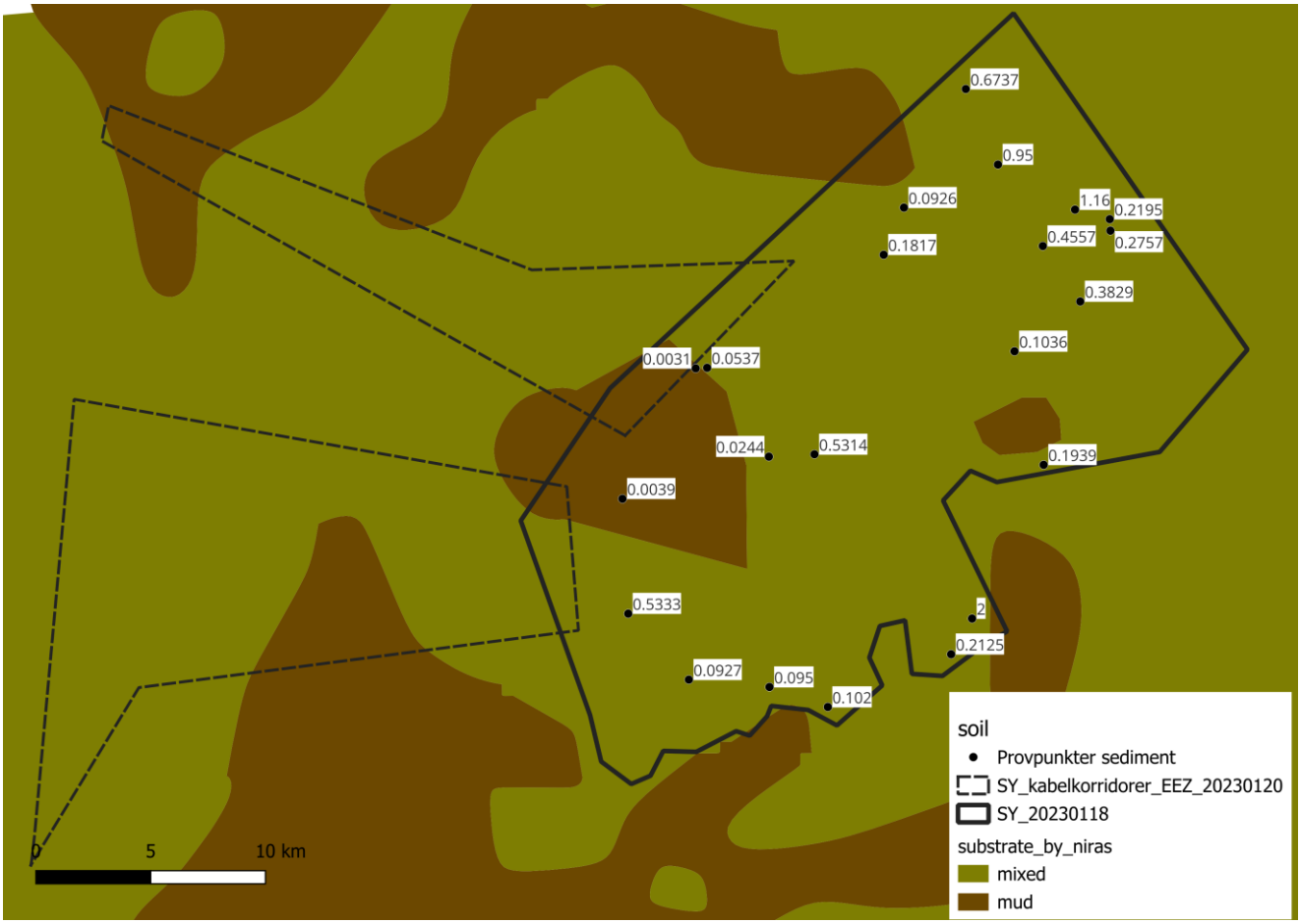



*Figure 8.1: Sylen OWF and cable corridors togther with the identified soil types and measured mean grain diameter in mm.*

## 8.3. Estimated spill

In total is the spill estimated to 2,420,00 $m^3$ (1,570,770 $m^3$ exclusive the coarse sediments), Table 8-3. Furthermore, it should be highlighted, that significantly more sediment is released near the bottom (85% compared to the surface with 15%).

| Sediment → | coarse | fine sand | coarse silt | medium silt | fine silt | Clay | Sum |
|---|---|---|---|---|---|---|---|
| Activity ↓ | $m^3$ | $m^3$ | $m^3$ | $m^3$ | $m^3$ | $m^3$ | $m^3$ |
| OSS-25MW-bottom_1 | 246 | 225 | 131 | 49 | 138 | 408 | **1,196** |
| OSS-25MW-bottom_2 | 472 | 278 | 127 | 55 | 81 | 185 | **1,196** |
| OSS-25MW-surface_1 | 492 | 449 | 262 | 99 | 276 | 815 | **2,392** |
| OSS-25MW-surface_2 | 943 | 555 | 253 | 110 | 161 | 370 | **2,392** |
| WTG-25MW-bottom_1 | 10,802 | 8,475 | 4,623 | 1,805 | 4,388 | 12,479 | **42,571** |
| WTG-25MW-bottom_2 | 14,693 | 9,114 | 4,320 | 1,827 | 3,067 | 7,570 | **40,591** |
| WTG-25MW-surface_1 | 21,603 | 16,950 | 9,246 | 3,610 | 8,776 | 24,958 | **85,142** |
| WTG-25MW-surface_2 | 29,386 | 18,228 | 8,641 | 3,654 | 6,134 | 15,139 | **81,182** |
| IAC-25MW_1 | 88,161 | 68,100 | 36,860 | 14,452 | 34,528 | 97,681 | **339,783** |
| IAC-25MW_2 | 124,630 | 75,877 | 35,481 | 15,126 | 24,300 | 58,647 | **334,061** |
| Export-C-25MW_1 | 90,498 | 55,120 | 25,782 | 10,989 | 17,672 | 42,673 | **242,735** |
| Export-C-25MW_2 | 15,284 | 9,640 | 4,624 | 1,942 | 3,382 | 8,496 | **43,368** |
| **Sum - Season 1** | **397,209** | **263,009** | **130,351** | **53,717** | **102,904** | **269,421** | **1,216,611** |
| **Proportion** | **33%** | **22%** | **11%** | **4%** | **8%** | **22%** | |
| OSS-25MW-bottom_3 | 472 | 278 | 127 | 55 | 81 | 185 | **1,196** |
| OSS-25MW-bottom_4 | 472 | 278 | 127 | 55 | 81 | 185 | **1,196** |
| OSS-25MW-surface_3 | 943 | 555 | 253 | 110 | 161 | 370 | **2,392** |
| OSS-25MW-surface_4 | 943 | 555 | 253 | 110 | 161 | 370 | **2,392** |
| WTG-25MW-bottom_3 | 16,246 | 9,962 | 4,683 | 1,990 | 3,253 | 7,922 | **44,056** |
| WTG-25MW-bottom_4 | 17,189 | 10,253 | 4,721 | 2,031 | 3,096 | 7,262 | **44,551** |
| WTG-25MW-surface_3 | 32,492 | 19,924 | 9,366 | 3,980 | 6,506 | 15,844 | **88,112** |
| WTG-25MW-surface_4 | 34,378 | 20,505 | 9,441 | 4,062 | 6,193 | 14,524 | **89,103** |
| IAC-25MW_3 | 135,236 | 82,676 | 38,779 | 16,502 | 26,778 | 64,968 | **364,938** |
| IAC-25MW_4 | 139,941 | 83,283 | 38,278 | 16,486 | 24,982 | 58,389 | **361,359** |
| Export-C-25MW_3 | 49,116 | 31,322 | 15,140 | 6,330 | 11,282 | 28,642 | **141,833** |
| Export-C-25MW_4 | 24,509 | 14,431 | 6,577 | 2,847 | 4,188 | 9,620 | **62,173** |
| **Sum - Season 2** | **451,936** | **274,022** | **127,745** | **54,557** | **86,763** | **208,281** | **1,203,303** |
| **Proportion** | **38%** | **23%** | **11%** | **5%** | **7%** | **17%** | |
| **Sum - Total** | **849,145** | **537,031** | **258,096** | **108,274** | **189,667** | **477,702** | **2,419,914** |

*Table 8-3: Total spill per source and sediment category.*

## 8.4. Estimated sediment concentrations and associated durations

The sediment concentrations expected according to the simulation and the associated total time periods during which they will be reached or exceeded (not necessarily consecutive) are discussed hereafter. The results are shown separately for the different water depths, whereas within the wind farm area, the depth varies between 30 and 60 metres. Greater depths (locally up to max. 80 m) can also be observed along the export cables (Figure 8.2).

Results relevant to the sediment distribution assessment are presented in **Error! Reference source not found.** to Figure 8.5, Table 8-4 to Table 8-5, and Appendix 17 to Appendix 18.

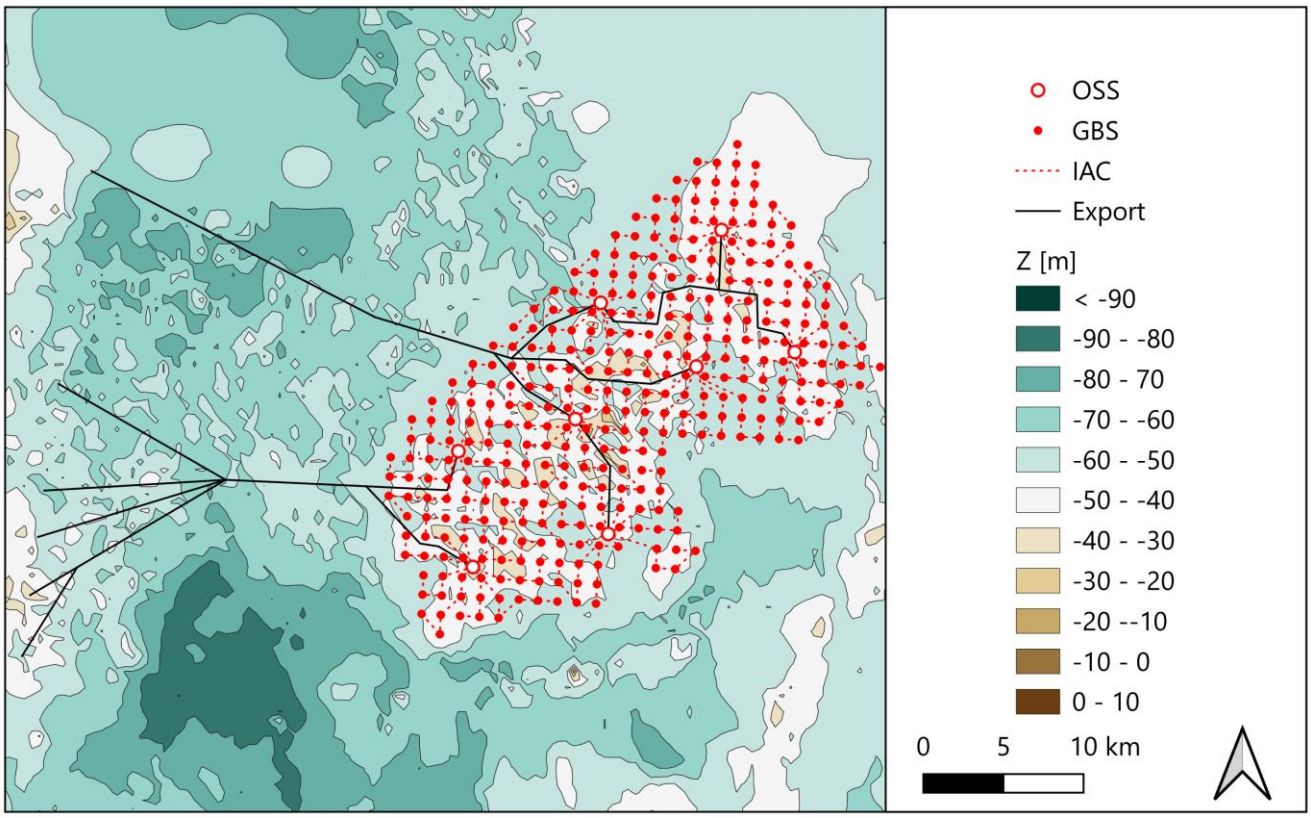



*Figure 8.2: Bathymetry within the project area (source : Database (BSBD, last updated on 16/10/2017 (HELCOM, 2023)).*

### 8.4.1. Surface

The total duration of the construction period during which the sediment concentrations in the surface layer reach or exceed 10 mg/l is presented in **Error! Reference source not found.**.

The shown sediment originates from the overflow from the barge (within the wind farm site) during the dredging of the gravity-based substructures and offshore substations. The released sediments are transported and dispersed with surface currents while sinking through the water column. The fact that the individual sources (locations of gravity-based substructures and offshore substations) cannot be identified in **Error! Reference source not found.**, indicates pronounced transport and dispersion.

In addition, the results (**Error! Reference source not found.**, Table 8-4 and Table 8-5) show, that

- The observed concentrations and their exceedance durations tend to be higher in season 1, due to the larger proportion of fine material released (see Table 8-3).
- After a maximum of 2 days, the concentration falls below 10 mg/l in the top 10 meters.
- Regardless of the season under consideration, a concentration of 500 mg/l in the top 10 metres is neither reached nor exceeded.

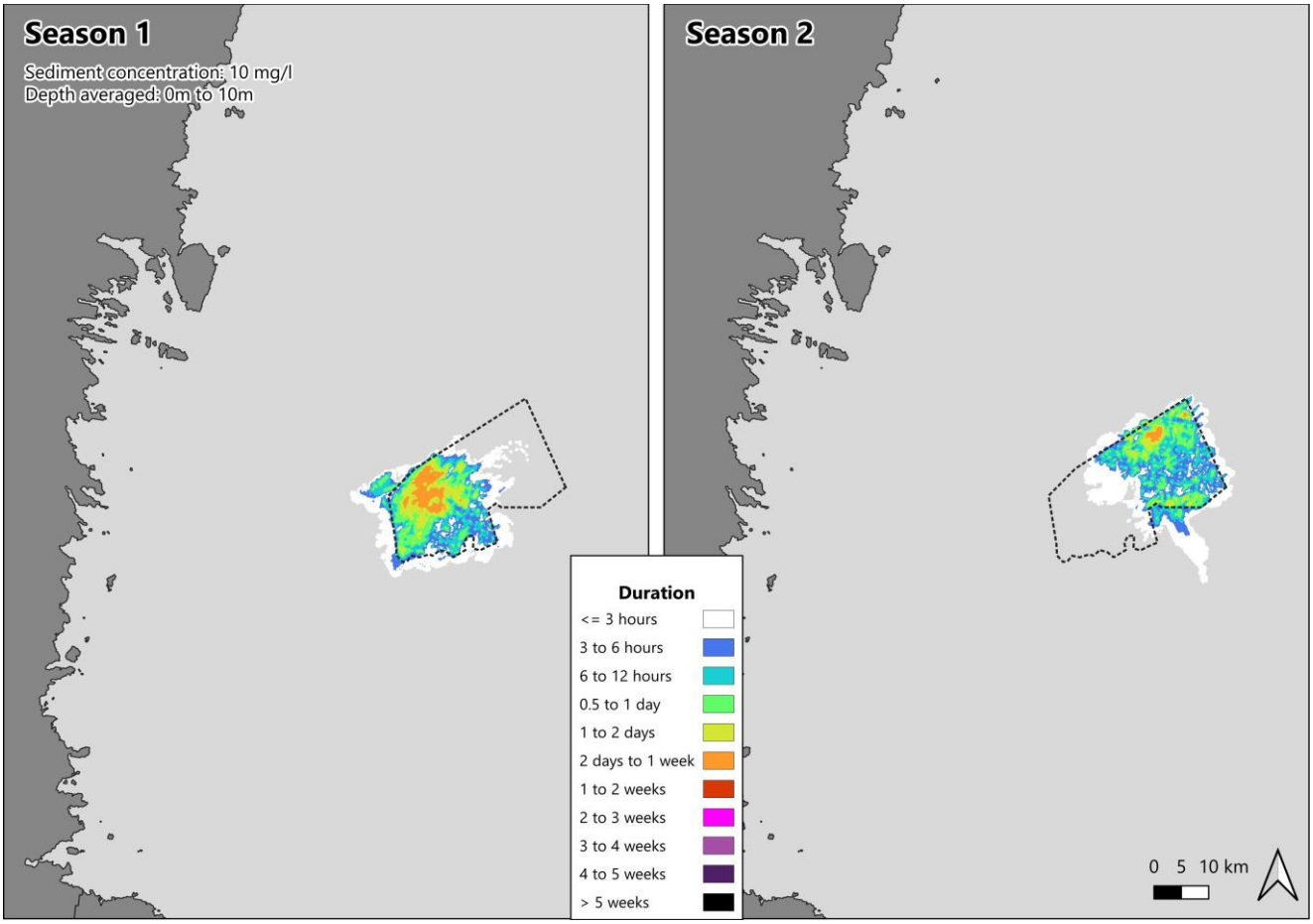



*Figure 8.3: Duration with sediment concentration of 10 mg/l is reached or exceeded in the upper 10 m of the water column during season 1 (left) and season 2 (right). The seabed is shown in light gray, indicating the areas where no spilled sediments are observed).*

### 8.4.2. Distribution over the water column

The released sediments sink through the water column, while being transported and dispersed with surface currents. Therefore, the sediment concentration decreases up to a depth of approximately 30 m (see e.g. **Error! Reference source not found.**, Table 8-4 and Table 8-5, and Appendix 17 to Appendix 18). The concentration increases again at greater depths as the bottom is reached. The material documented in these layers no longer originates solely from the settling of the material released by the overflow of the barge but is released by the activities near the bottom.

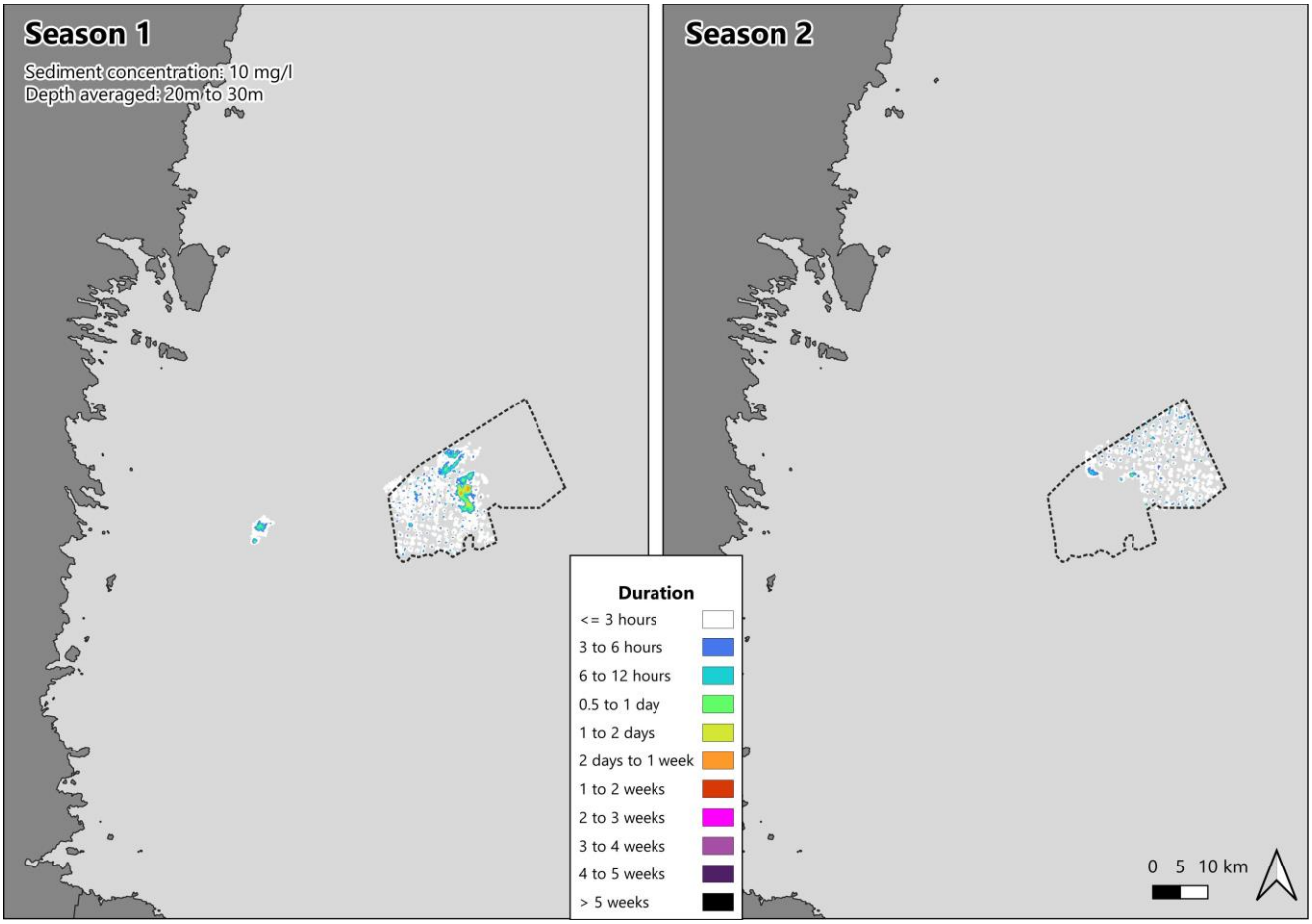



*Figure 8.4: Duration with sediment concentration of 10 mg/l (Left: Season 1, right: Season 2) is reached or exceeded in at a depth of 20-30 m of the water column during season 1 (left) and season 2 (right). The seabed is shown in light gray, indicating the areas where no spilled sediments are observed).*

### 8.4.3. At the bottom

Sediment is released near the bottom by dredging of the gravity-based substructures and the offshore sub-stations, and by burying the inter-array and export cables using jets. Compared to the surface, significantly more sediment is released near the bottom (Table 8-3). However, in addition, sediments that are released at the surface arrive at the bottom through sedimentation processes before settling.

The results shown in Figure 8.5, Table 8-4,and Table 8-5, and Appendix 17 to Appendix 18 depict the following points:

- Aligned with the observations of sediment distribution at the surface, greater concentrations are observed in season 1 over a larger area and for a longer duration. This is due to the larger proportion of fines (see Table 8-3).

- The relatively large sediment volumes released directly near the seabed explain why:

    - the highest concentrations occur near the seabed (e.g. 1000 mg/l is reached or exceed during 6 hours on an area of 195 ha in season 1, and on 4 ha in season 2)

- Sediment spreading reaches the maximum extent near the seabed (e.g. 10mg/l is reached or exceeded during season 1 on an area of > 43,000 ha, Table 8-4).

- The concentration of 10 mg/l is reached or exceeded during a maximum period duration of 15 days (Figure 8.5, season 1).

- Due to transport and dispersion with bottom currents, the concentration decreases with increasing distance from the source, this is clearly visible when comparing the areas on which 10 mg/l or 100 mg/l are reached or exceeded (see Figure 8.5, Table 8-4 and Table 8-5). Regardless of the season, the area where 100 mg/l is reached or exceeded for 6 hours is 3.5 times smaller than the area with a minimum concentration of 10 mg/l.

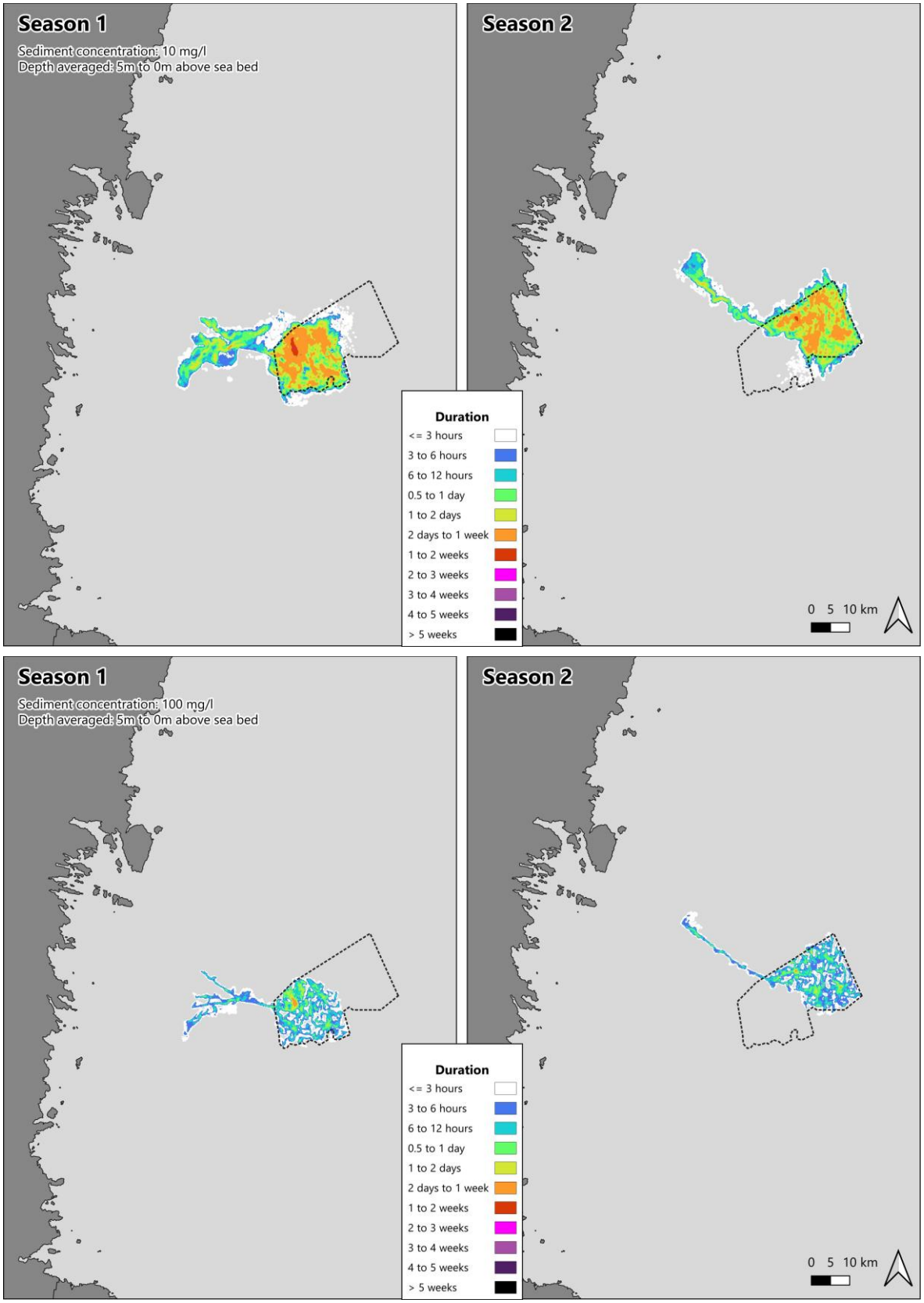



*Figure 8.5: Duration with sediment concentration of 10 mg/l (top) and 100 mg/l (bottom) is reached or exceeded lowest 5 m of the water column, 5 m above the sea bed, during season 1 (left) and season 2 (right). The seabed is shown in light gray, indicating the areas where no spilled sediments are observed).*

| | | Duration | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Concentration** | **6 h** | **12 h** | **24 h** | **2 d** | **1 week** | **2 weeks** | **3 weeks** | **4 weeks** | **5 weeks** |
| **0 - 10 m** | **10 mg/l** | 23,010 | 15,652 | 8,834 | 3,243 | - | - | - | - | - |
| | **20 mg/l** | 9,835 | 6,243 | 2,828 | 318 | - | - | - | - | - |
| | **100 mg/l** | 379 | 85 | 5 | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **10 - 20 m** | **10 mg/l** | 6,354 | 3,643 | 1,309 | 23 | - | - | - | - | - |
| | **20 mg/l** | 592 | 179 | 11 | - | - | - | - | - | - |
| | **100 mg/l** | - | - | - | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **20 - 30 m** | **10 mg/l** | 2,206 | 914 | 345 | 69 | - | - | - | - | - |
| | **20 mg/l** | 461 | 175 | 46 | 0 | - | - | - | - | - |
| | **100 mg/l** | 24 | 4 | - | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **30 - 40 m** | **10 mg/l** | 15,141 | 11,725 | 6,943 | 2,871 | - | - | - | - | - |
| | **20 mg/l** | 8,276 | 5,468 | 2,291 | 291 | - | - | - | - | - |
| | **100 mg/l** | 1,127 | 270 | 5 | - | - | - | - | - | - |
| | **500 mg/l** | 3 | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **40 - 50 m** | **10 mg/l** | 29,963 | 24,595 | 17,937 | 8,975 | 502 | - | - | - | - |
| | **20 mg/l** | 22,341 | 16,923 | 9,095 | 2,833 | 74 | - | - | - | - |
| | **100 mg/l** | 6,080 | 1,853 | 366 | 3 | - | - | - | - | - |
| | **500 mg/l** | 129 | 12 | - | - | - | - | - | - | - |
| | **1000 mg /l** | 1 | - | - | - | - | - | - | - | - |
| **50 - 60 m** | **10 mg/l** | 22,629 | 15,652 | 8,608 | 3,002 | 342 | 22 | - | - | - |
| | **20 mg/l** | 15,515 | 9,248 | 3,947 | 1,020 | 125 | - | - | - | - |
| | **100 mg/l** | 3,993 | 1,458 | 483 | 165 | - | - | - | - | - |
| | **500 mg/l** | 428 | 176 | 27 | - | - | - | - | - | - |
| | **1000 mg /l** | 135 | 11 | - | - | - | - | - | - | - |
| **5 m above seabed** | **10 mg/l** | 43,073 | 35,267 | 24,964 | 12,156 | 544 | 16 | - | - | - |
| | **20 mg/l** | 34,391 | 25,857 | 13,917 | 4,138 | 161 | - | - | - | - |
| | **100 mg/l** | 12,893 | 4,524 | 903 | 191 | - | - | - | - | - |
| | **500 mg/l** | 791 | 210 | 33 | - | - | - | - | - | - |
| | **1000 mg /l** | 195 | 30 | - | - | - | - | - | - | - |

*Table 8-4: Area (ha) experiencing sediment concentration equal or greater than 10, 20, 100, 500, and 1000 mg/l for during varying durations and at different depths during season 1. For Info: 100 ha = 1km$^2$.*

| | | Duration | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Concentration** | **6 h** | **12 h** | **24 h** | **2 d** | **1 week** | **2 weeks** | **3 weeks** | **4 weeks** | **5 weeks** |
| **0 - 10 m** | **10 mg/l** | 20,405 | 10,480 | 2,952 | 539 | - | - | - | - | - |
| | **20 mg/l** | 6,077 | 2,364 | 628 | 12 | - | - | - | - | - |
| | **100 mg/l** | 114 | 11 | - | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **10 - 20 m** | **10 mg/l** | 2,280 | 786 | 95 | 0 | - | - | - | - | - |
| | **20 mg/l** | 46 | 3 | - | - | - | - | - | - | - |
| | **100 mg/l** | - | - | - | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **20 - 30 m** | **10 mg/l** | 441 | 69 | 1 | - | - | - | - | - | - |
| | **20 mg/l** | 5 | - | - | - | - | - | - | - | - |
| | **100 mg/l** | - | - | - | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **30 - 40 m** | **10 mg/l** | 8,044 | 5,255 | 2,371 | 445 | - | - | - | - | - |
| | **20 mg/l** | 4,114 | 2,316 | 596 | 29 | - | - | - | - | - |
| | **100 mg/l** | 317 | 29 | - | - | - | - | - | - | - |
| | **500 mg/l** | - | - | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **40 - 50 m** | **10 mg/l** | 26,982 | 22,433 | 15,518 | 6,830 | 8 | - | - | - | - |
| | **20 mg/l** | 20,394 | 14,898 | 7,514 | 1,222 | - | - | - | - | - |
| | **100 mg/l** | 4,778 | 1,191 | 91 | 16 | - | - | - | - | - |
| | **500 mg/l** | 64 | 1 | - | - | - | - | - | - | - |
| | **1000 mg /l** | - | - | - | - | - | - | - | - | - |
| **50 - 60 m** | **10 mg/l** | 20,143 | 14,202 | 7,806 | 2,305 | 75 | - | - | - | - |
| | **20 mg/l** | 13,328 | 8,619 | 3,650 | 703 | 12 | - | - | - | - |
| | **100 mg/l** | 4,081 | 1,282 | 173 | 23 | - | - | - | - | - |
| | **500 mg/l** | 156 | 15 | - | - | - | - | - | - | - |
| | **1000 mg /l** | 7 | - | - | - | - | - | - | - | - |
| **5 m above seabed** | **10 mg/l** | 39,091 | 32,666 | 22,746 | 9,588 | 92 | - | - | - | - |
| | **20 mg/l** | 31,188 | 23,761 | 12,515 | 2,328 | 12 | - | - | - | - |
| | **100 mg/l** | 11,420 | 3,468 | 336 | 37 | - | - | - | - | - |
| | **500 mg/l** | 254 | 14 | - | - | - | - | - | - | - |
| | **1000 mg /l** | 4 | - | - | - | - | - | - | - | - |

*Table 8-5: Area (ha) experiencing sediment concentration equal or greater than 10, 20, 100, 500, and 1000 mg/l for during varying durations and at different depths during season 2 For Info: 100 ha = 1km$^2$.*

## 8.1. Estimated sedimentation

The sedimented sediments originate from the dredging of the gravity-based substructures and the offshore substations and the burying of the inter-array and export cables using jetting.

Results of the sedimentation case are presented in Figure 8.6, Table 8-6 and Table 8-7, Appendix 19 and Appendix 20. The results can be summarised as follows:

- There is no outstanding difference in respect to the maximum sedimentation height between the seasons considered.

- The strongest sedimentation is observed along the inter-array and export cables, where the largest amount of sediment is released.

- Sedimentation of at least 1 mm must be expected over an area of 19,365 ha (season 1), respectively 18,139 ha (season 2).

- As a result of the construction phase a maximum sedimentation height of 30 mm (1,650 kg/m$^3$, over an area of 3 ha (season 1), 6 h respectively (season 2)) is reached.

- The greatest distance for a sedimentation of less than 1 mm between the source and sedimentation accounts to approximately 38 kilometres to the south and 24 kilometres to the south-west (season 1). Larger sedimentation occur in a short distance to the source, approximately +/-500m.

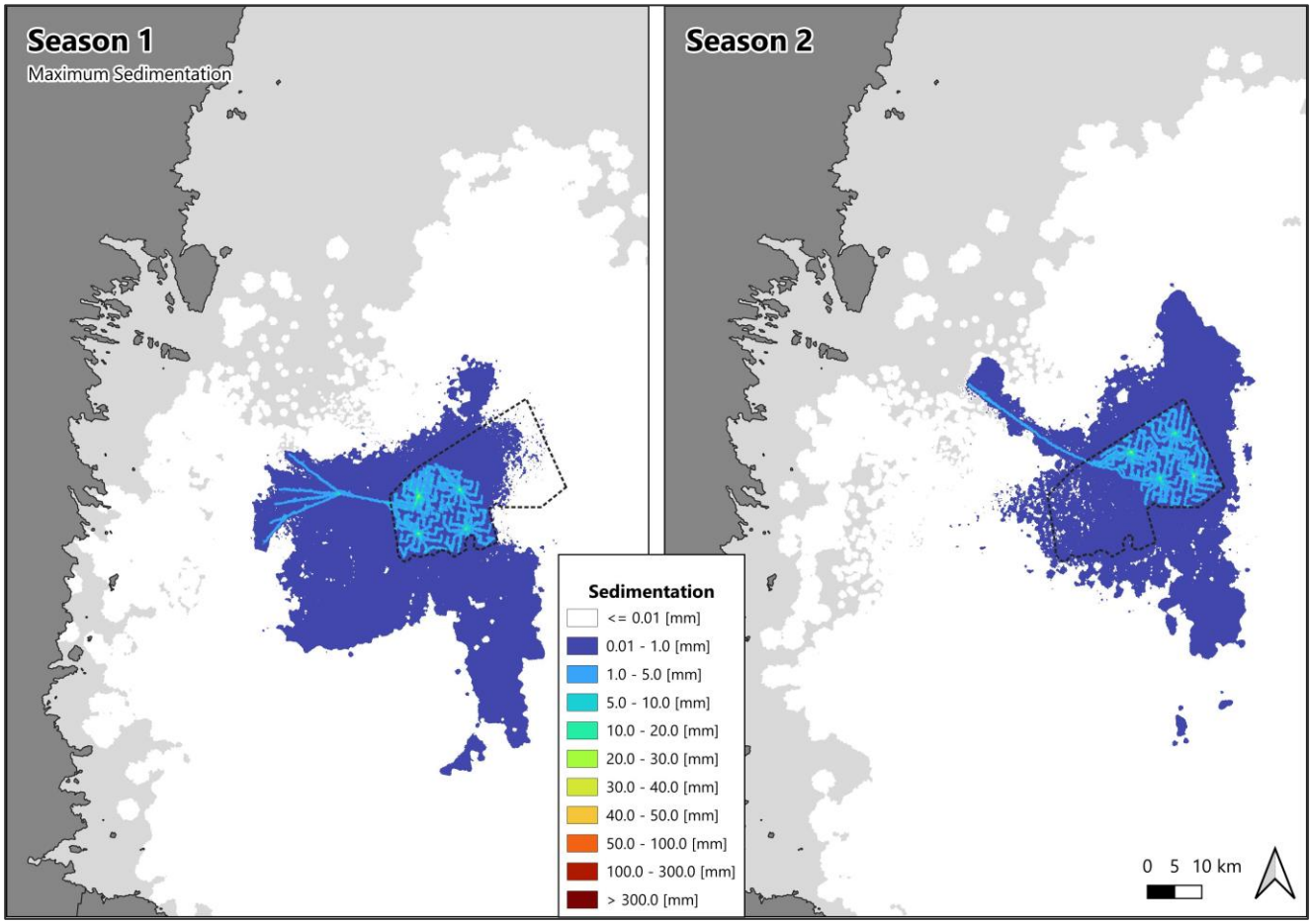



*Figure 8.6: Maximum recorded sedimentation (10 minutes value, 1,650 kg/m$^3$) resulting from season 1 (top) and season 2 (bottom).*

*Table 8-6: Area (ha) experiencing sedimentation due to the sediment disposal during season 1 case. For info: 100 ha = 1 km$^2$.*

| | Sedimentation [mm] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **5** | **10** | **20** | **30** | **40** | **50** | **100** | **300** |
| **Maximum** | 19,365 | 3,680 | 465 | 47 | 3 | - | - | - | - |
| **End** | 19,365 | 3,680 | 465 | 47 | 3 | - | - | - | - |

*Table 8-7: Area (ha) experiencing sedimentation due to the sediment disposal during season 1 case. For info: 100 ha = 1 km$^2$.*

| | Sedimentation [mm] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **5** | **10** | **20** | **30** | **40** | **50** | **100** | **300** |
| **Maximum** | 18,139 | 3,374 | 323 | 35 | 6 | - | - | - | - |
| **End** | 18,139 | 3,374 | 323 | 35 | 6 | - | - | - | - |

# 9. References


Copernicus. (2022, 10). *Baltic Sea Physics Analysis and Forecast, 2x2km*. Retrieved from https://resources.marine.copernicus.eu/product-detail/BALTICSEA_ANALYSISFORECAST_PHY_003_006/INFORMATION

Copernicus. (2022, 10). *Baltic Sea Physics Reanalysis 4x4km*. Retrieved from Copernicus: https://resources.marine.copernicus.eu/product-detail/BALTICSEA_REANALYSIS_PHY_003_011/INFORMATION

DHI/IOW Consortium. (2013). *Fehmarnbelt Fixed Link EIA. Marine Soil - Impact Assessment. Sediment Spill during Construction of the Fehmarnbelt Fixed Link. Report No. E1TR0059 - Voume II.* https://vvmdocumentation.femern.com/8.%20E1TR0059%20Vol%20II6fdc.pdf?filename=files/BR/8.%20E1TR0059%20Vol%20II.pdf.

ECMWF, C. C. (2022, 12 01). *Climate Data Store*. (ECMWF) Retrieved from https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=form

EMODnet. (2022). *EMODnet geology*. Retrieved from https://www.emodnet-geology.eu/map-viewer/?p=sea_floor_geology

EMODnet. (2023, 03 15). *Bathymetry 2022*. Retrieved from portal.emodnet-bathymetry.eu/#: portal.emodnet-bathymetry.eu/#

HELCOM. (2017). *Baltic Sea Bathymetry Database*. Retrieved from https://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/8b46e4c7-f911-44ab-89e6-2c8b8d9fa2c0

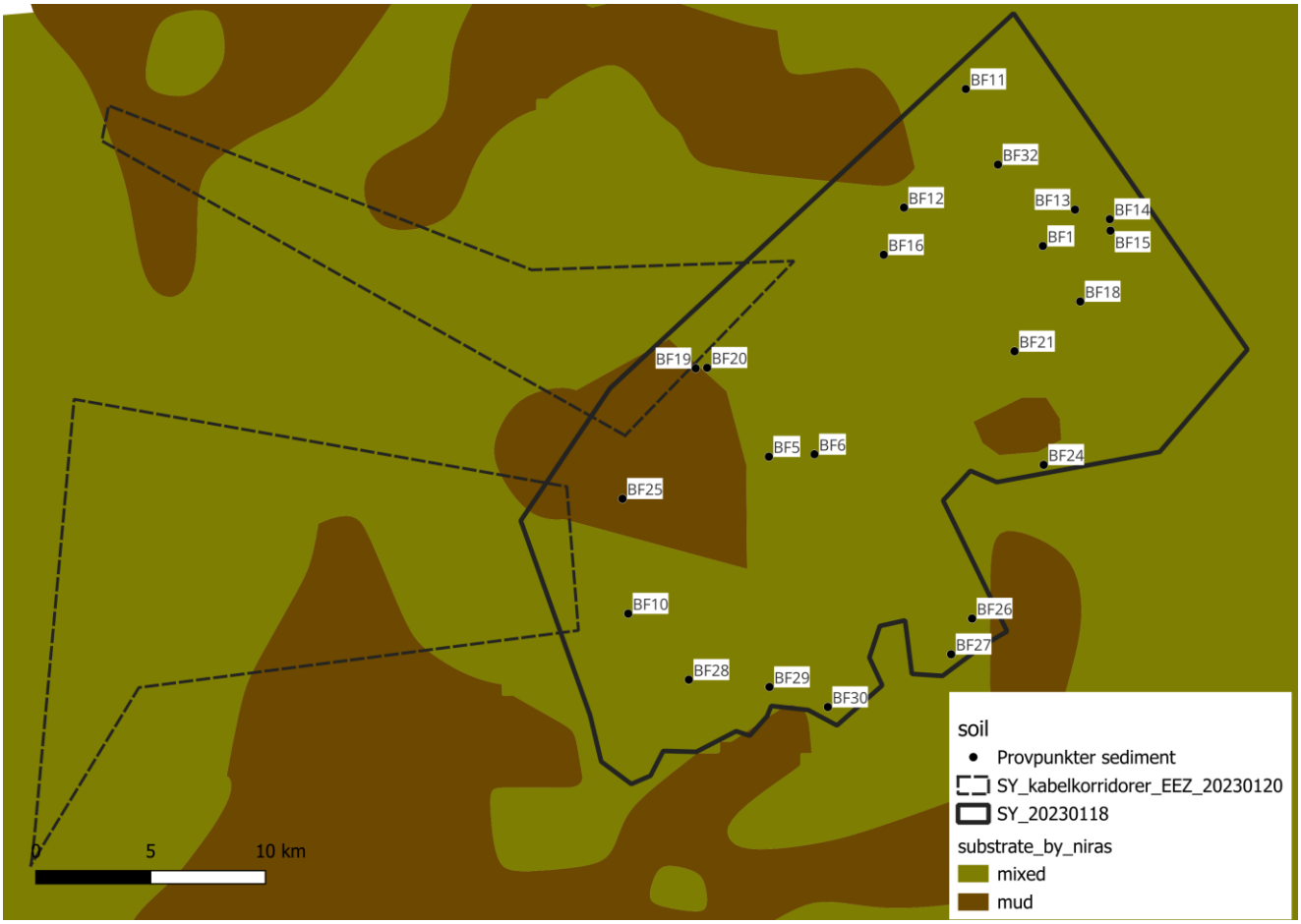
HELCOM. (2023). *Baltic Sea Bathymetry Database*. Retrieved from https://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/8b46e4c7-f911-44ab-89e6-2c8b8d9fa2c0

Jensen, N.O. (1983). *A note on wind generator interaction.* DTU.

SGU. (2020). *https://resource.sgu.se/service/wms/130/maringeologi-100-tusen*. Retrieved from Maringeologi 1:100 000: https://resource.sgu.se/service/wms/130/maringeologi-100-tusen

# Appendix 1: Grain sieve analyses

| Type | ID: | BF1 | BF5 | BF6 | BF10 | BF11 | BF12 | BF13 | BF14 | BF15 | BF16 | BF18 | BF19 | BF20 | BF21 | BF23 | BF24 | BF25 | BF26 | BF27 | BF28 | BF29 | BF30 | BF32 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ler | <0,002 mm | 1 | 25 | 2 | 5 | 7 | 15 | 3 | 10 | 9 | 8 | 5 | 46 | 20 | 4 | 70 | 7 | 42 | 7 | 9 | 6 | 4 | 16 | 8 |
| Finsilt | 0,002-0,006 mm | 1 | 16 | 2 | 5 | 2 | 8 | 2 | 6 | 6 | 4 | 3 | 15 | 9 | 3 | 17 | 5 | 17 | 3 | 3 | 4 | 3 | 8 | 4 |
| Mellansilt | 0,006-0,02 mm | 1 | 8 | 2 | 8 | 2 | 5 | 3 | 6 | 6 | 6 | 3 | 1 | 5 | 3 | 2 | 3 | 8 | 4 | 2 | 4 | 4 | 9 | 5 |
| Grovsilt | 0,02-0,06 mm | 4 | 9 | 4 | 9 | 3 | 12 | 5 | 11 | 10 | 12 | 6 | 17 | 19 | 21 | 2 | 13 | 15 | 4 | 8 | 22 | 24 | 11 | 0 |
| Finsand | 0,06-0,2 mm | 4 | 21 | 11 | 3 | 12 | 43 | 8 | 15 | 12 | 23 | 17 | 19 | 23 | 61 | 7 | 23 | 17 | 7 | 27 | 60 | 60 | 20 | 5 |
| Mellansand | 0,2-0,6 mm | 61 | 16 | 35 | 24 | 23 | 1 | 19 | 41 | 37 | 23 | 35 | 2 | 18 | 8 | 0 | 15 | 1 | 15 | 32 | 4 | 3 | 16 | 25 |
| Grovsand | 0,6-2 mm | 12 | 3 | 35 | 46 | 19 | 6 | 25 | 7 | 9 | 16 | 11 | 0 | 3 | 0 | 0 | 16 | 0 | 10 | 11 | 1 | 0 | 11 | 12 |
| Fingrus | 2-6 mm | 4 | 1 | 7 | 1 | 18 | 11 | 19 | 3 | 4 | 6 | 12 | 0 | 1 | 0 | 1 | 8 | 0 | 15 | 6 | 0 | 0 | 6 | 18 |
| Mellangrus | 6-20 mm | 12 | 1 | 3 | 0 | 15 | 0 | 18 | 1 | 7 | 1 | 9 | 0 | 1 | 0 | 0 | 10 | 0 | 36 | 1 | 0 | 0 | 4 | 23 |



# Appendix 2 Current field (SMHI)

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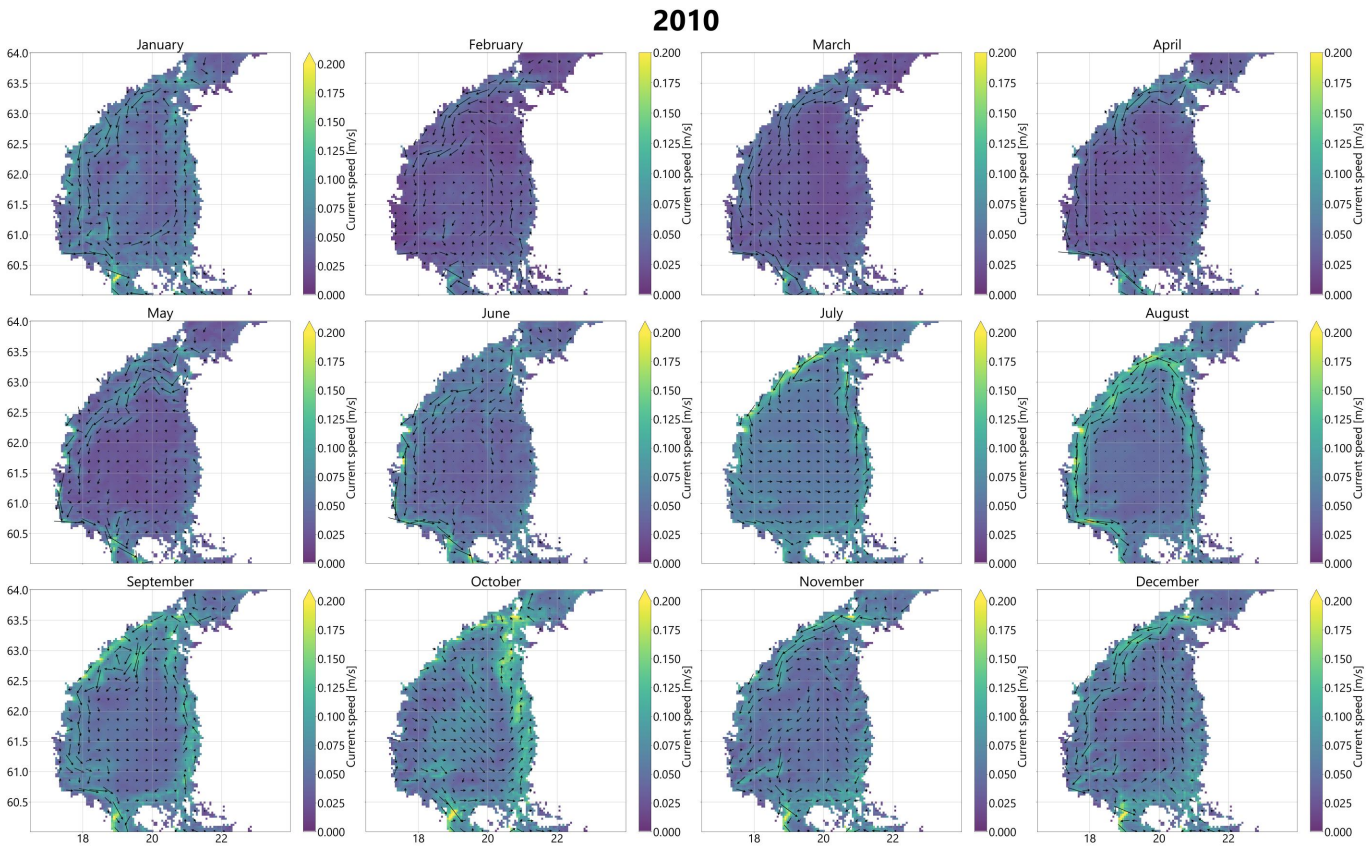

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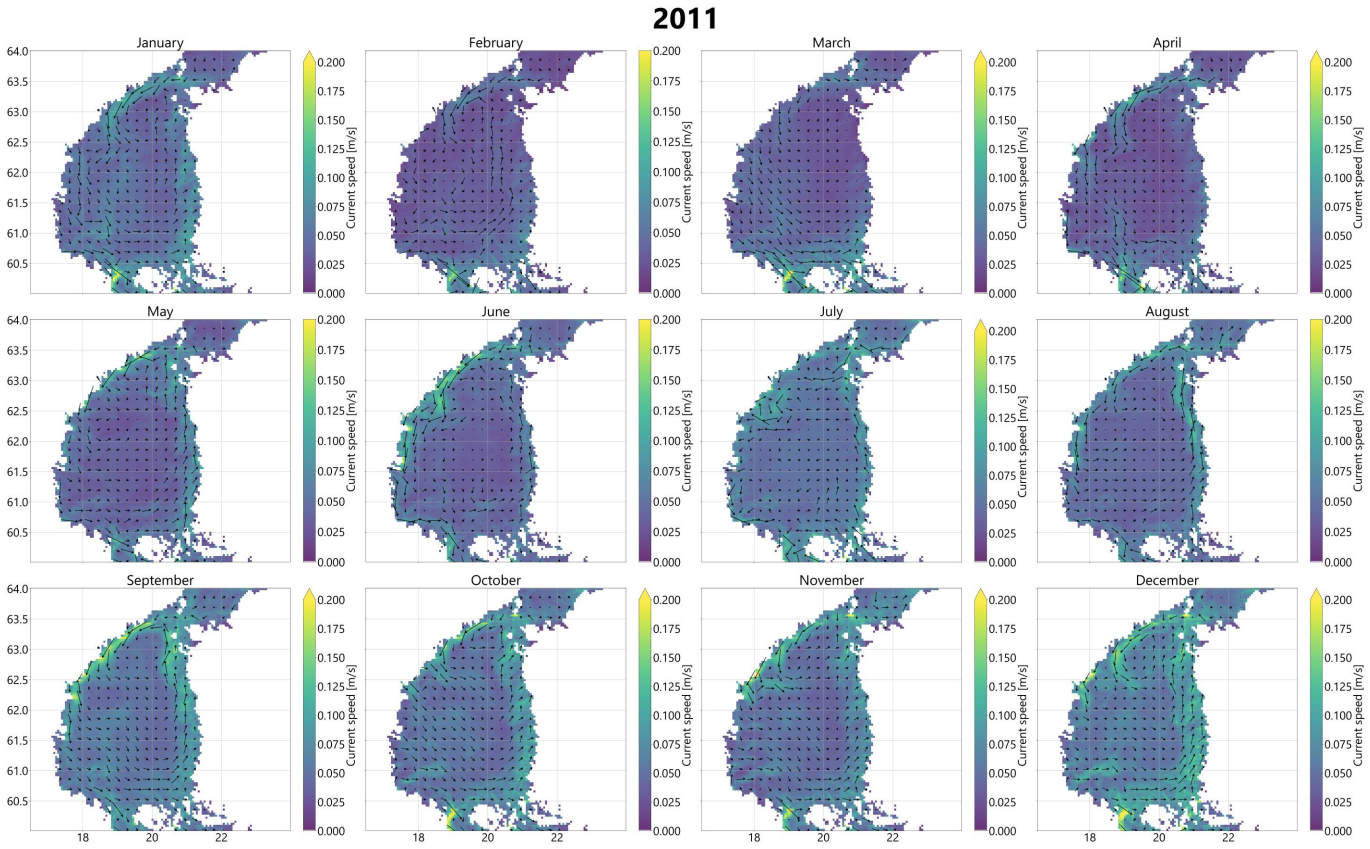

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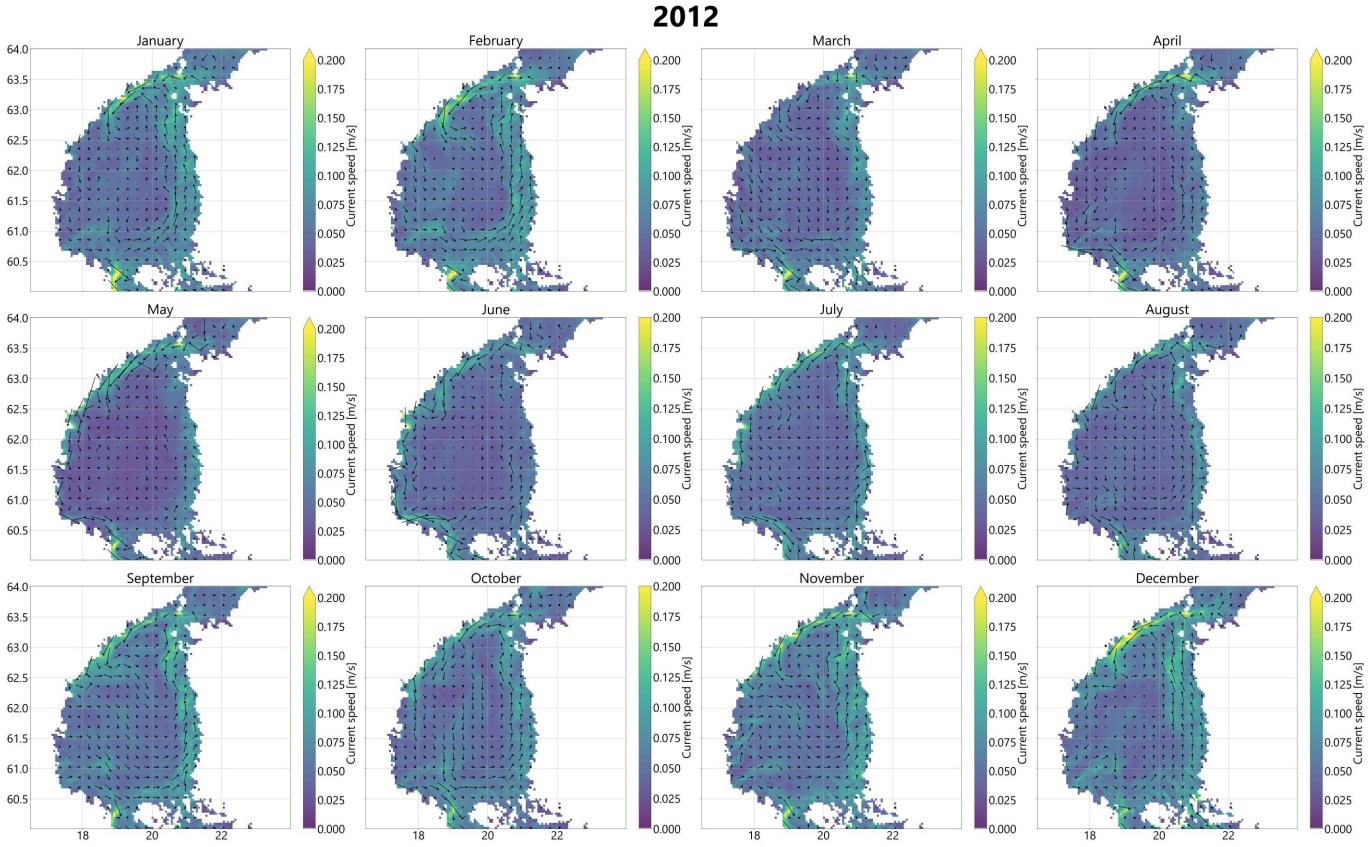

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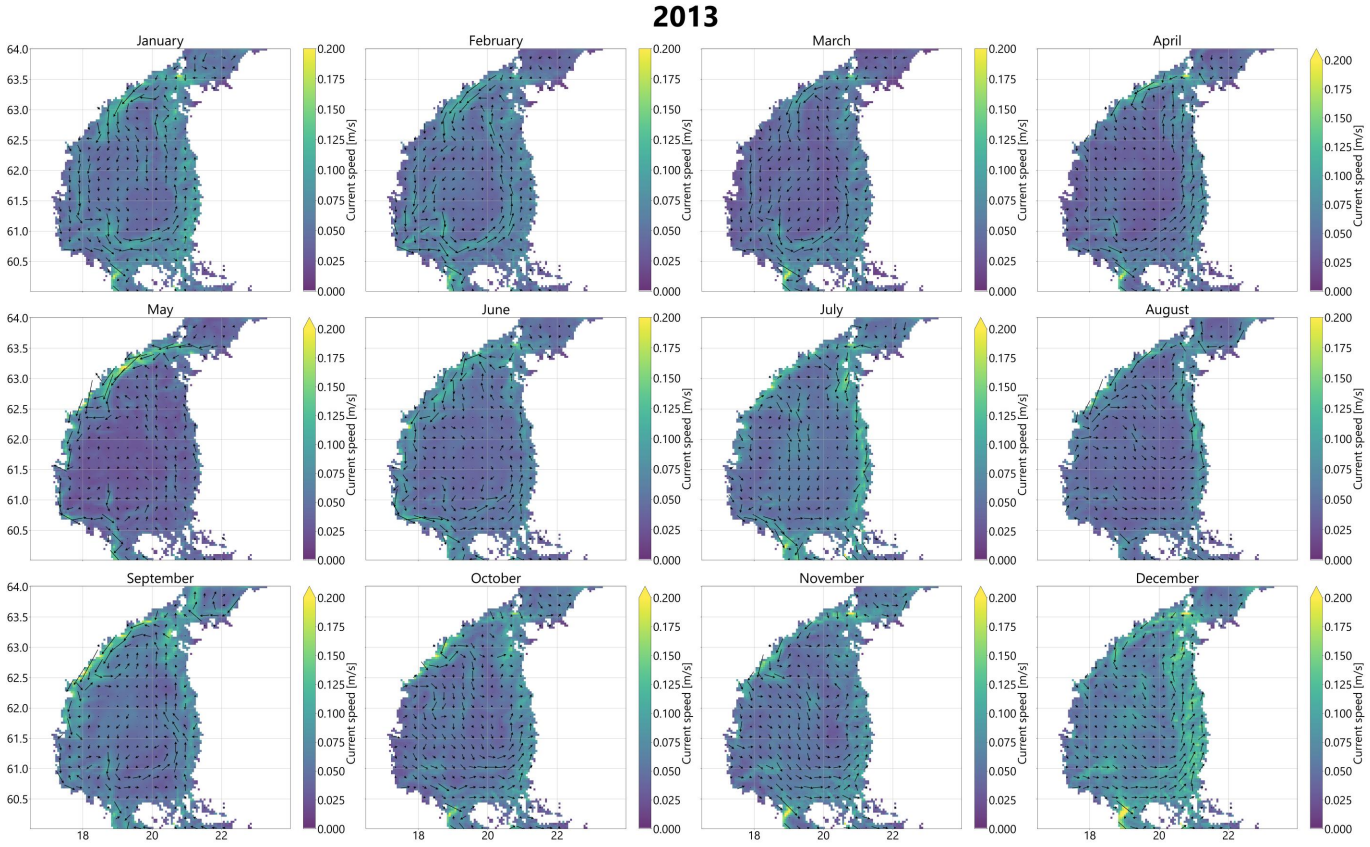

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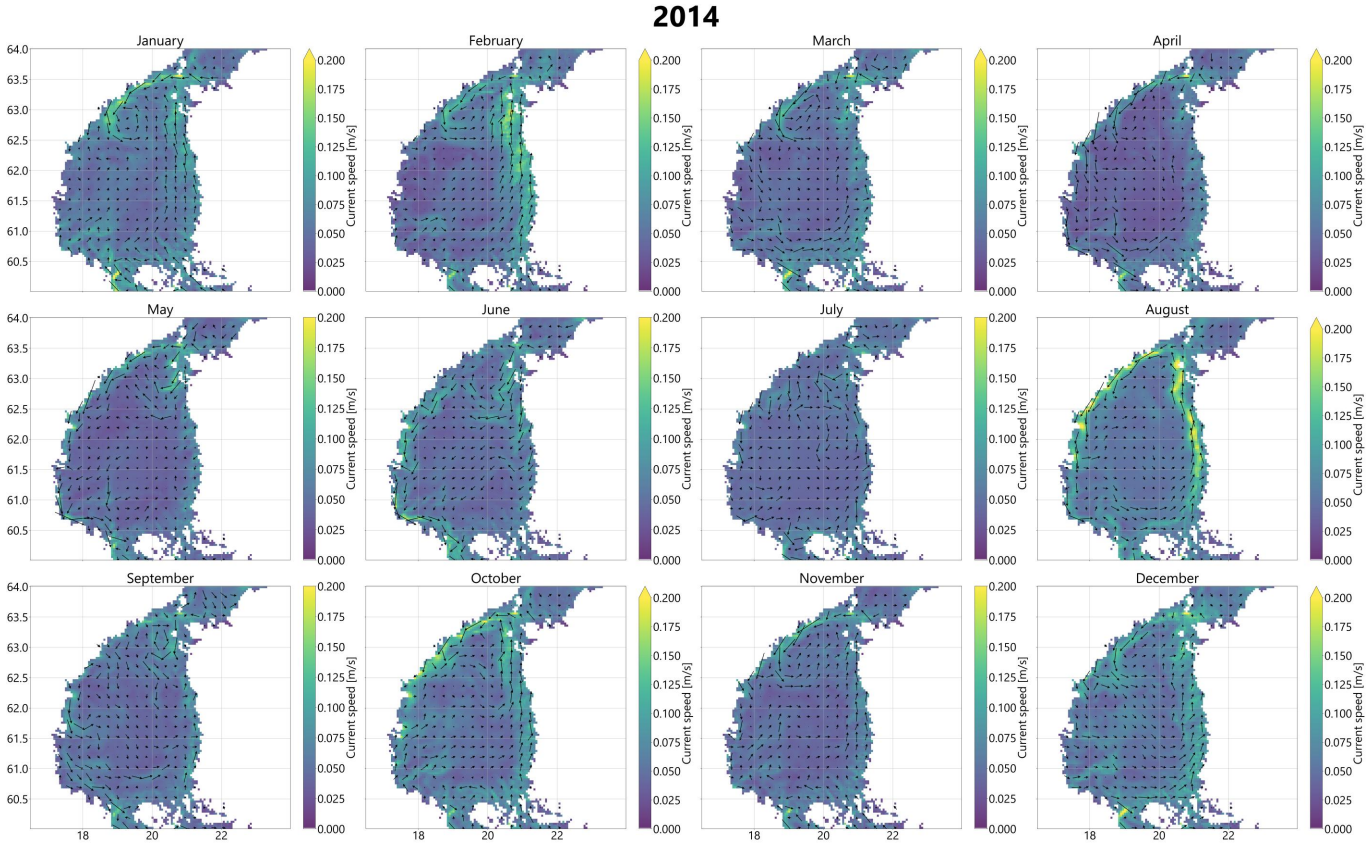

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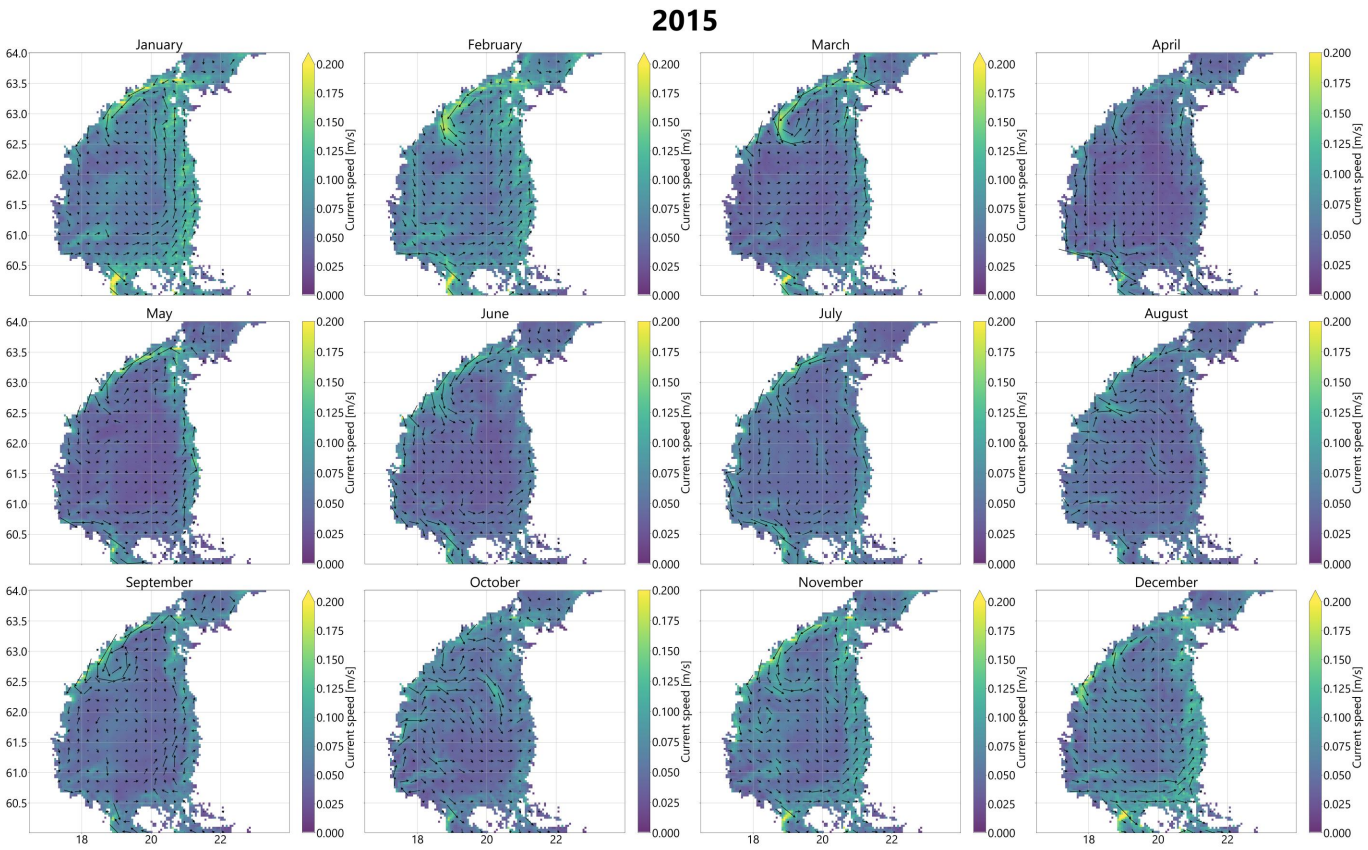

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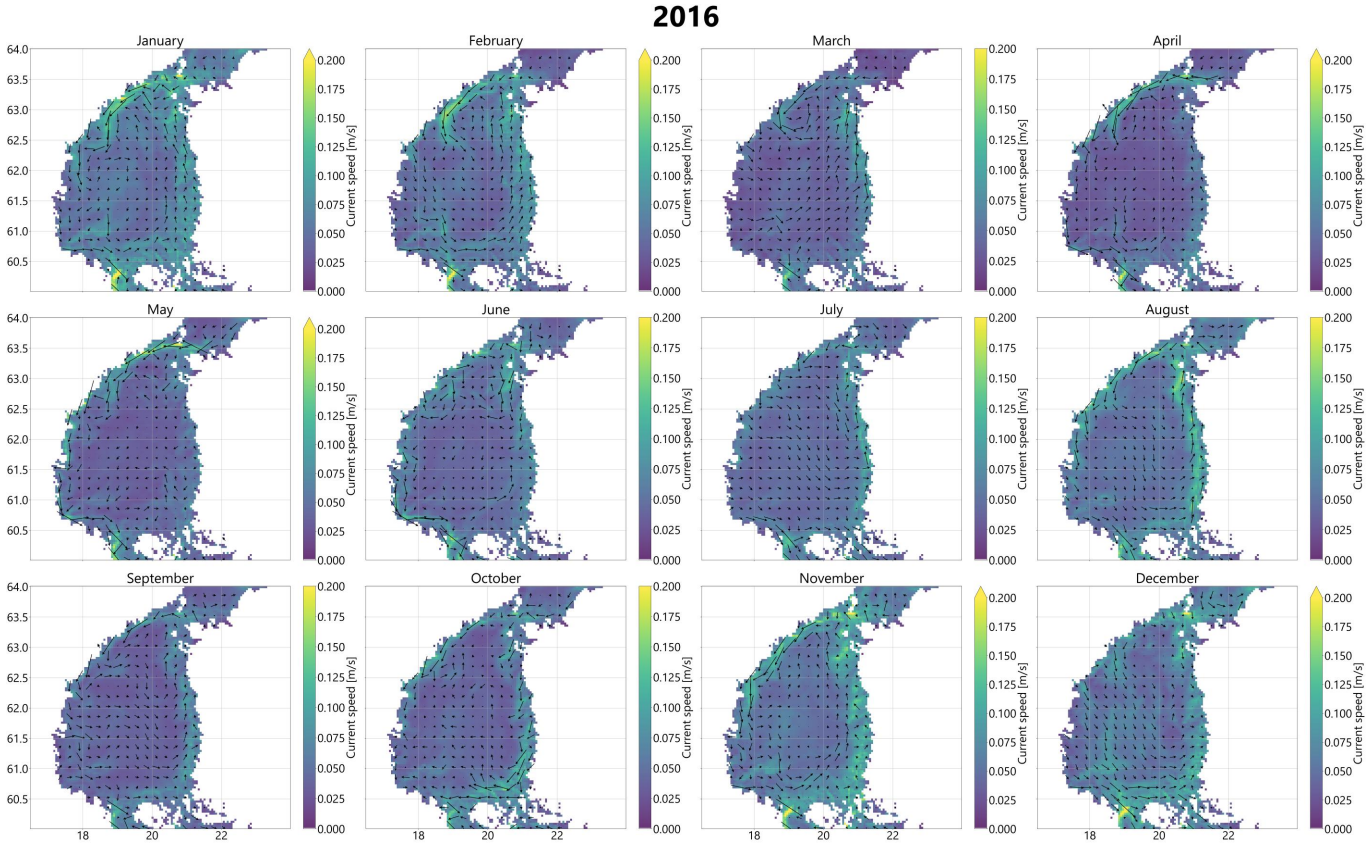

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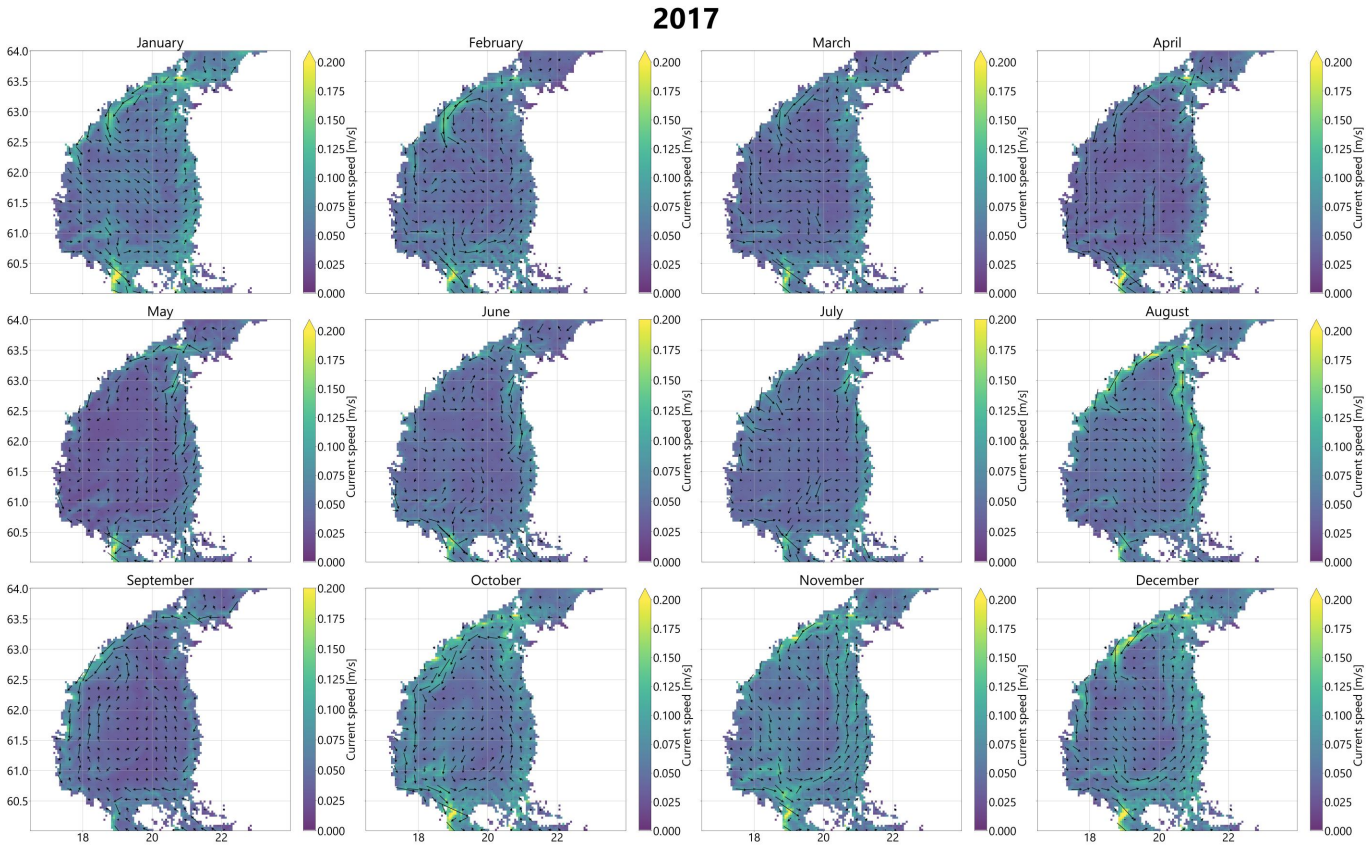

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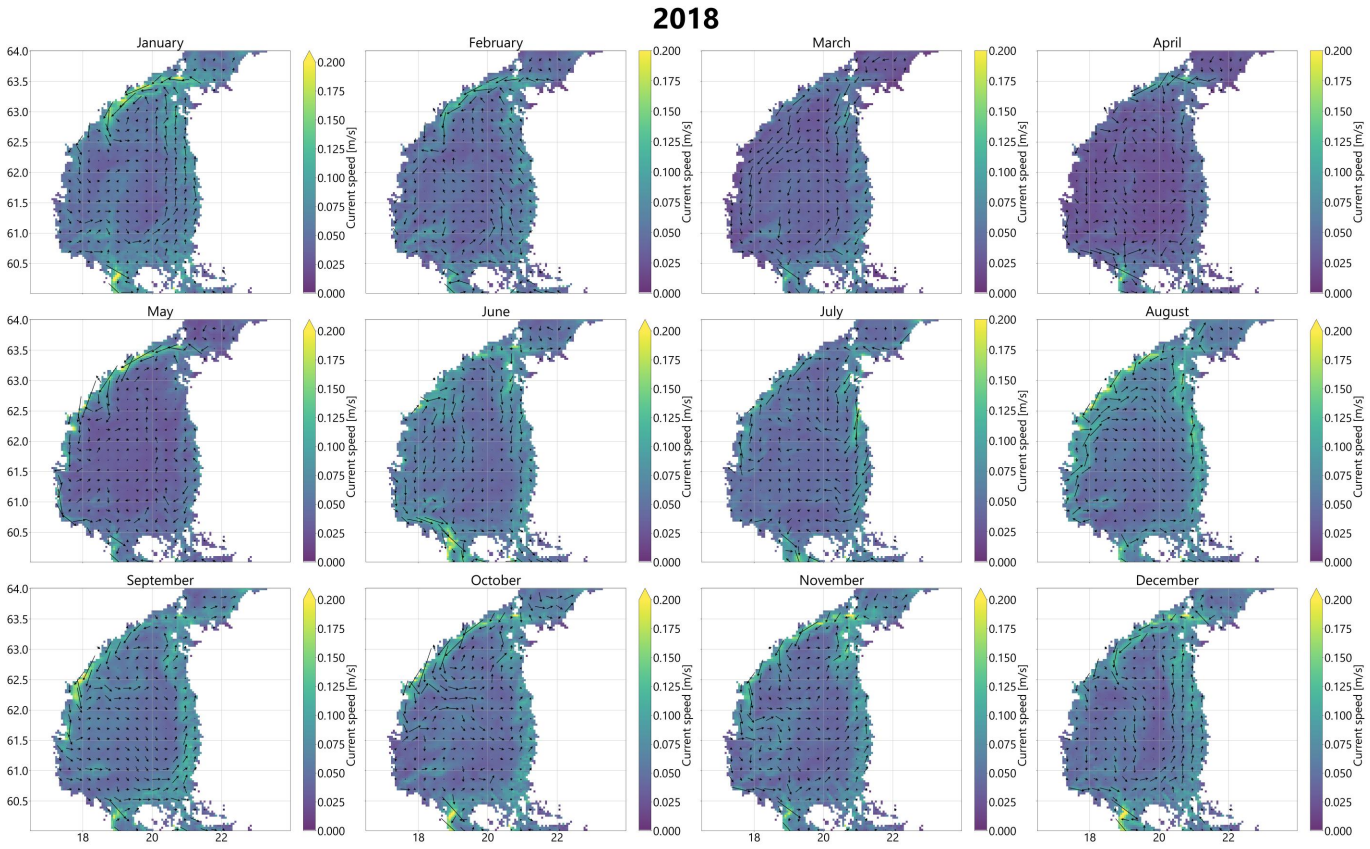

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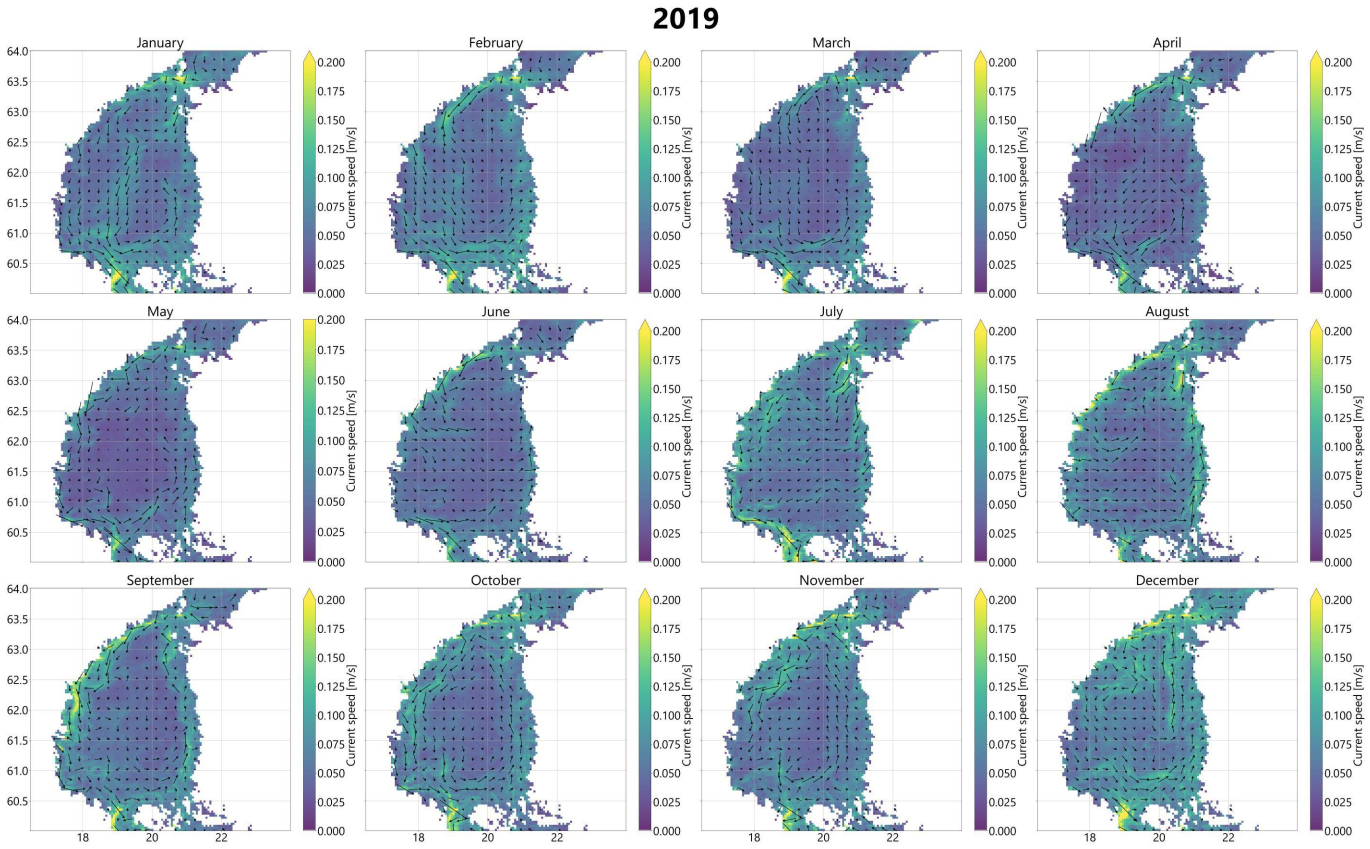

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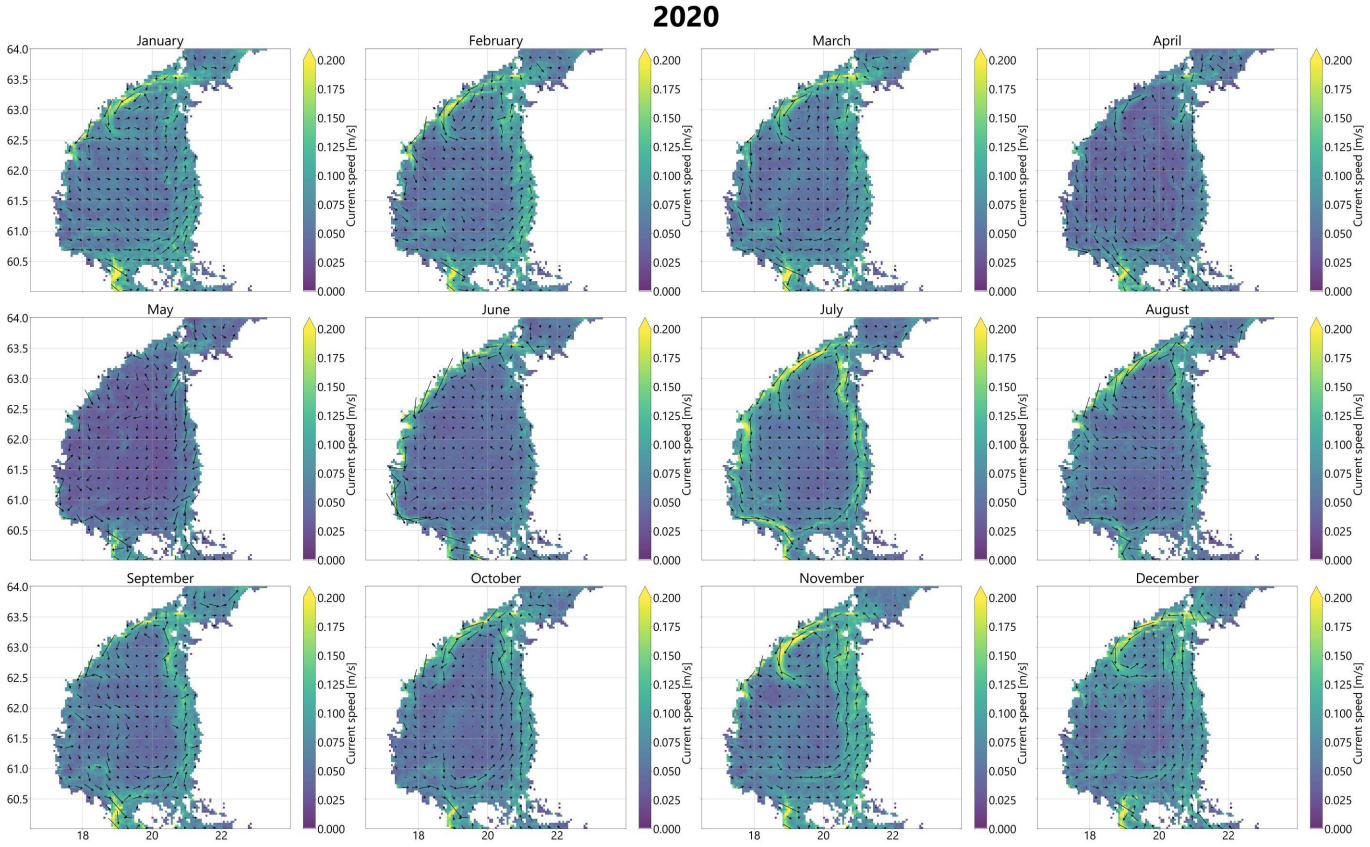

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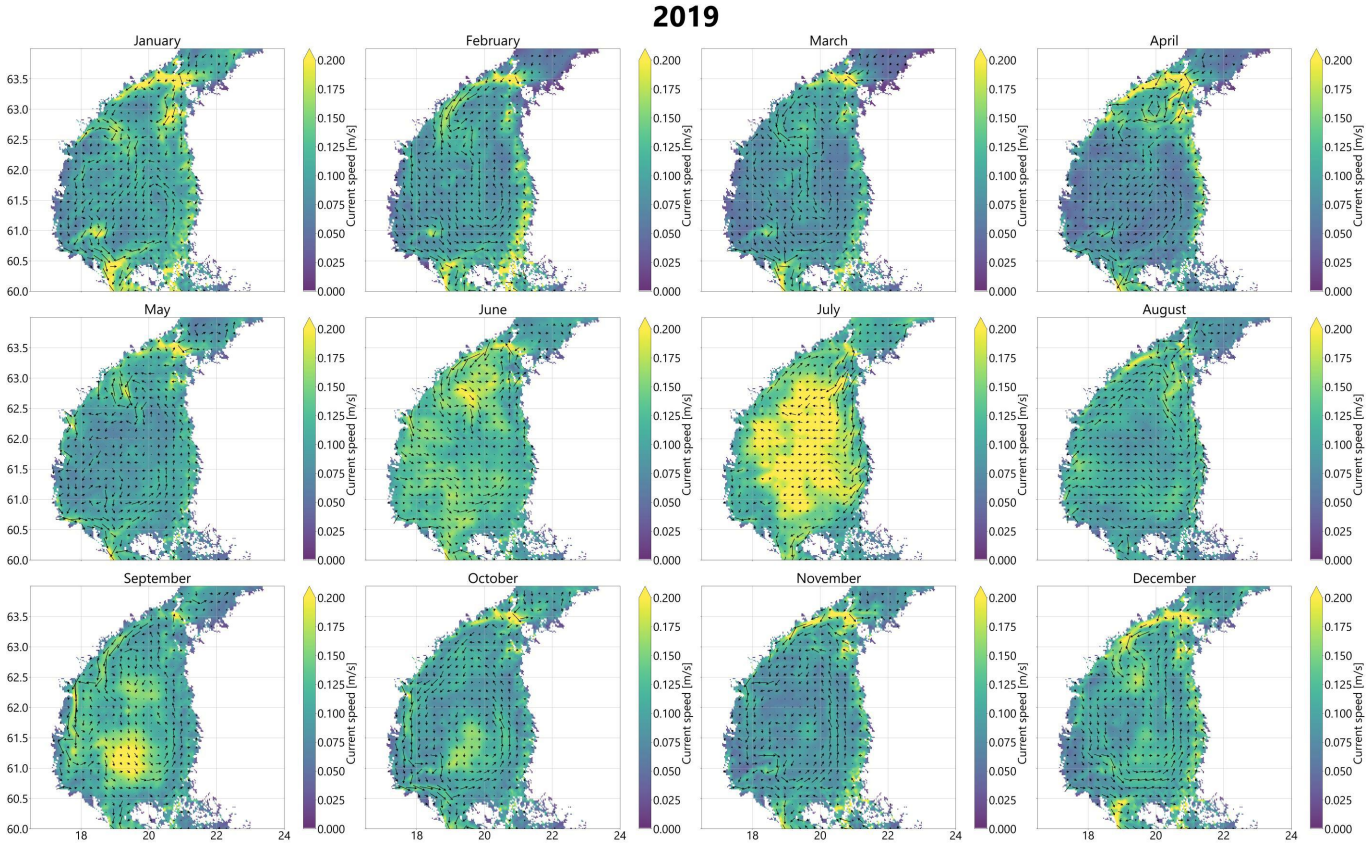

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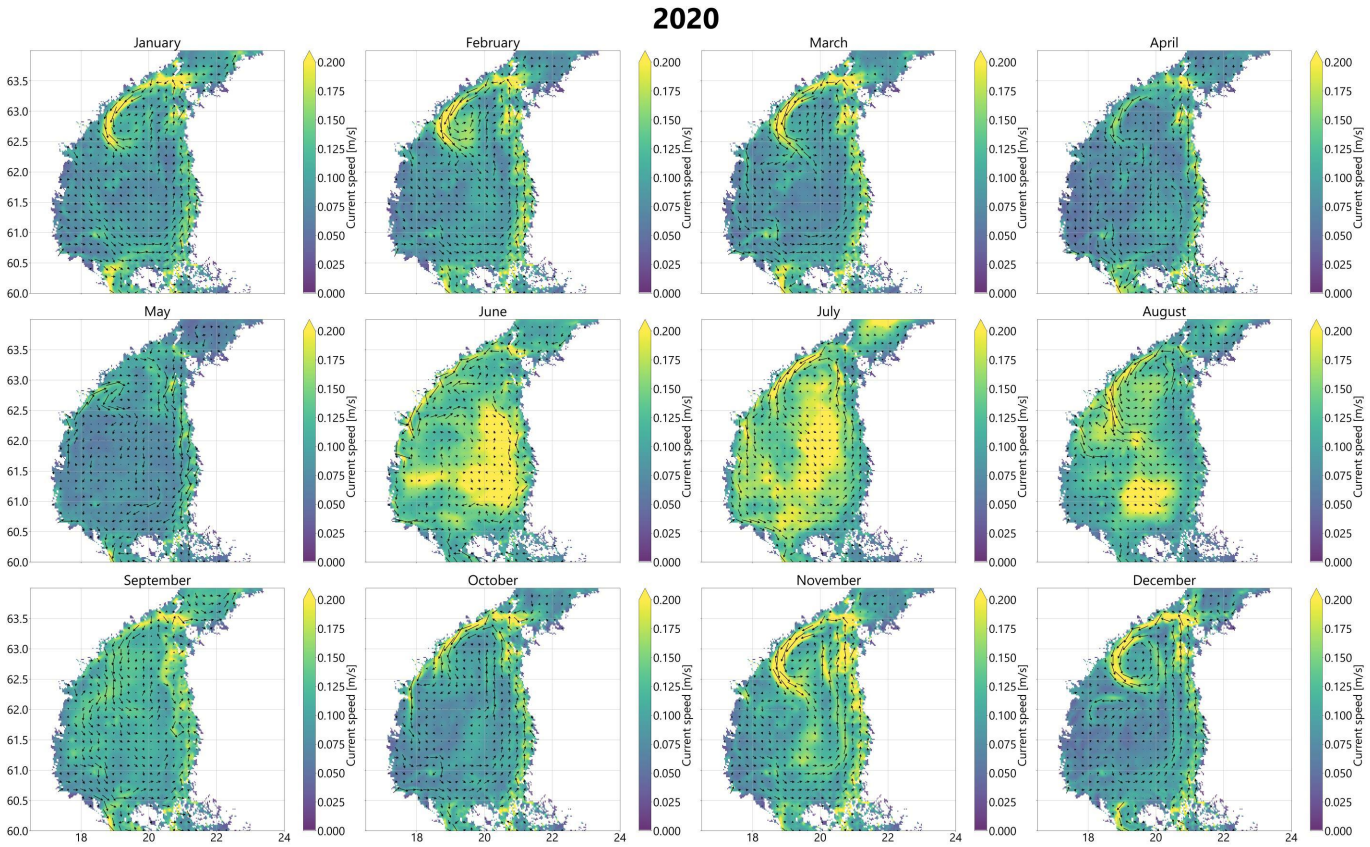

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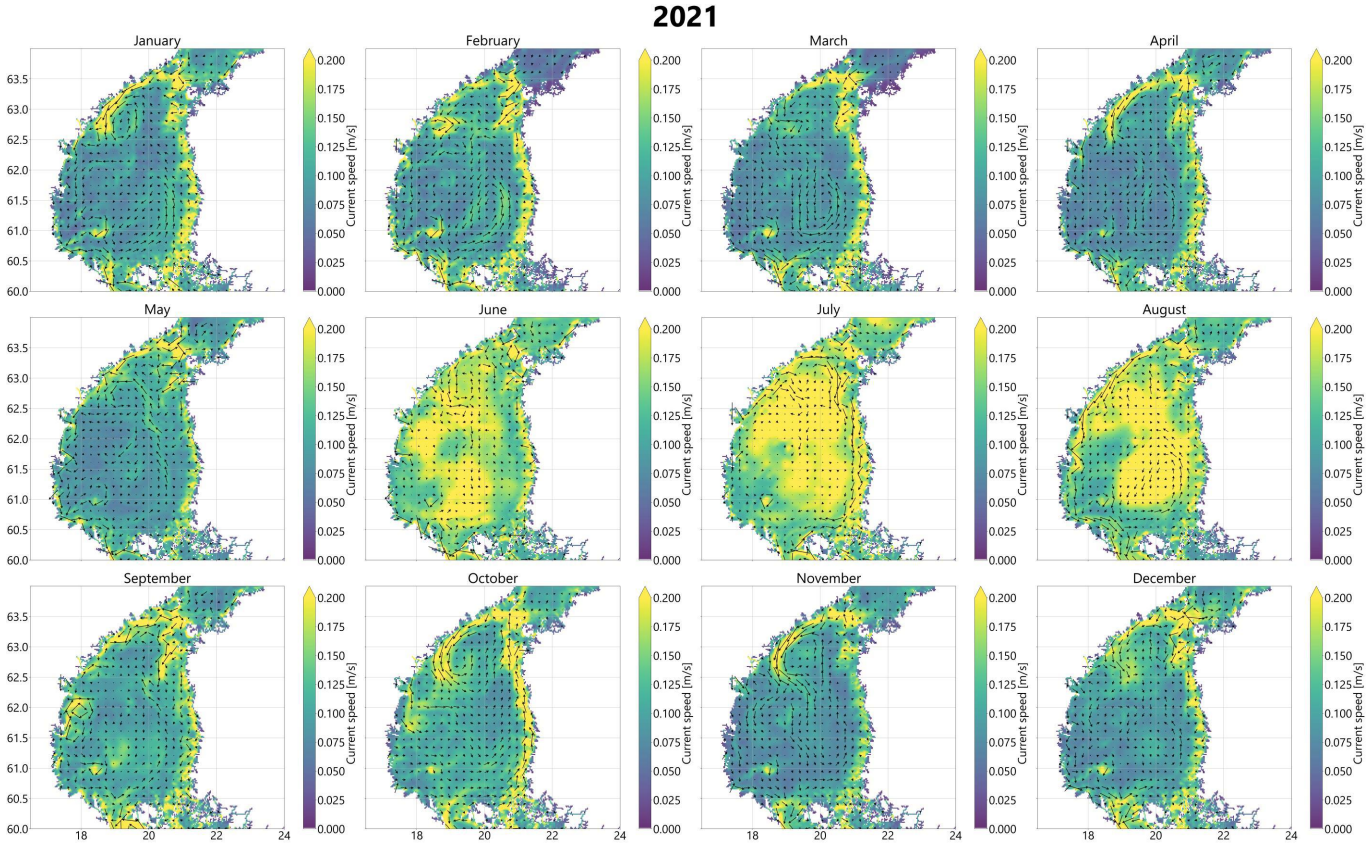

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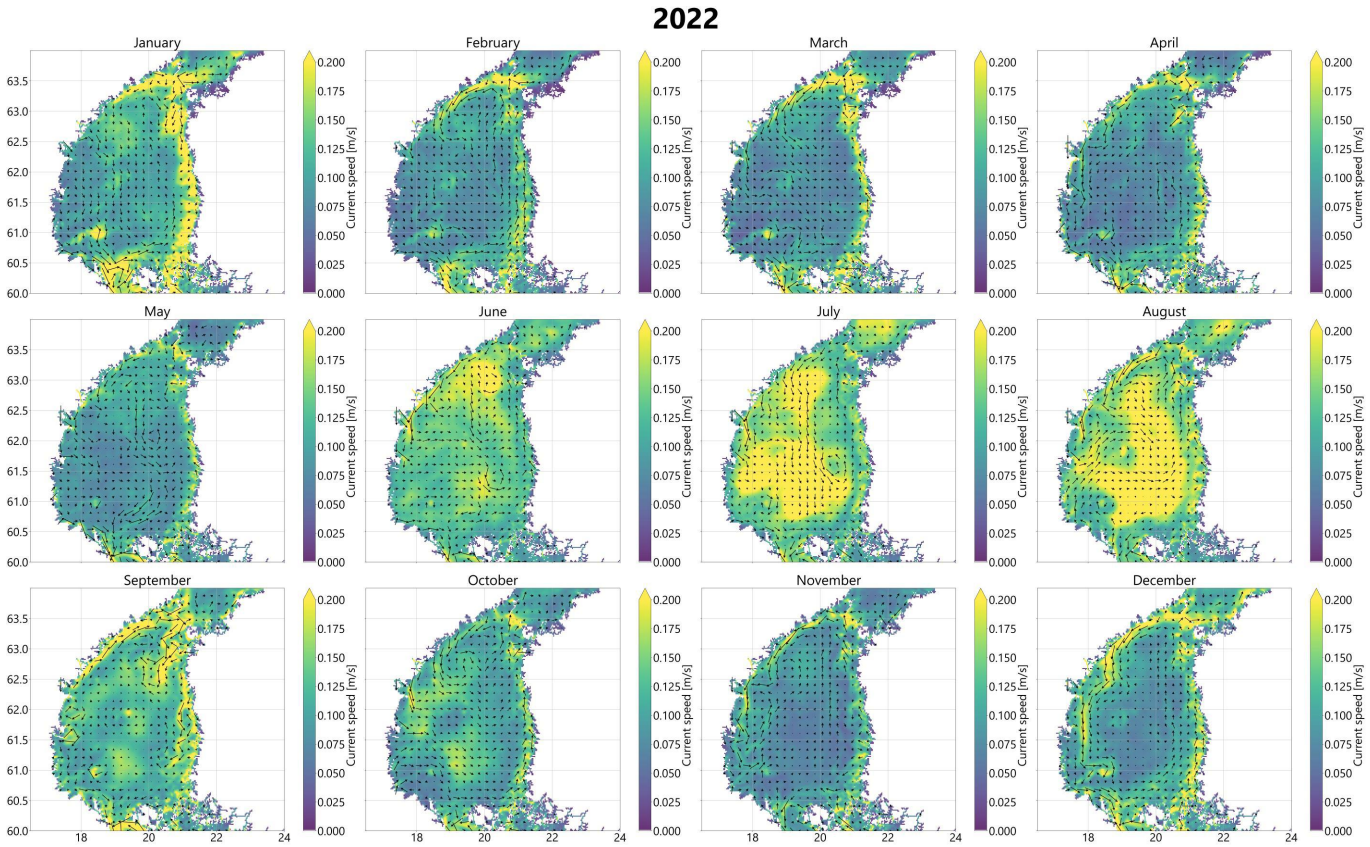

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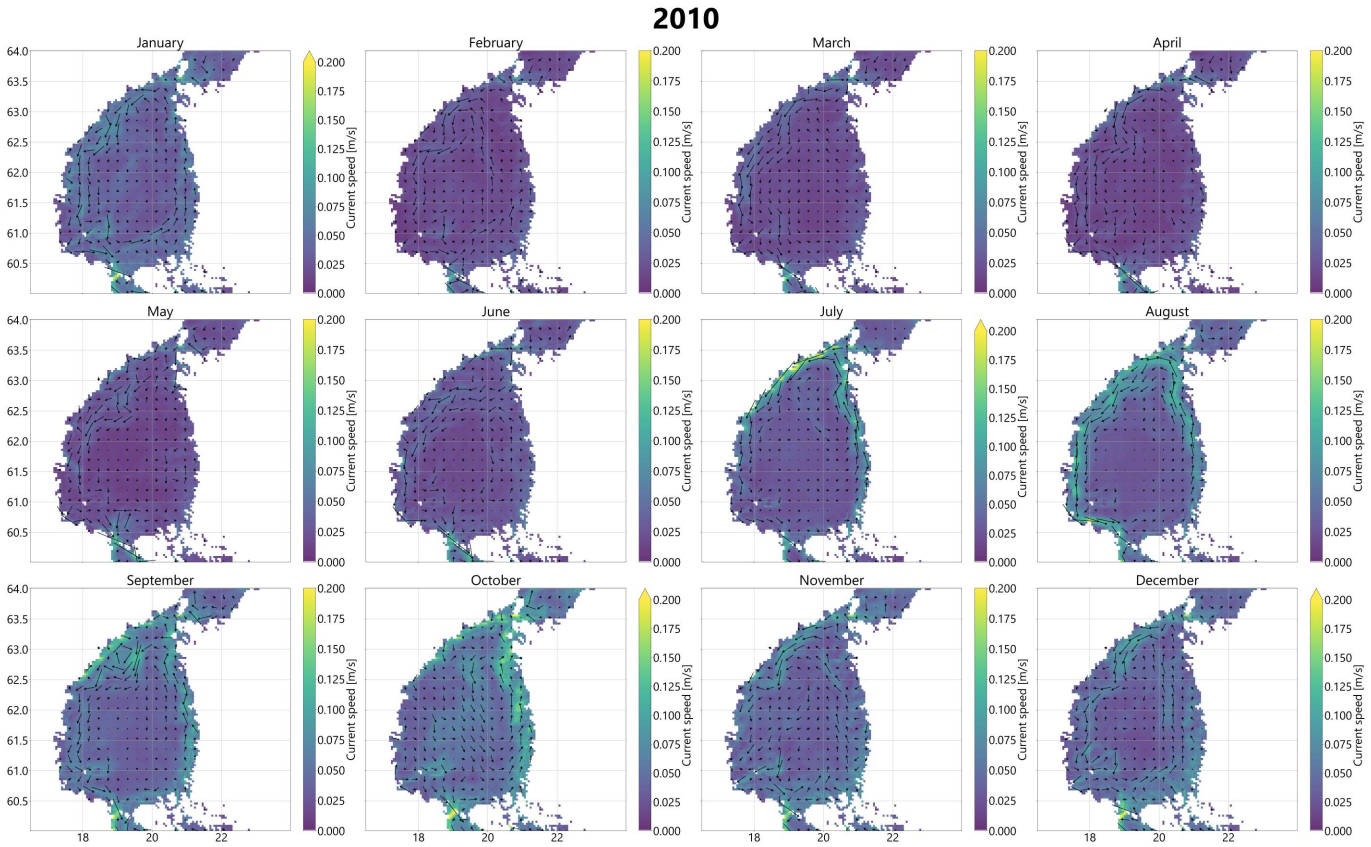

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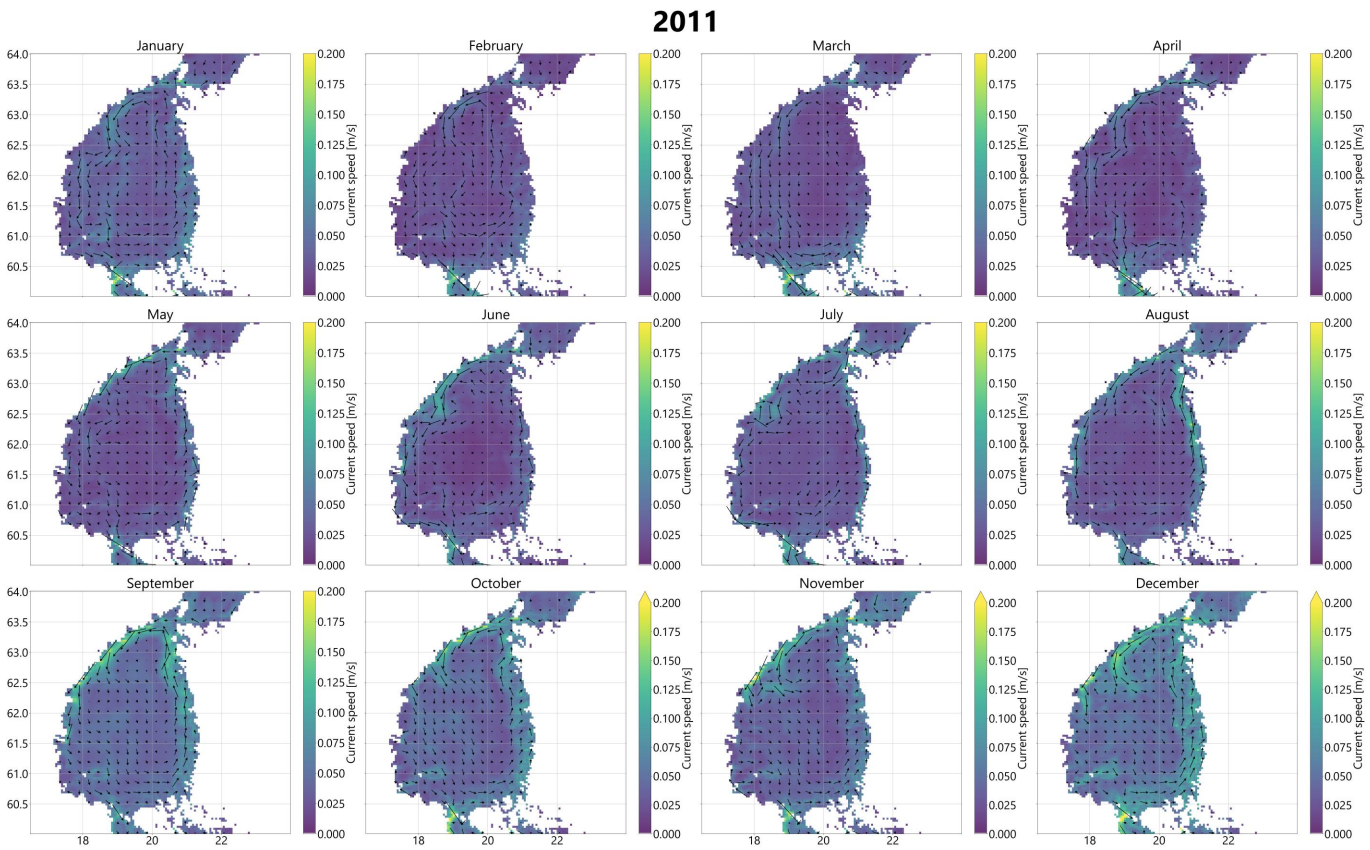

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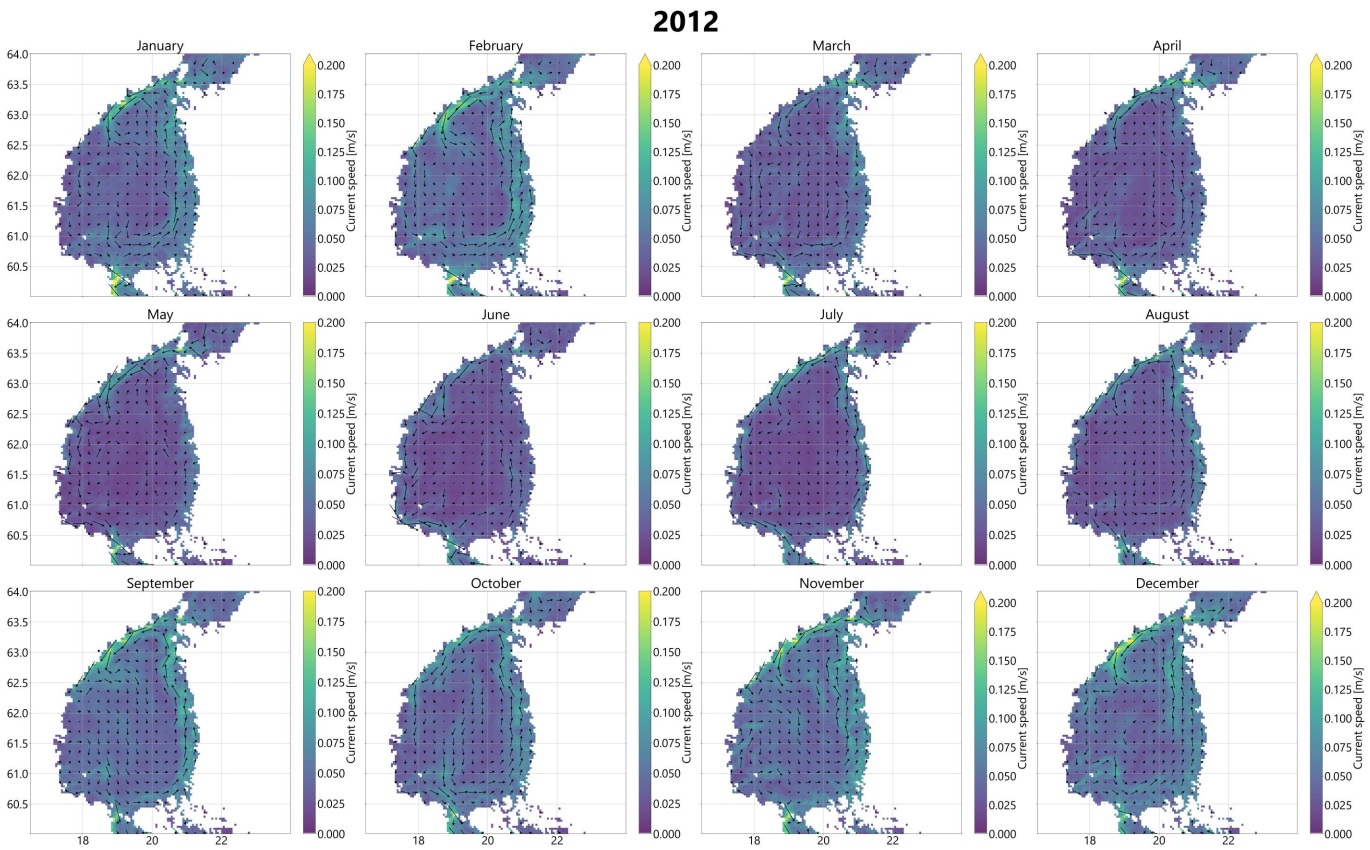

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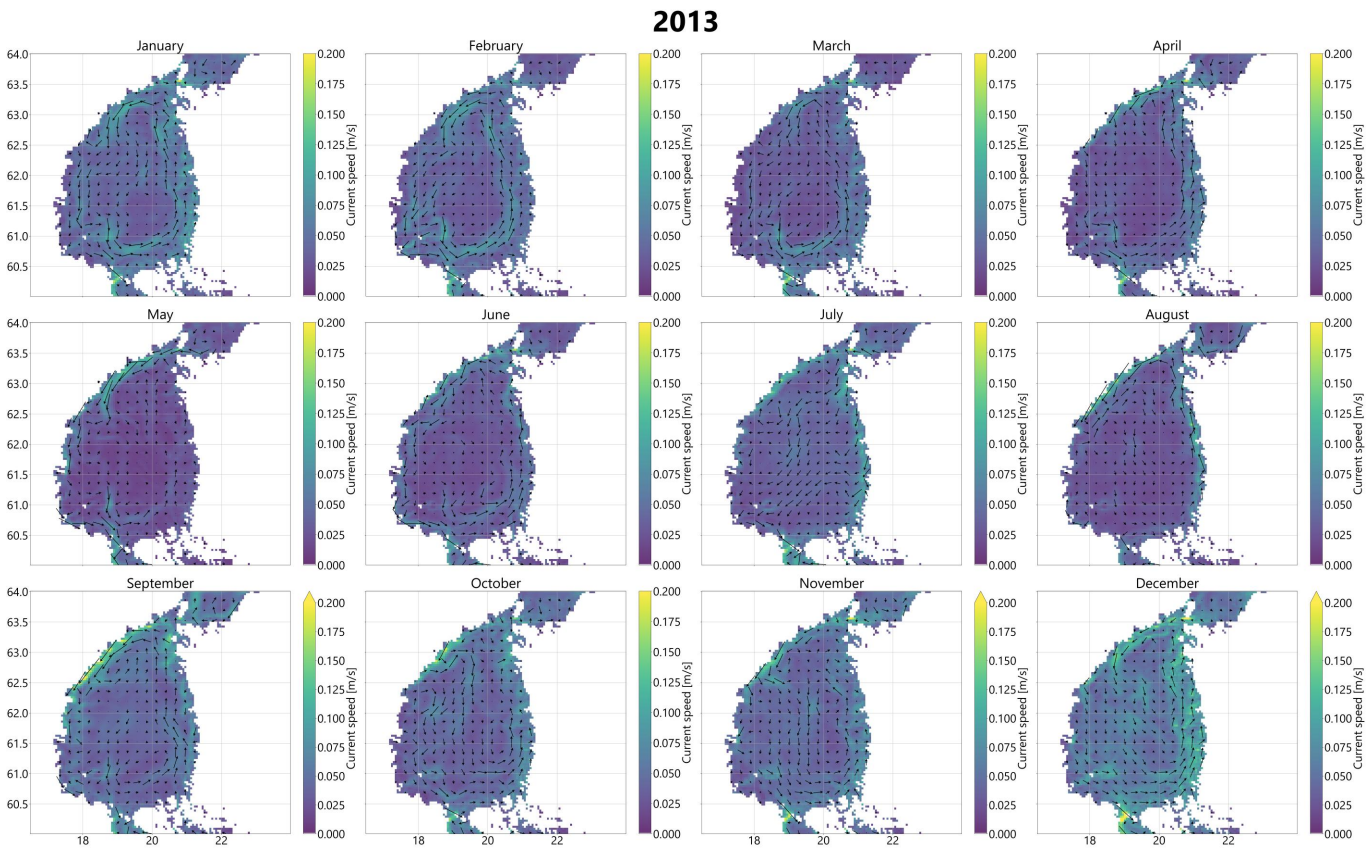

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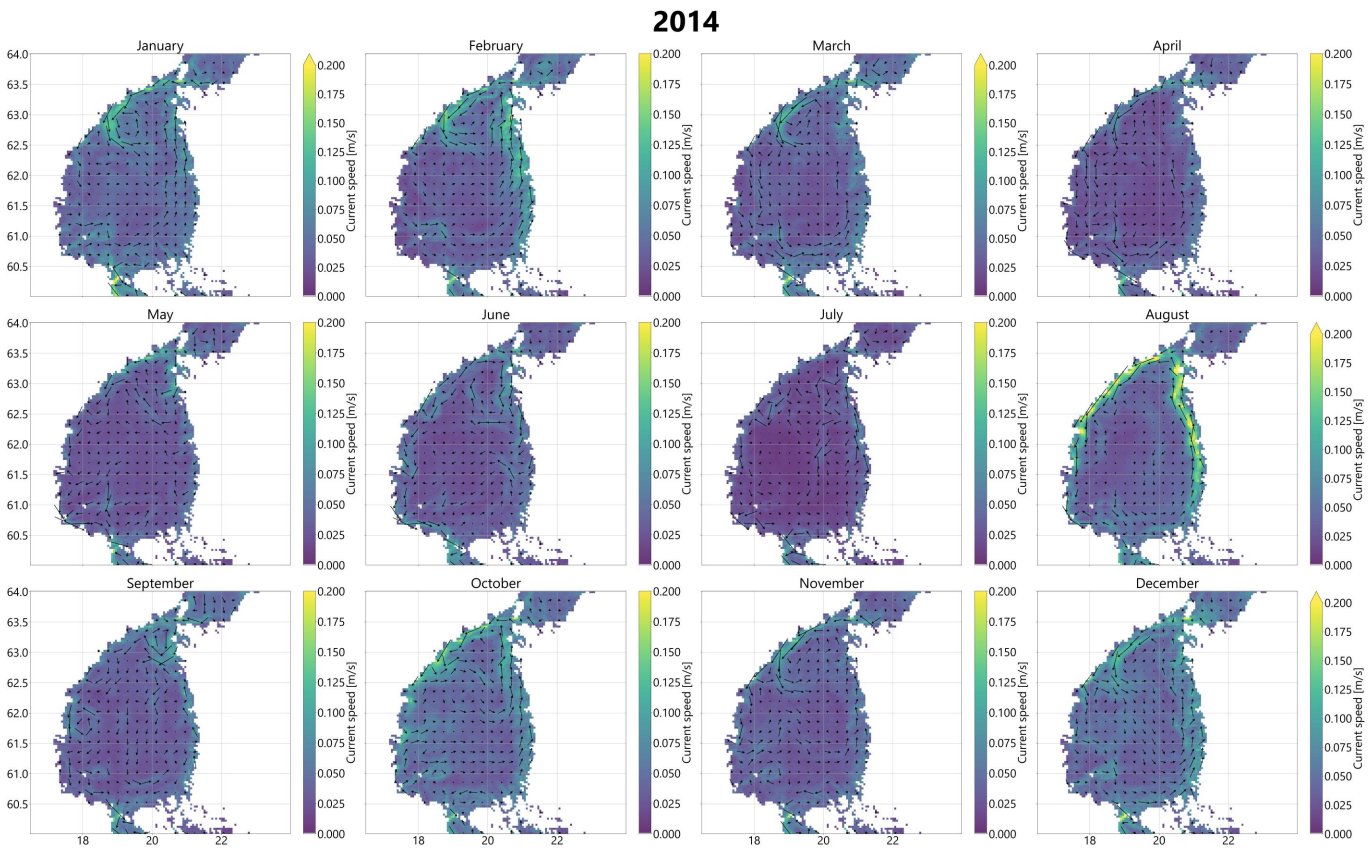

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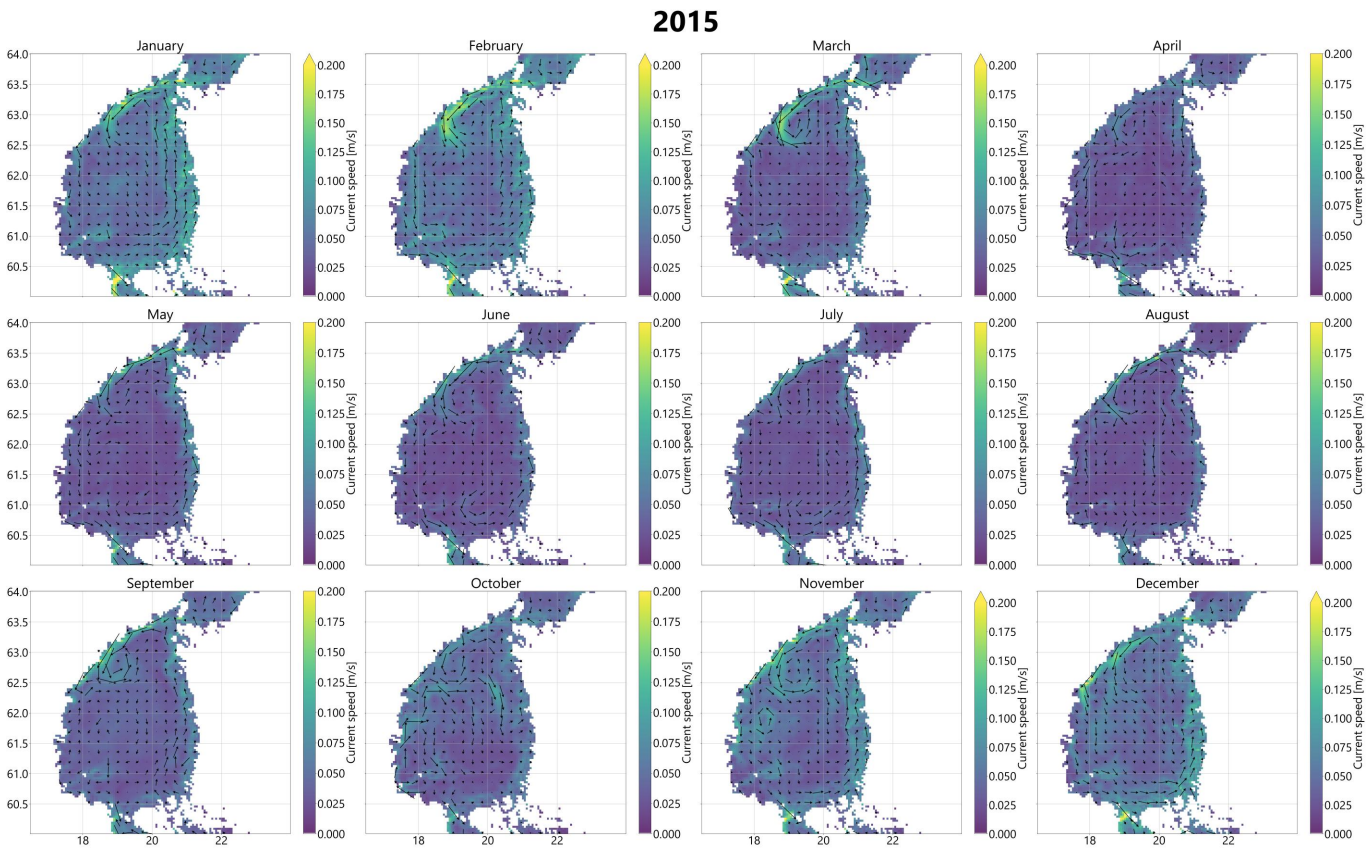

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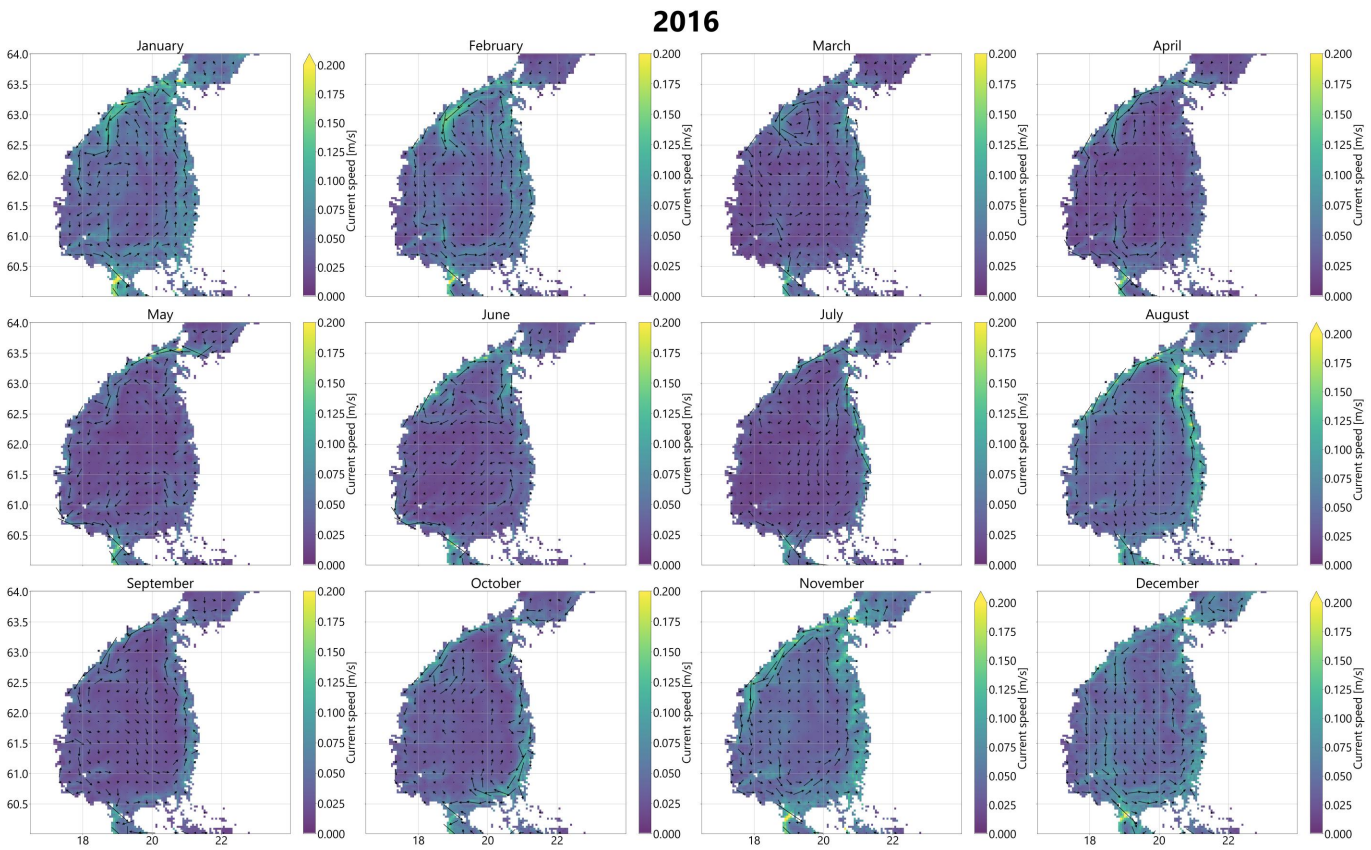

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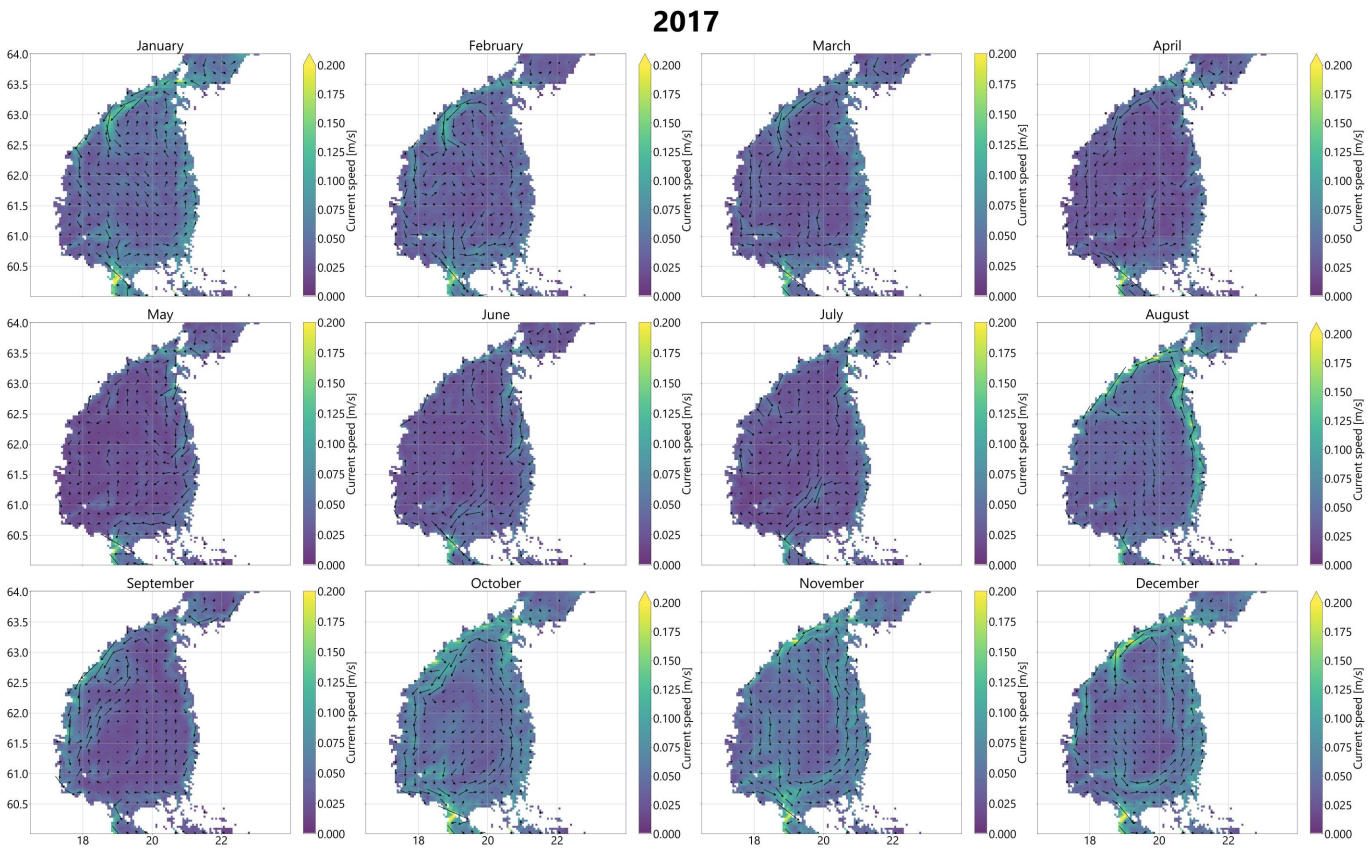

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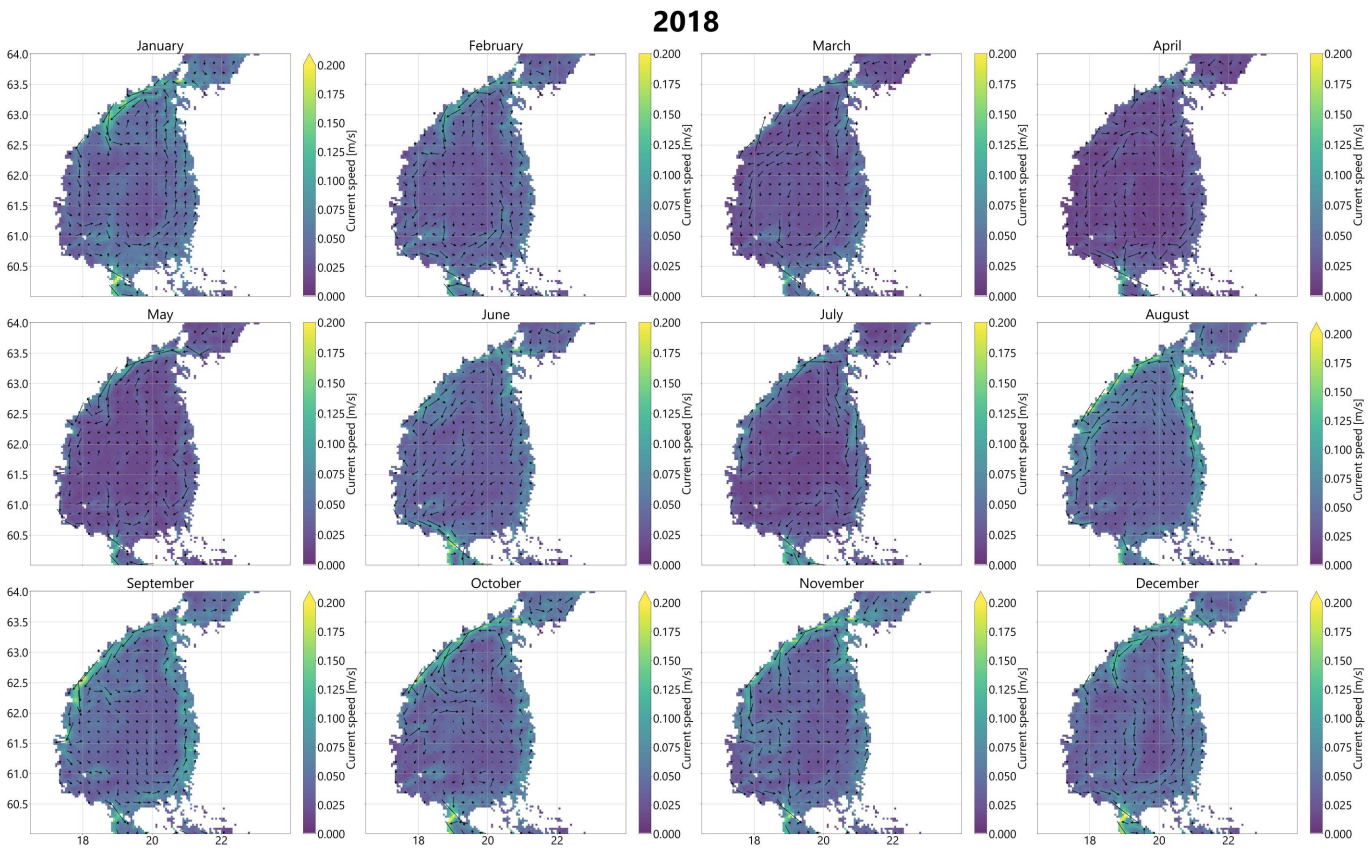

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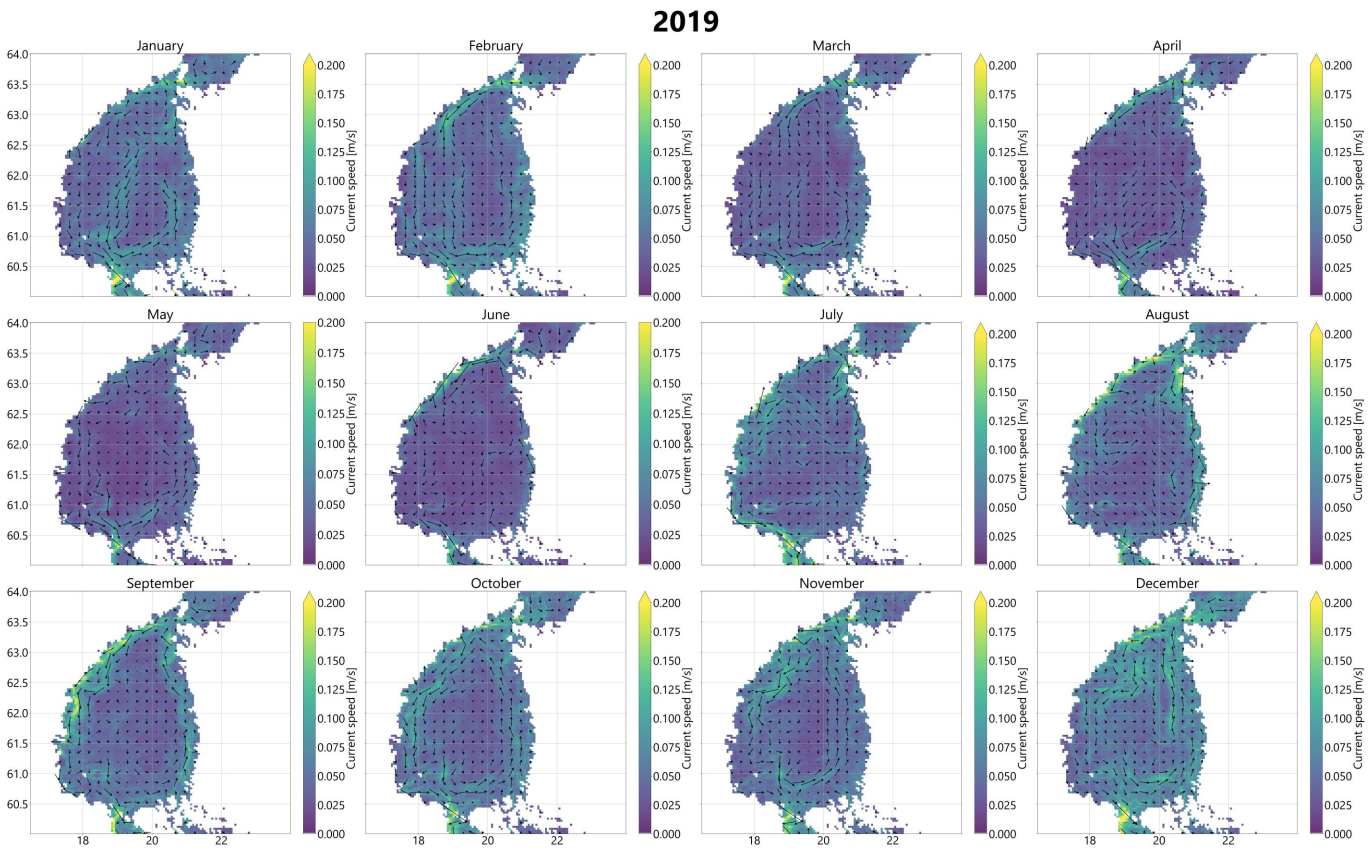

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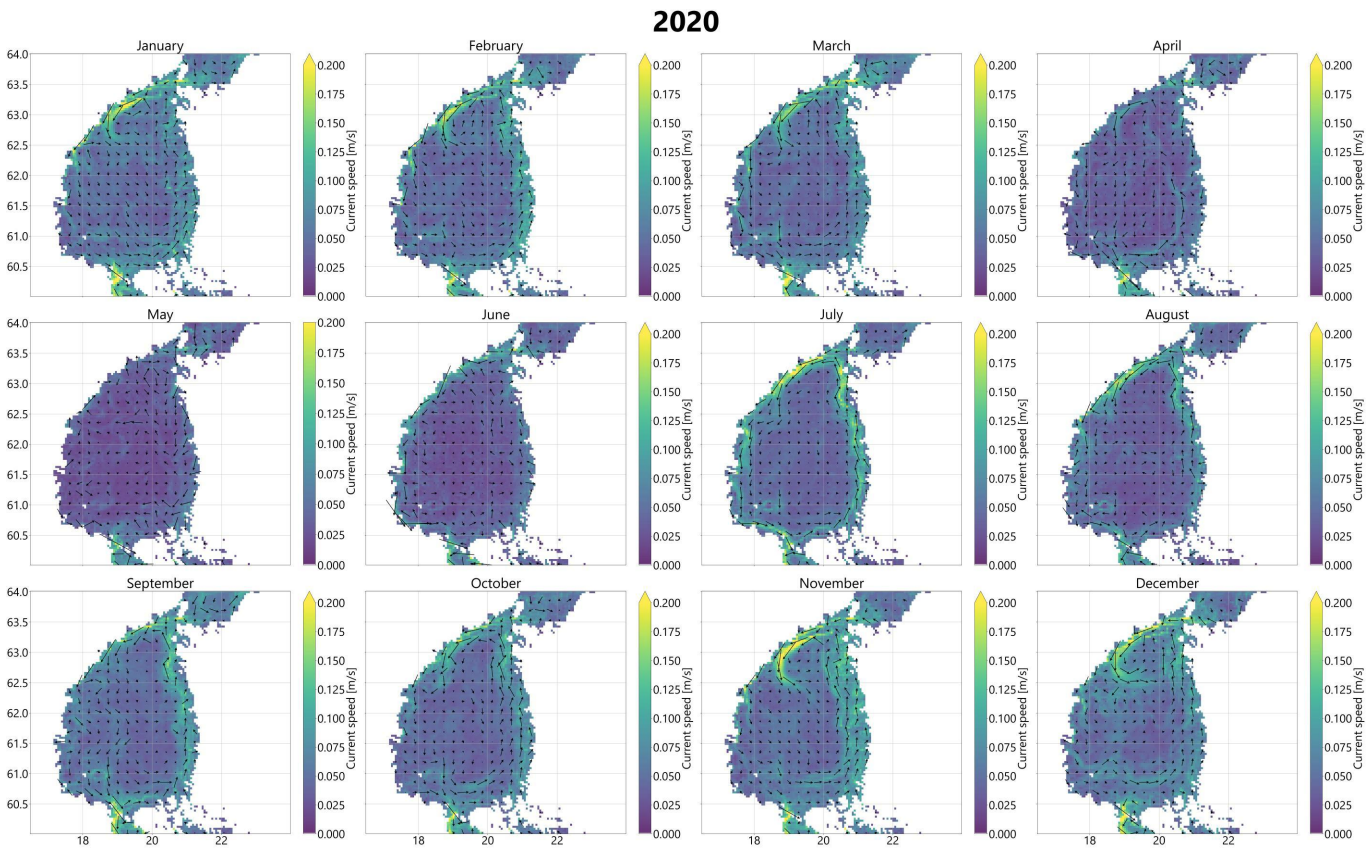

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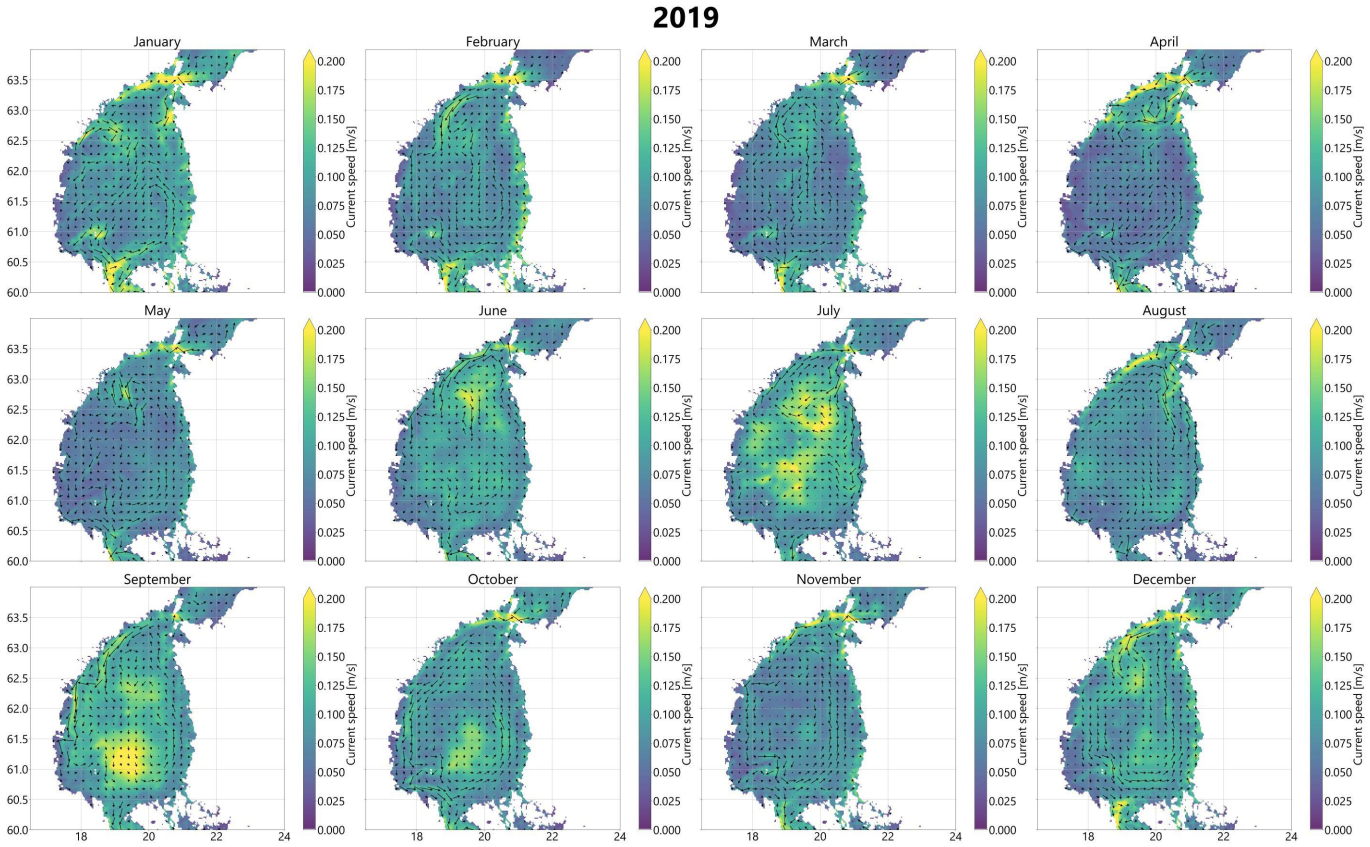
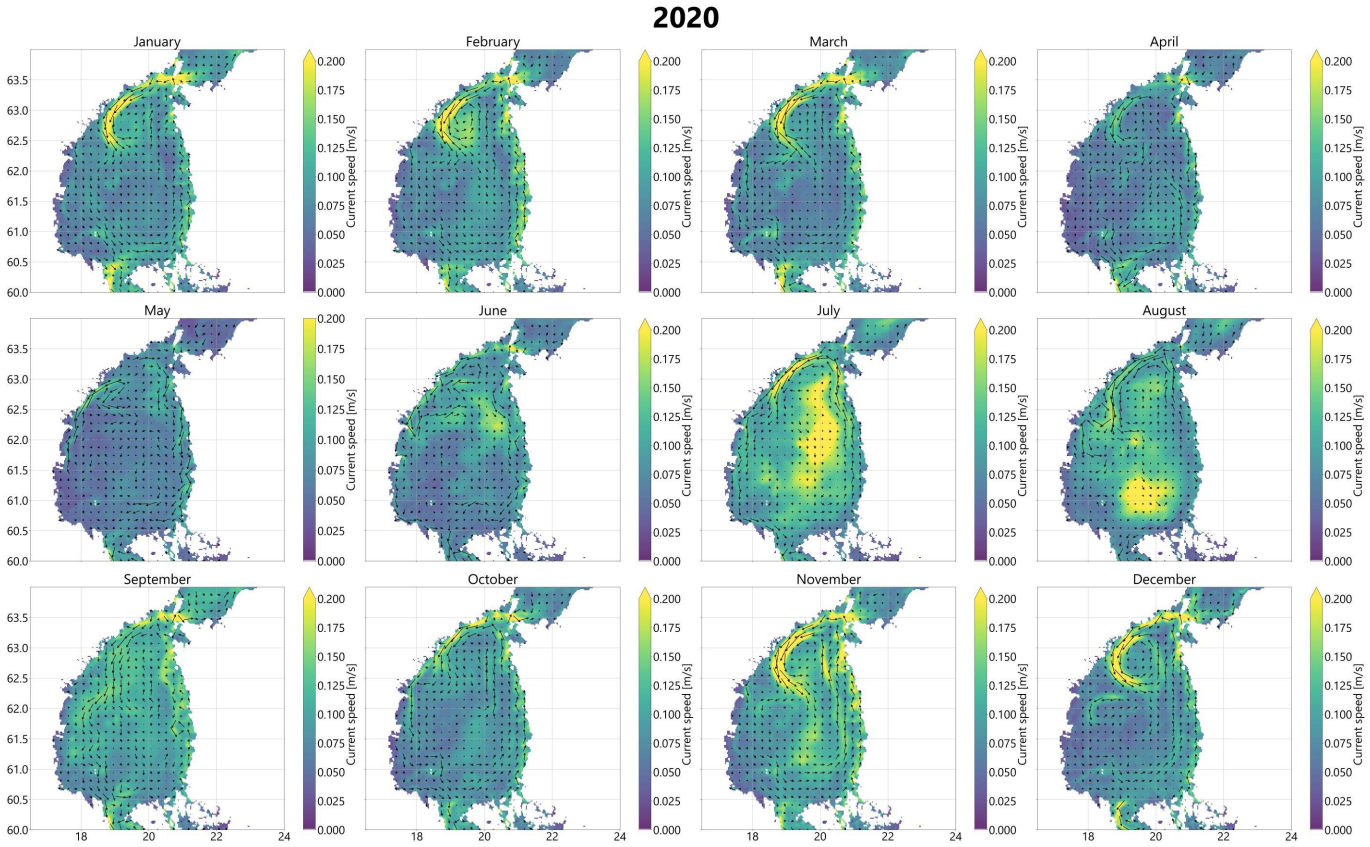
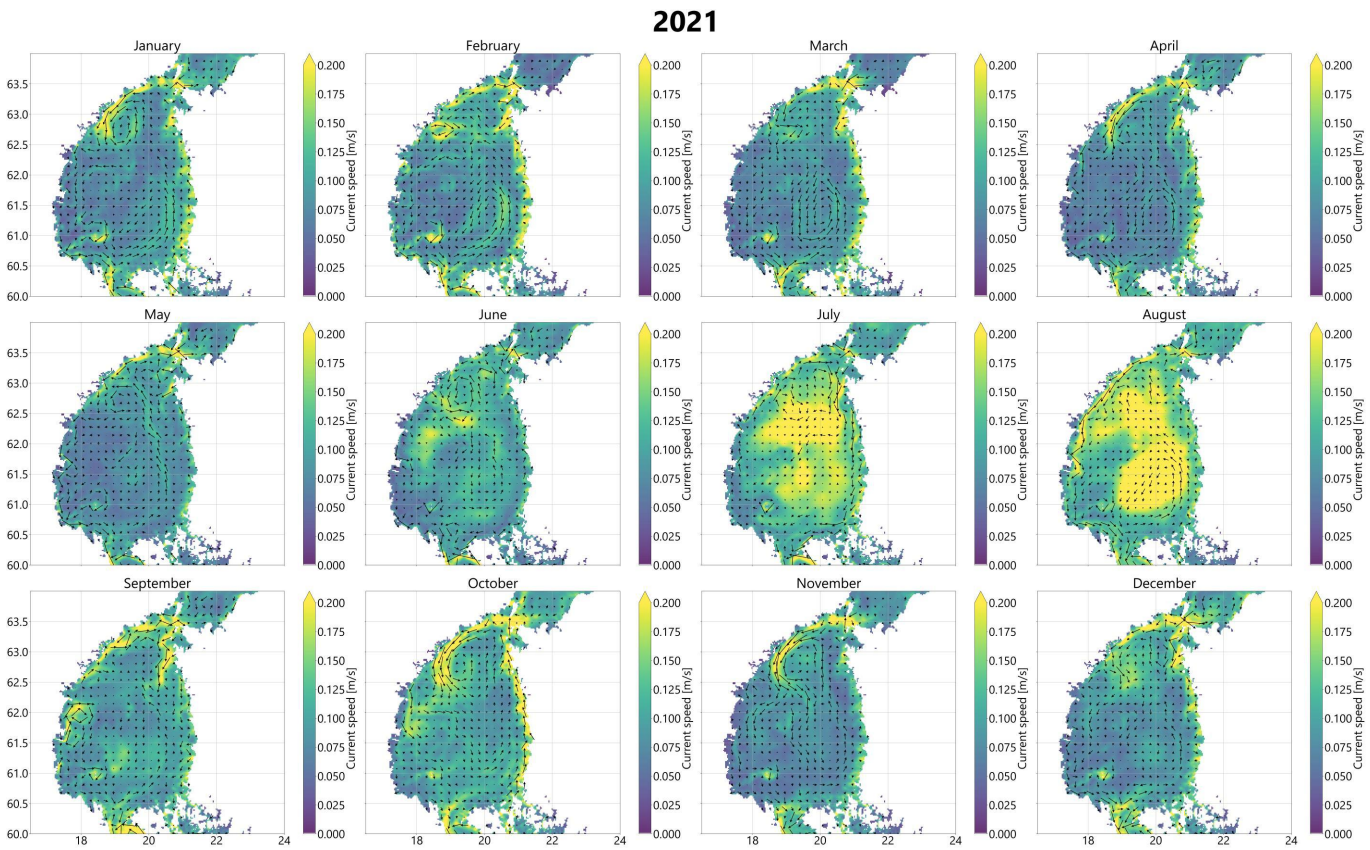


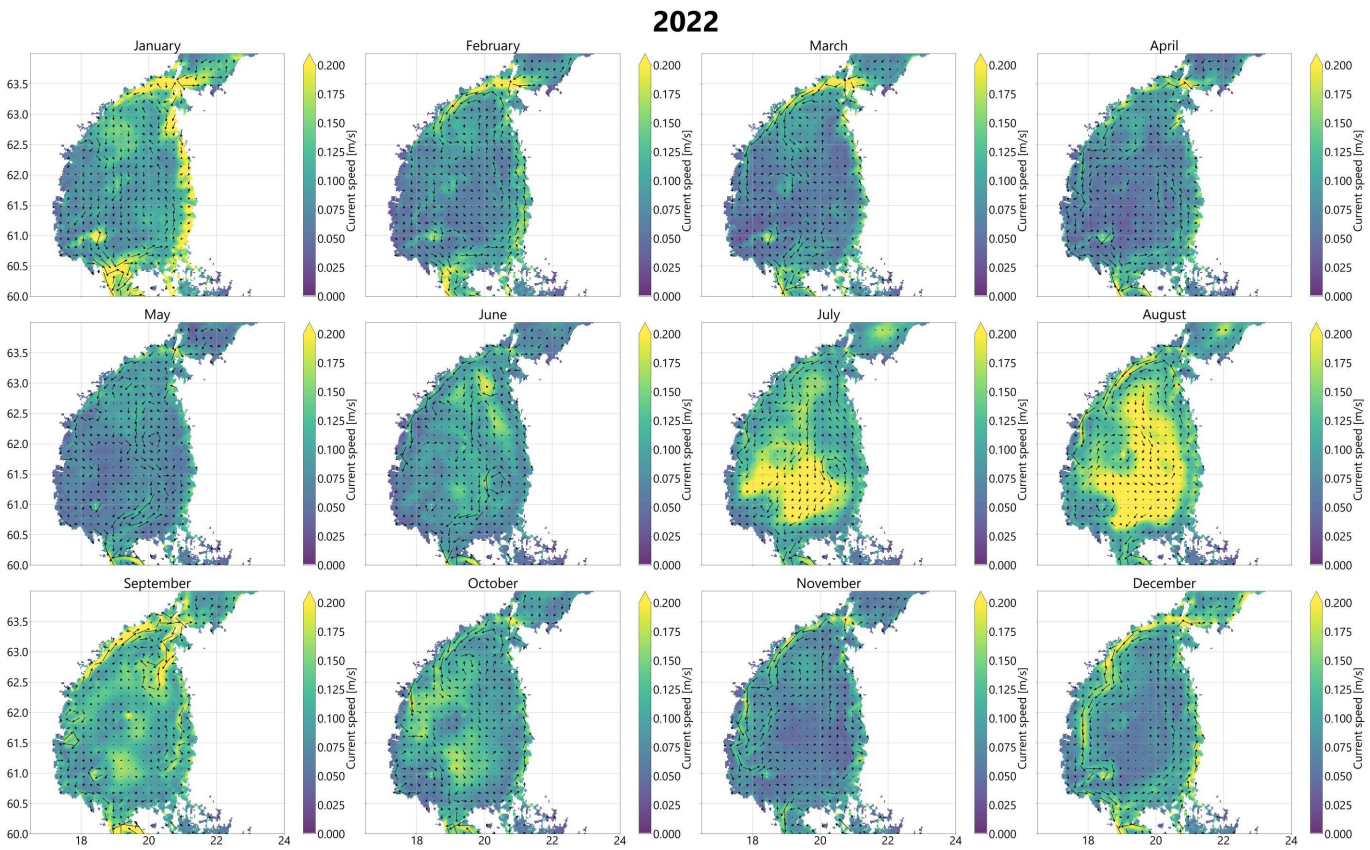
**SMHI 2x2 (daily values, depth: 10 m)**



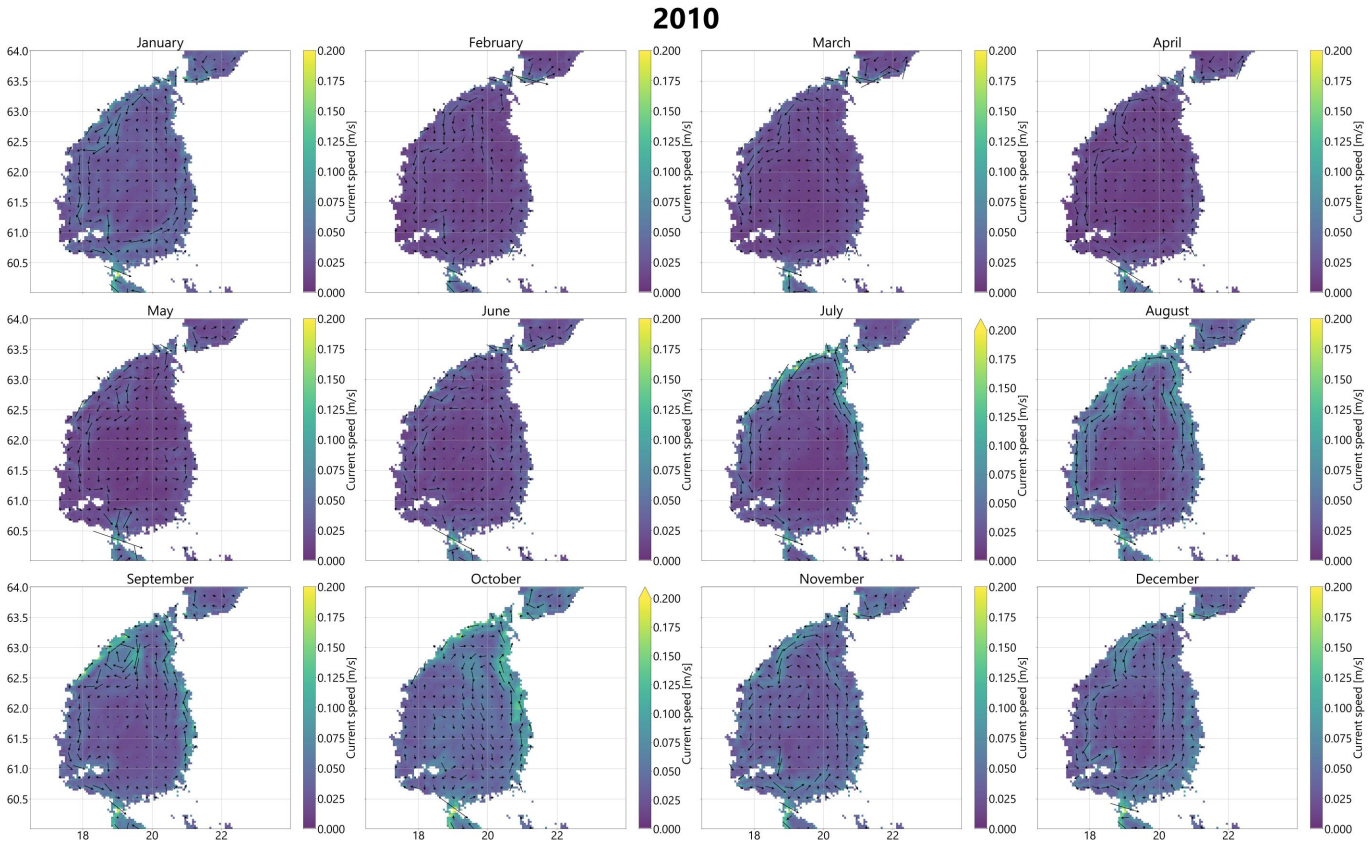
**SMHI 2x2 (daily values, depth: 10 m)**



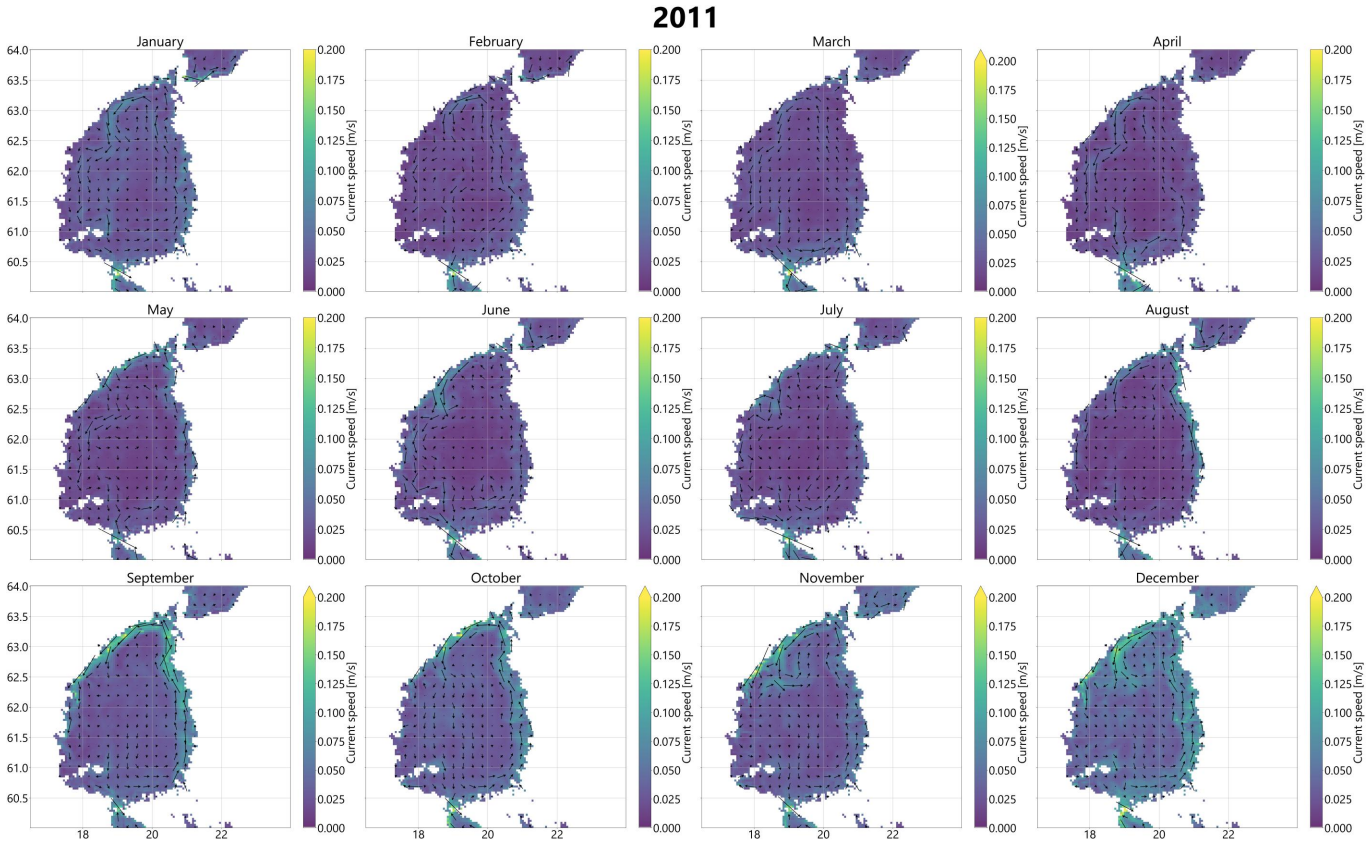
**SMHI 2x2 (daily values, depth: 10 m)**



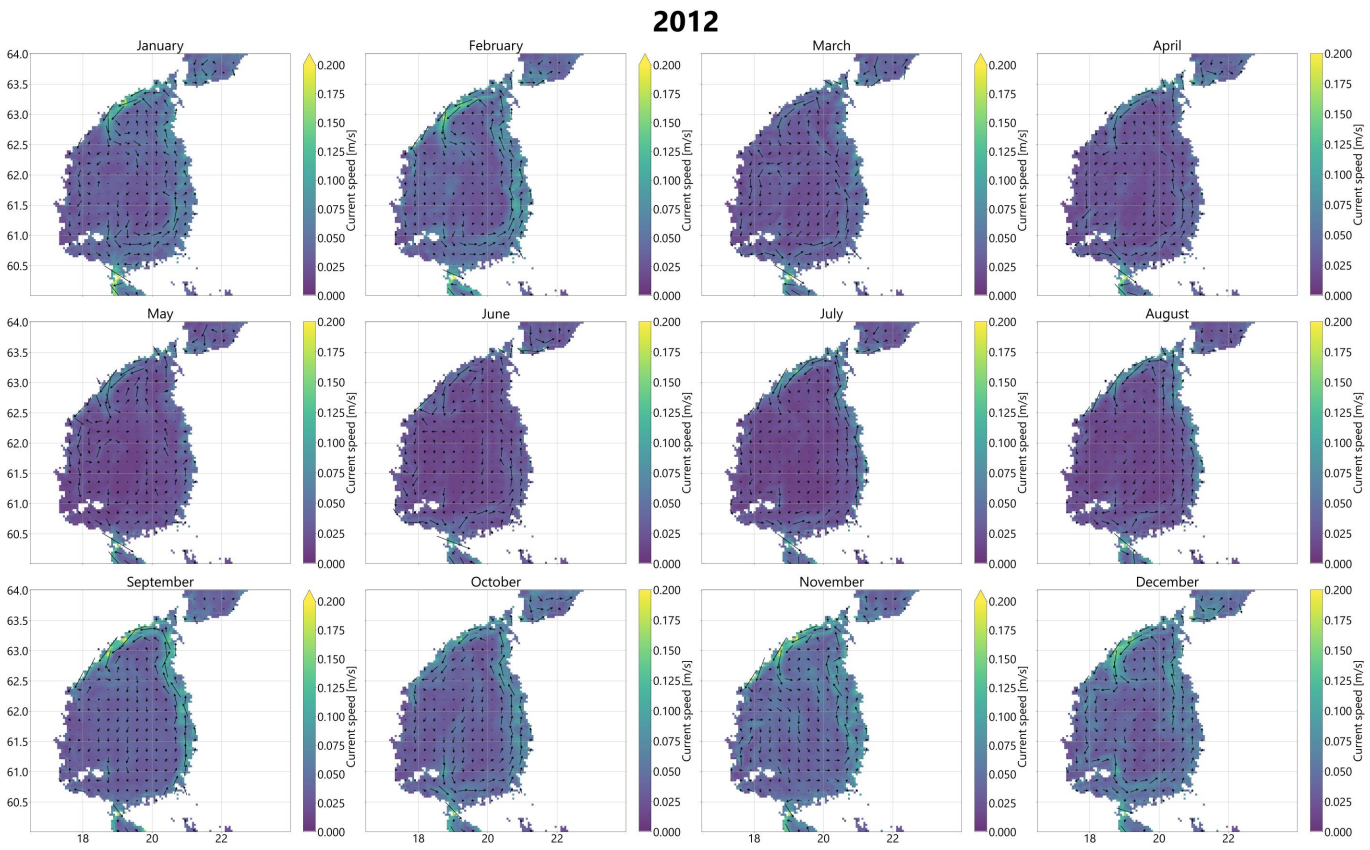
**SMHI 4x4 (daily values, depth: 20 m)**



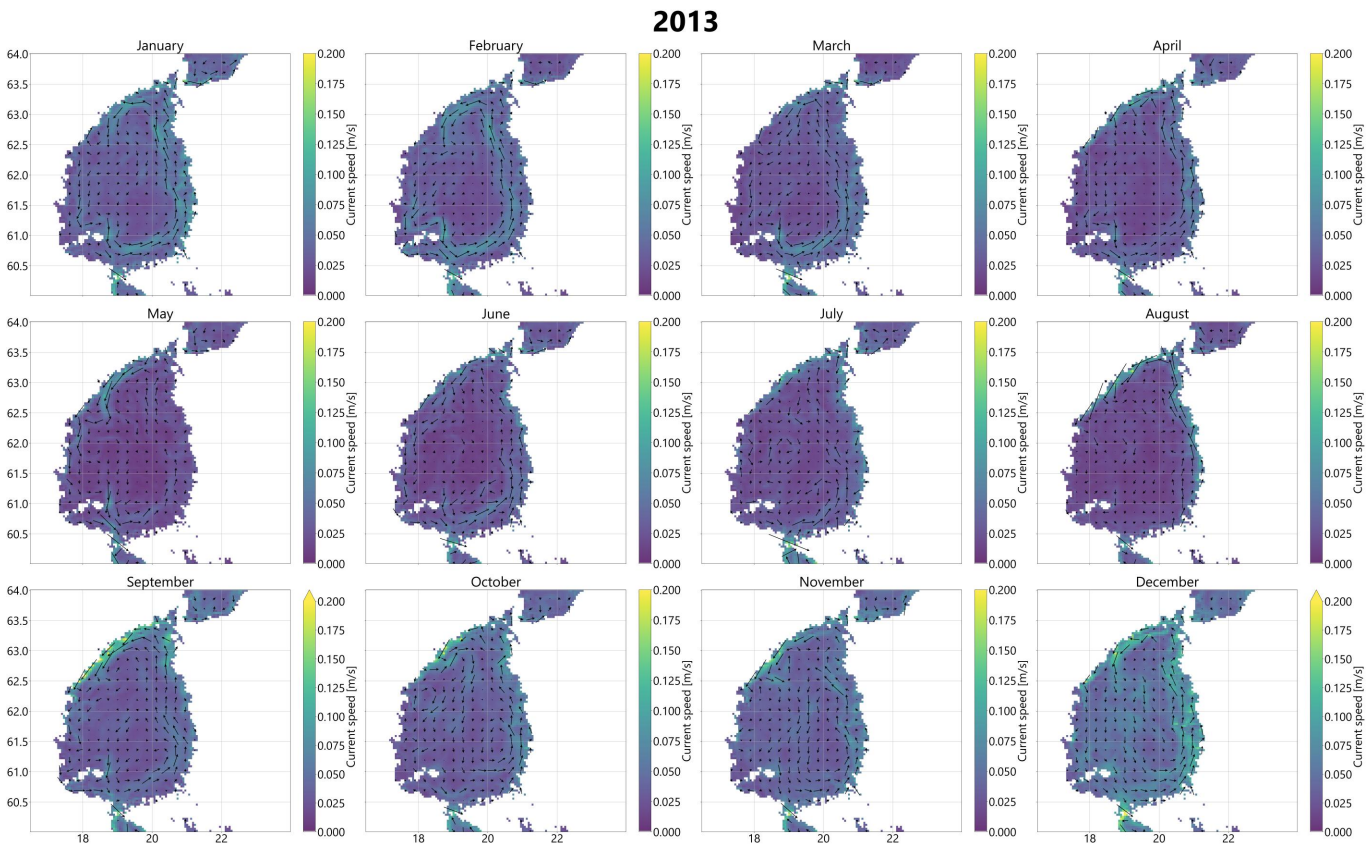
**SMHI 4x4 (daily values, depth: 20 m)**



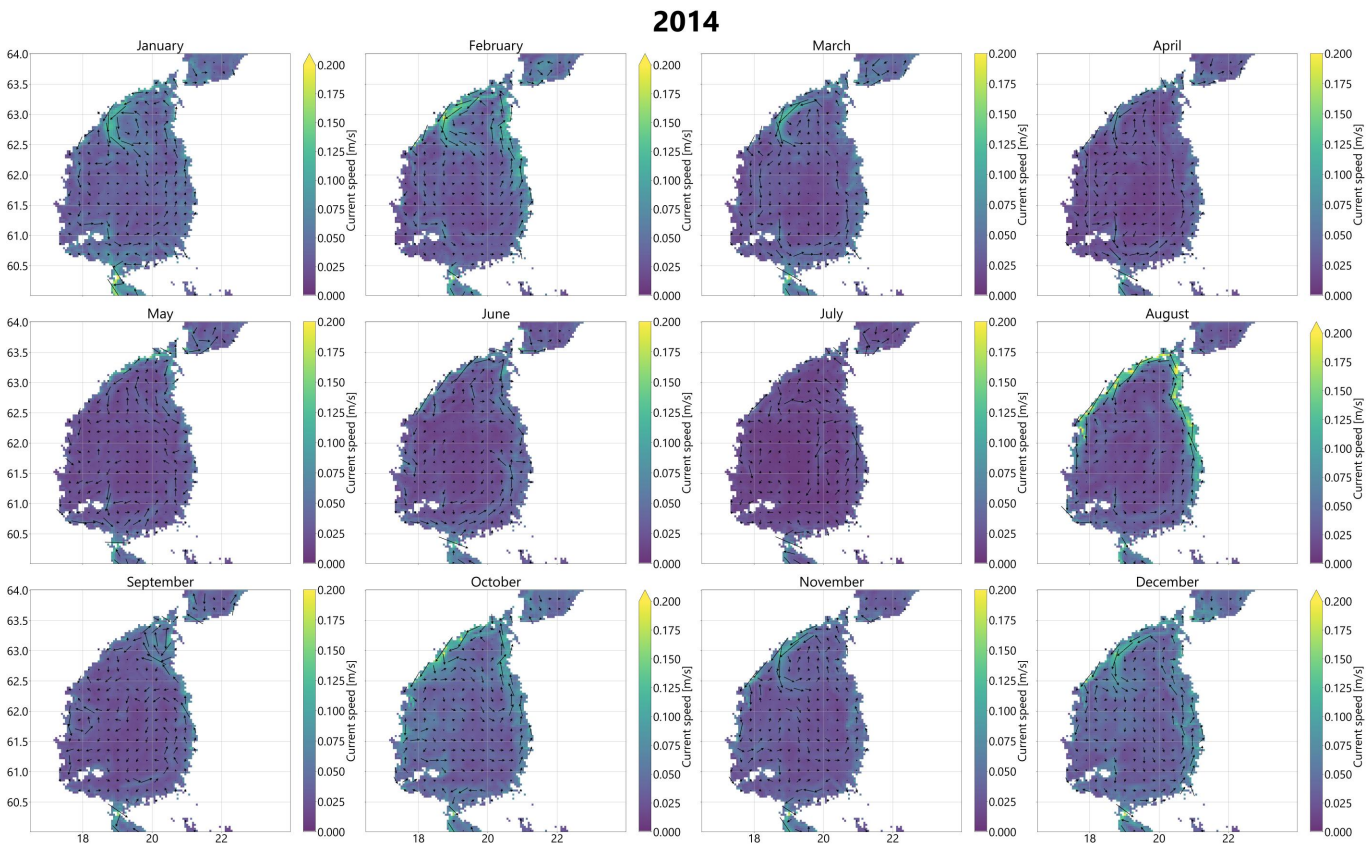
**SMHI 4x4 (daily values, depth: 20 m)**



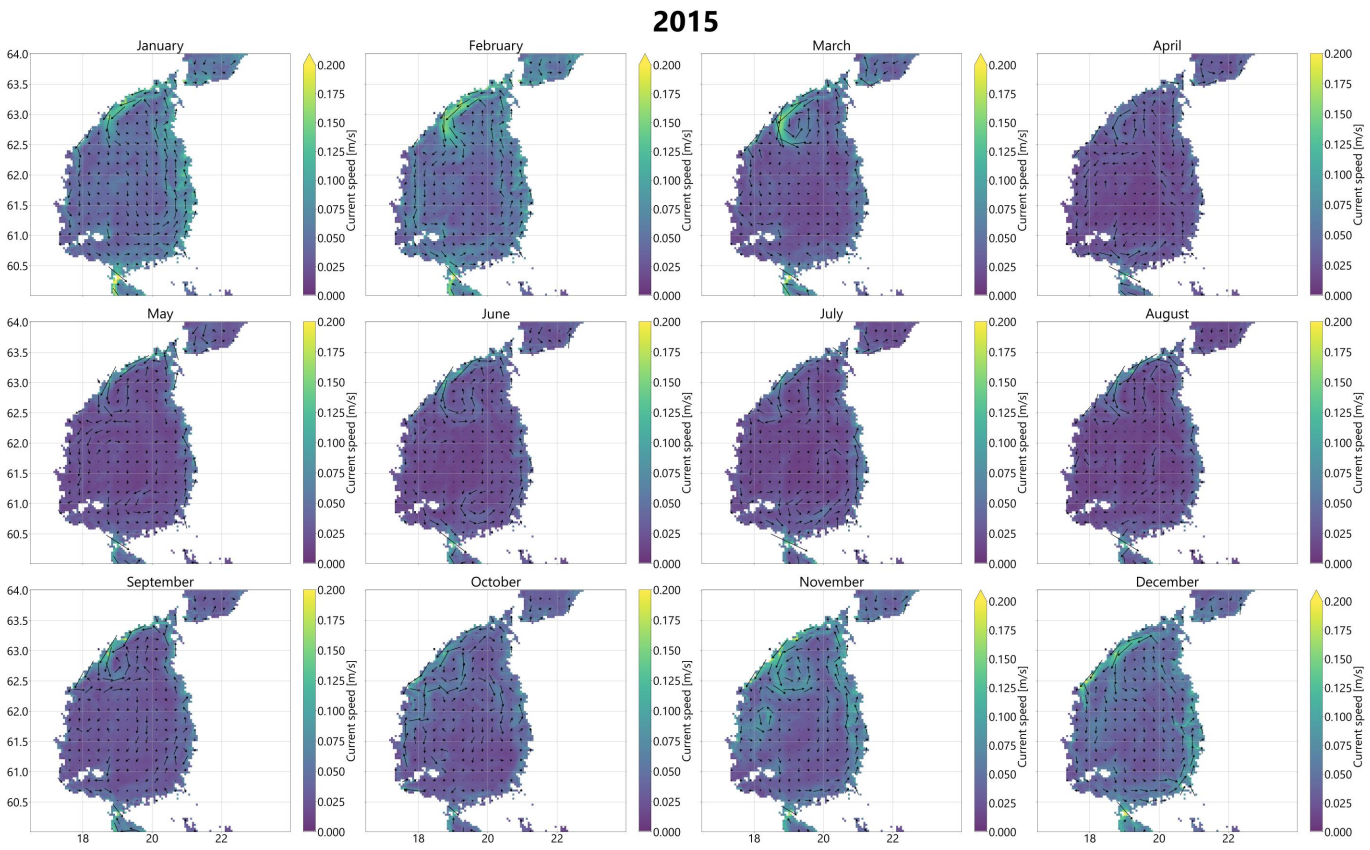
**SMHI 4x4 (daily values, depth: 20 m)**



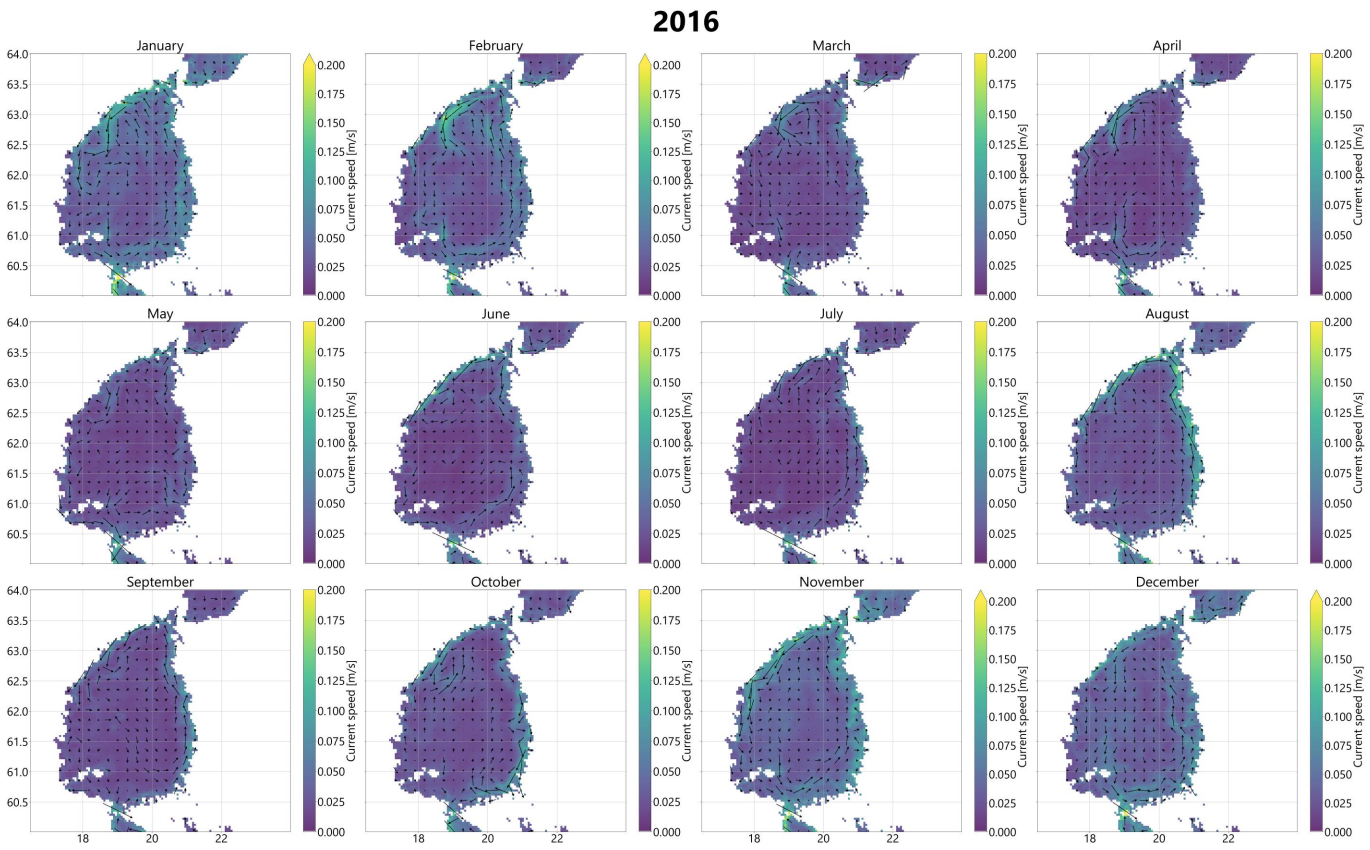
**SMHI 4x4 (daily values, depth: 20 m)**



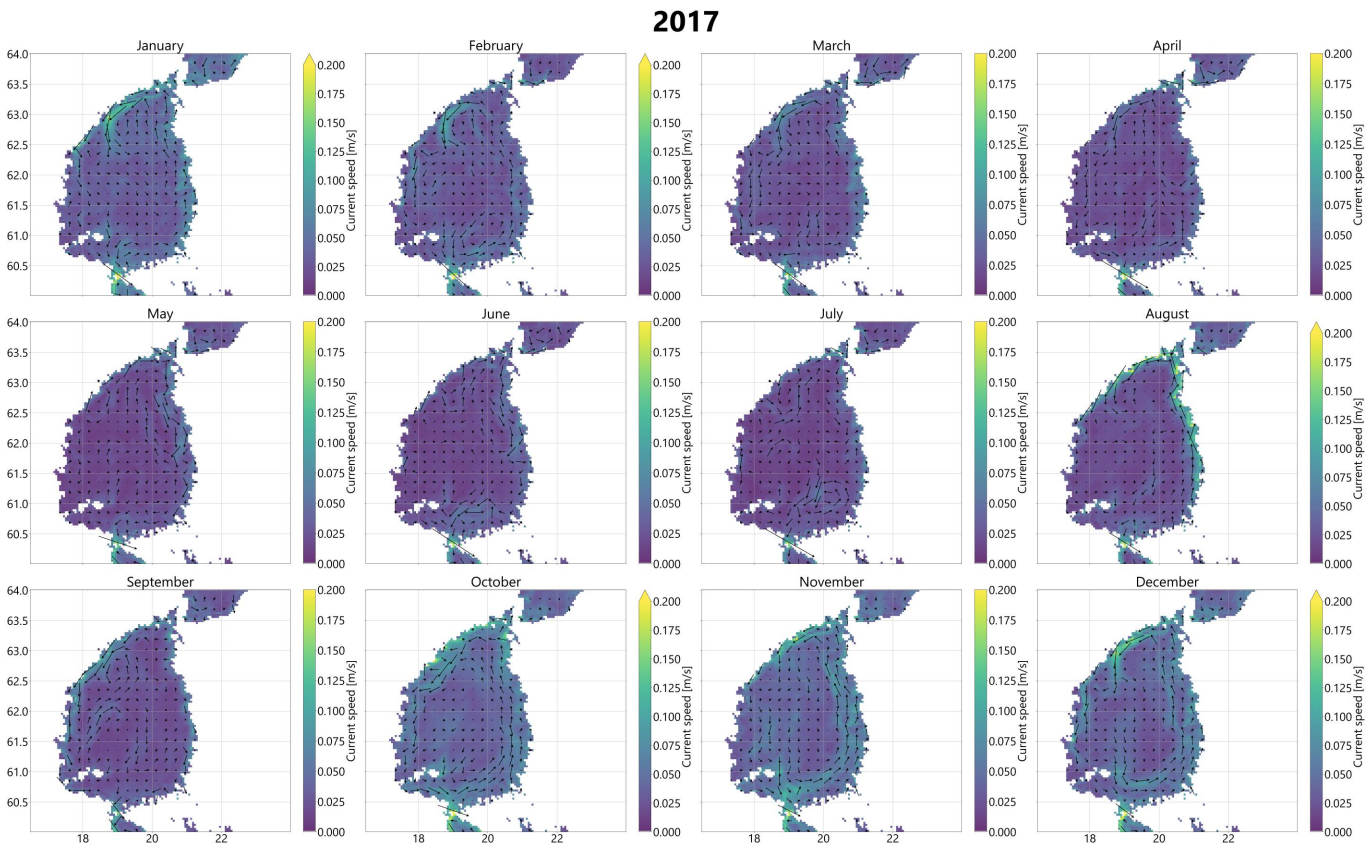
**SMHI 4x4 (daily values, depth: 20 m)**



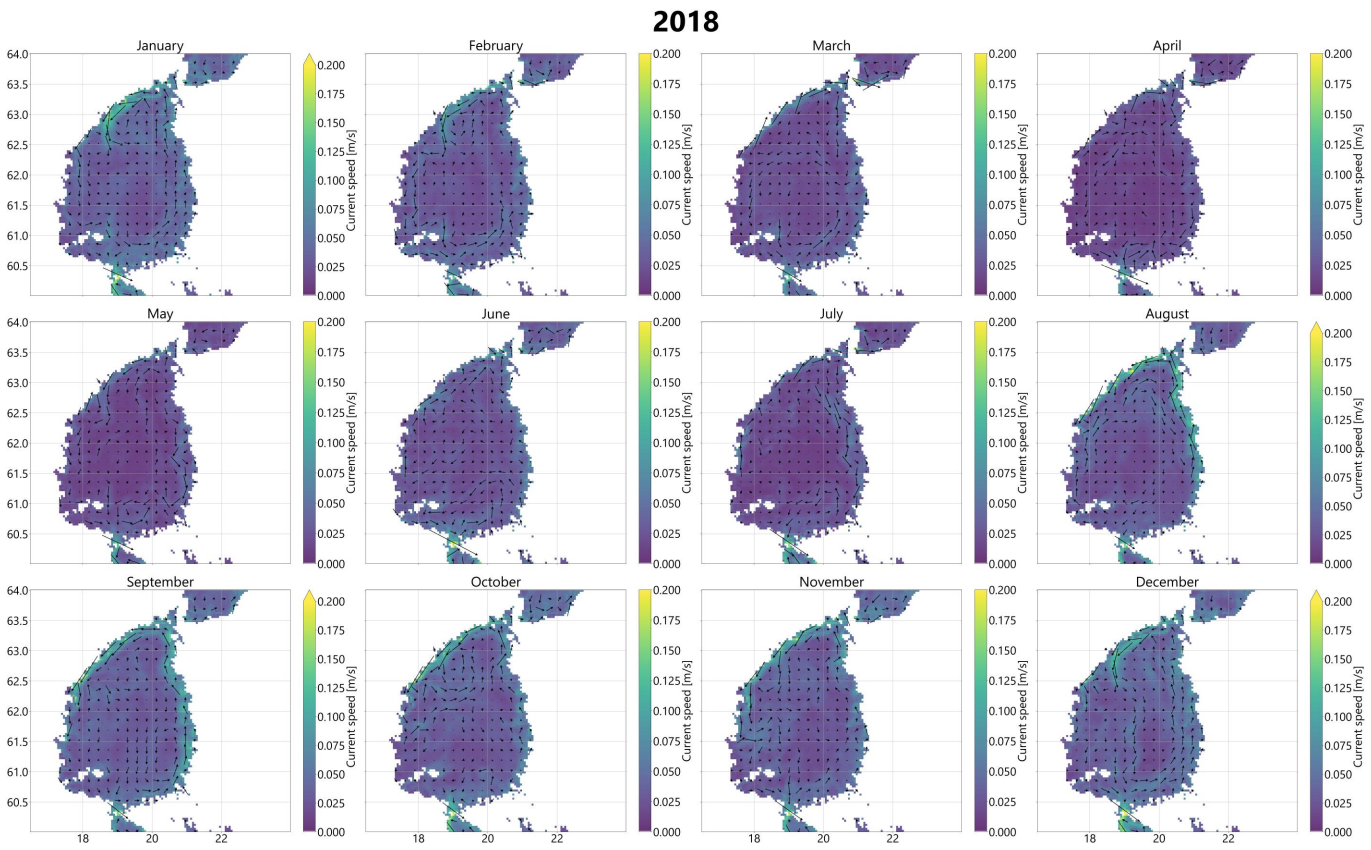
**SMHI 4x4 (daily values, depth: 20 m)**



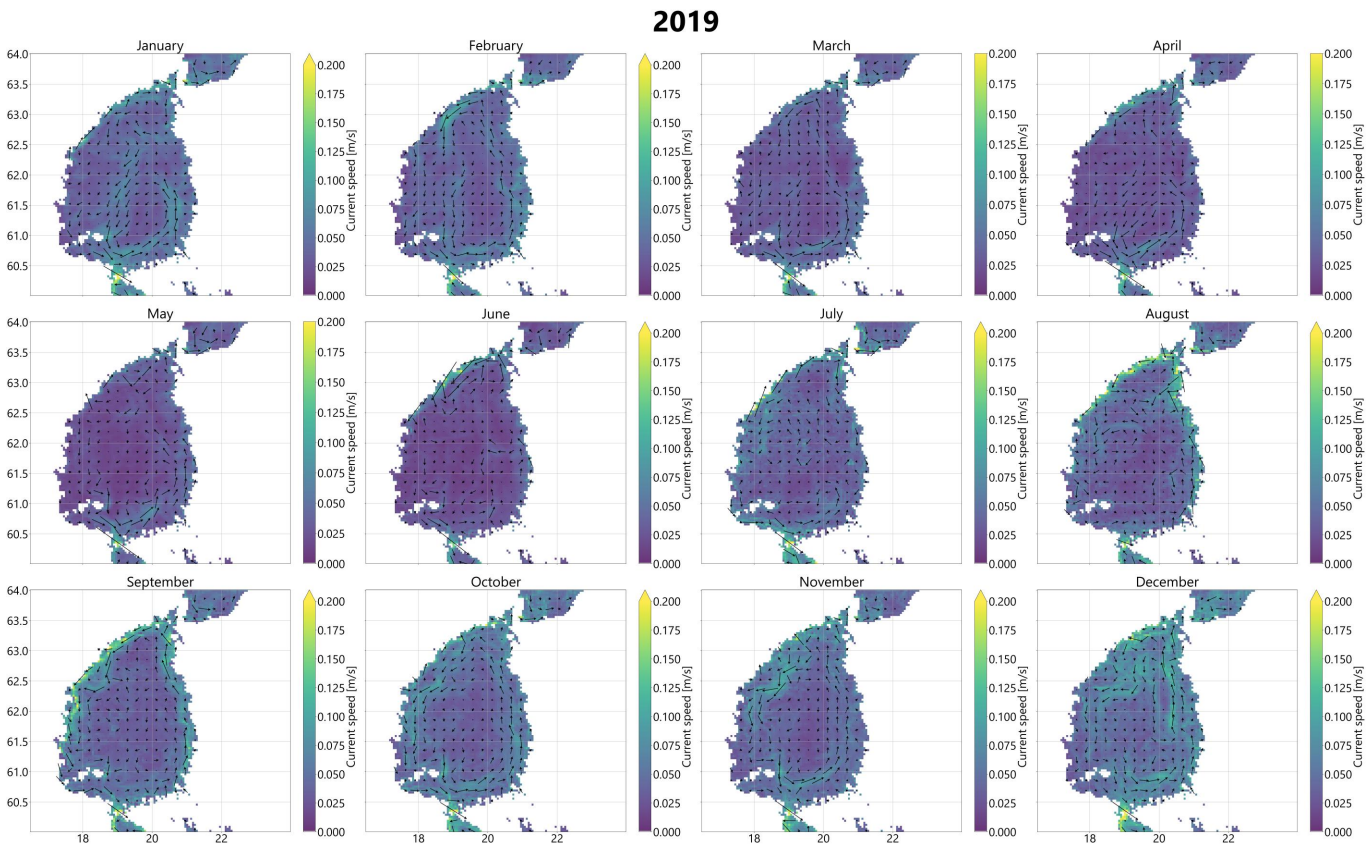
**SMHI 4x4 (daily values, depth: 20 m)**



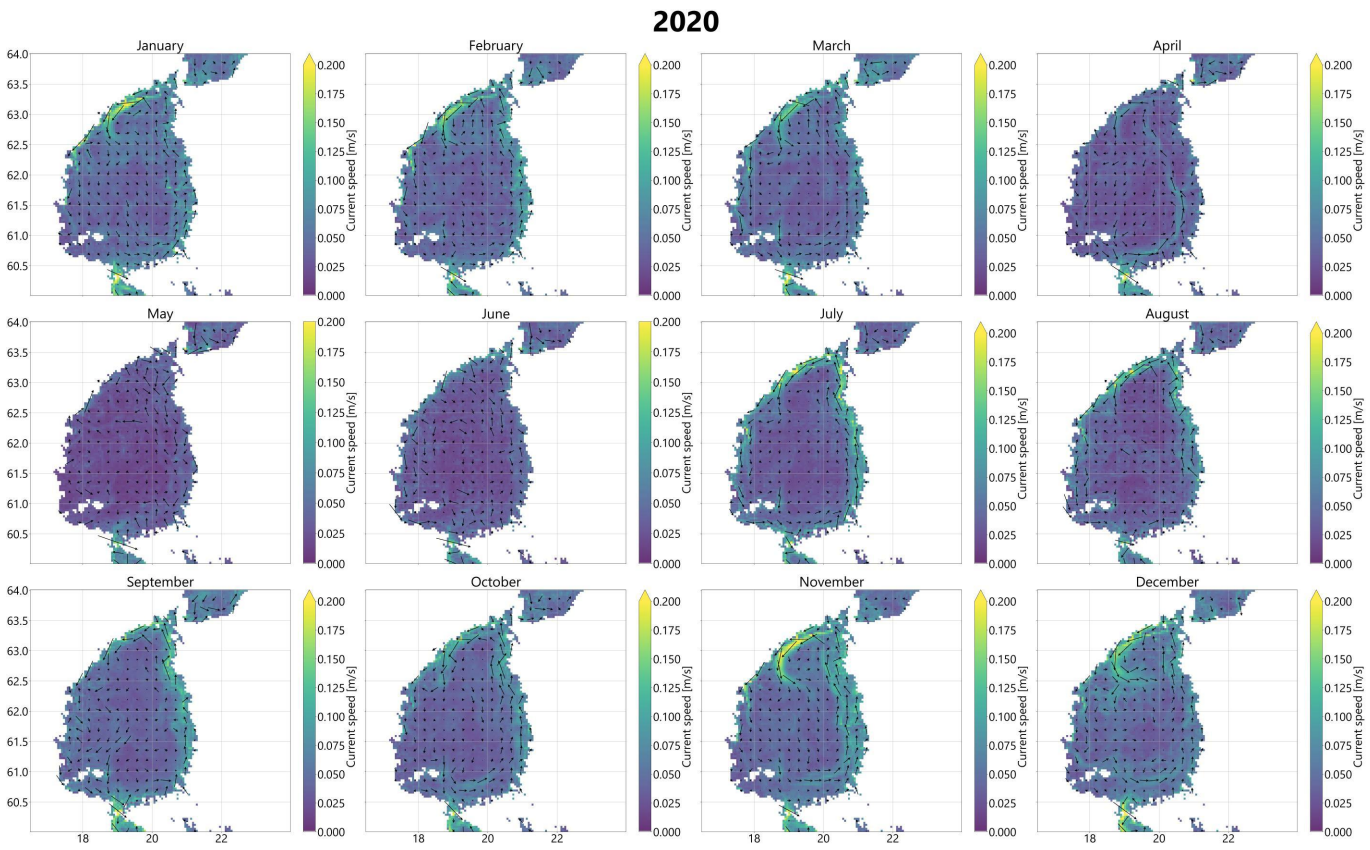
**SMHI 4x4 (daily values, depth: 20 m)**



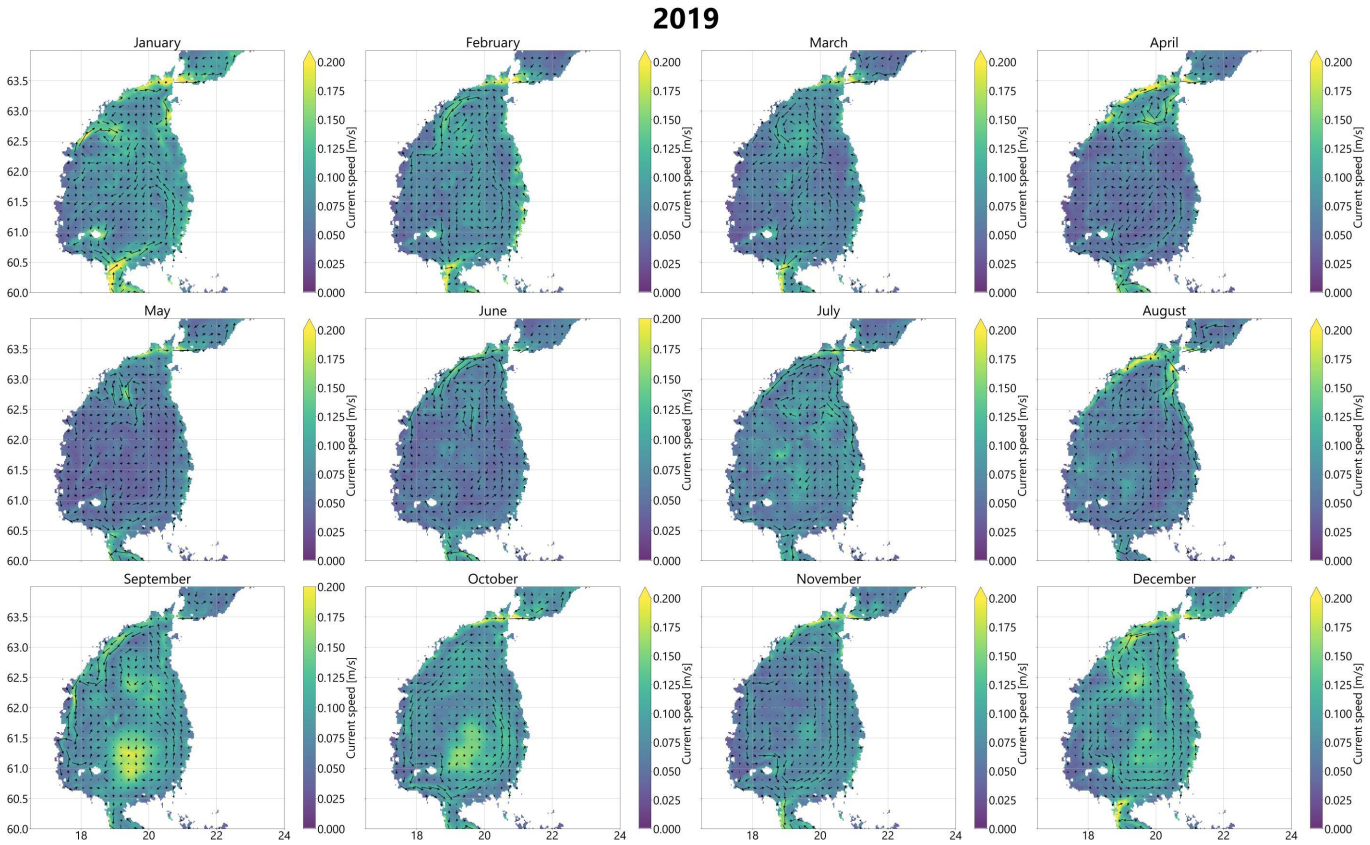
**SMHI 4x4 (daily values, depth: 20 m)**



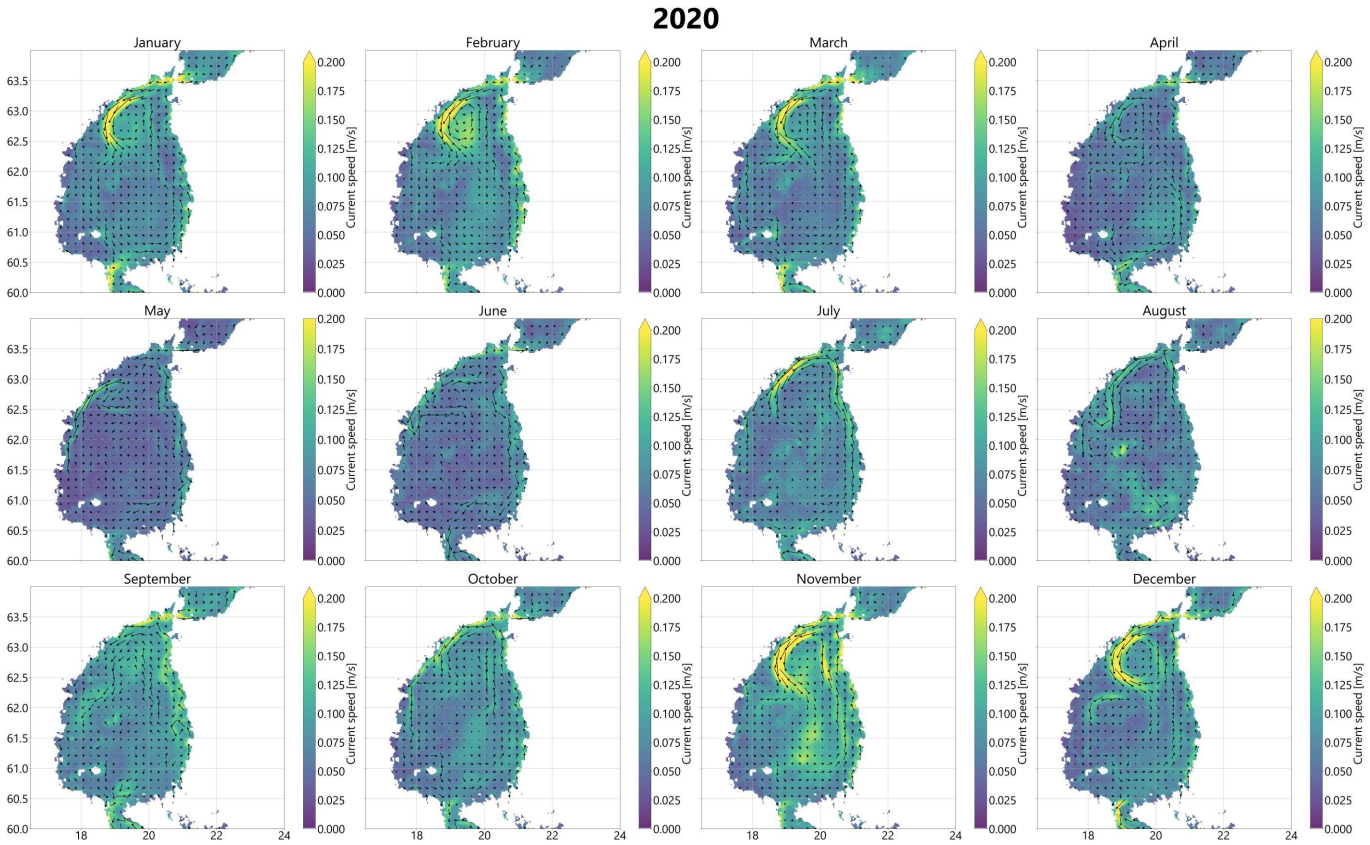
**SMHI 4x4 (daily values, depth: 20 m)**



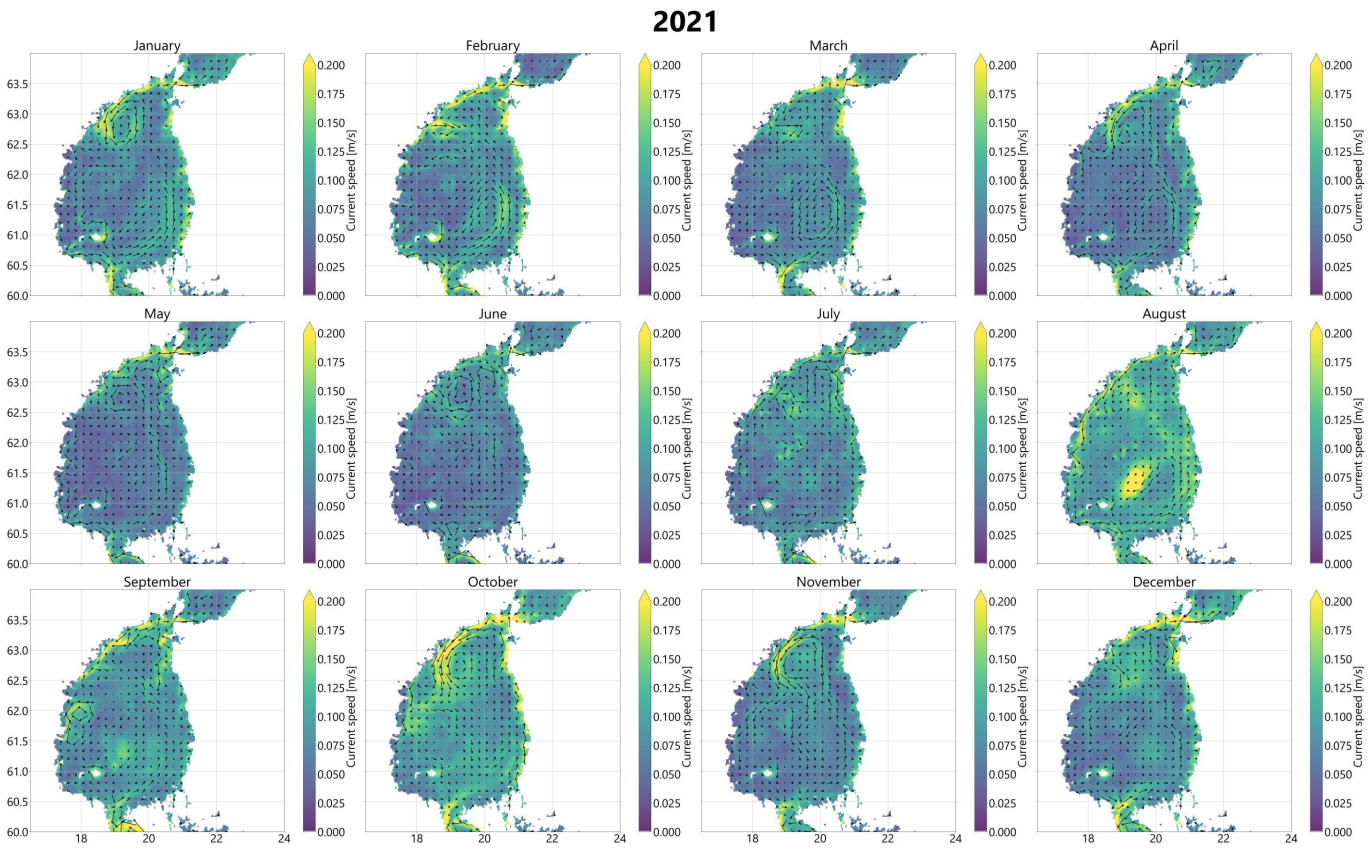
**SMHI 2x2 (daily values, depth: 20 m)**



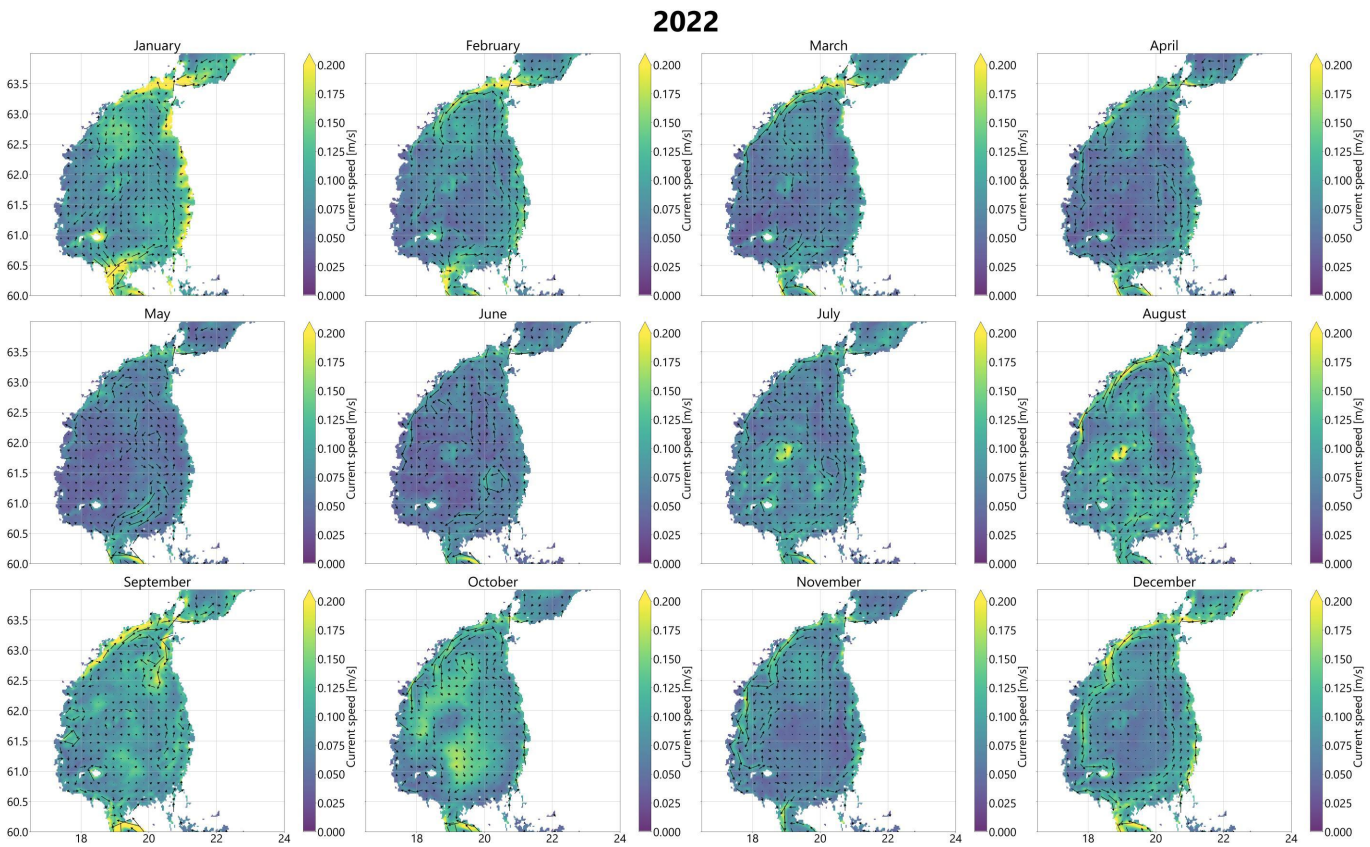
**SMHI 2x2 (daily values, depth: 20 m)**



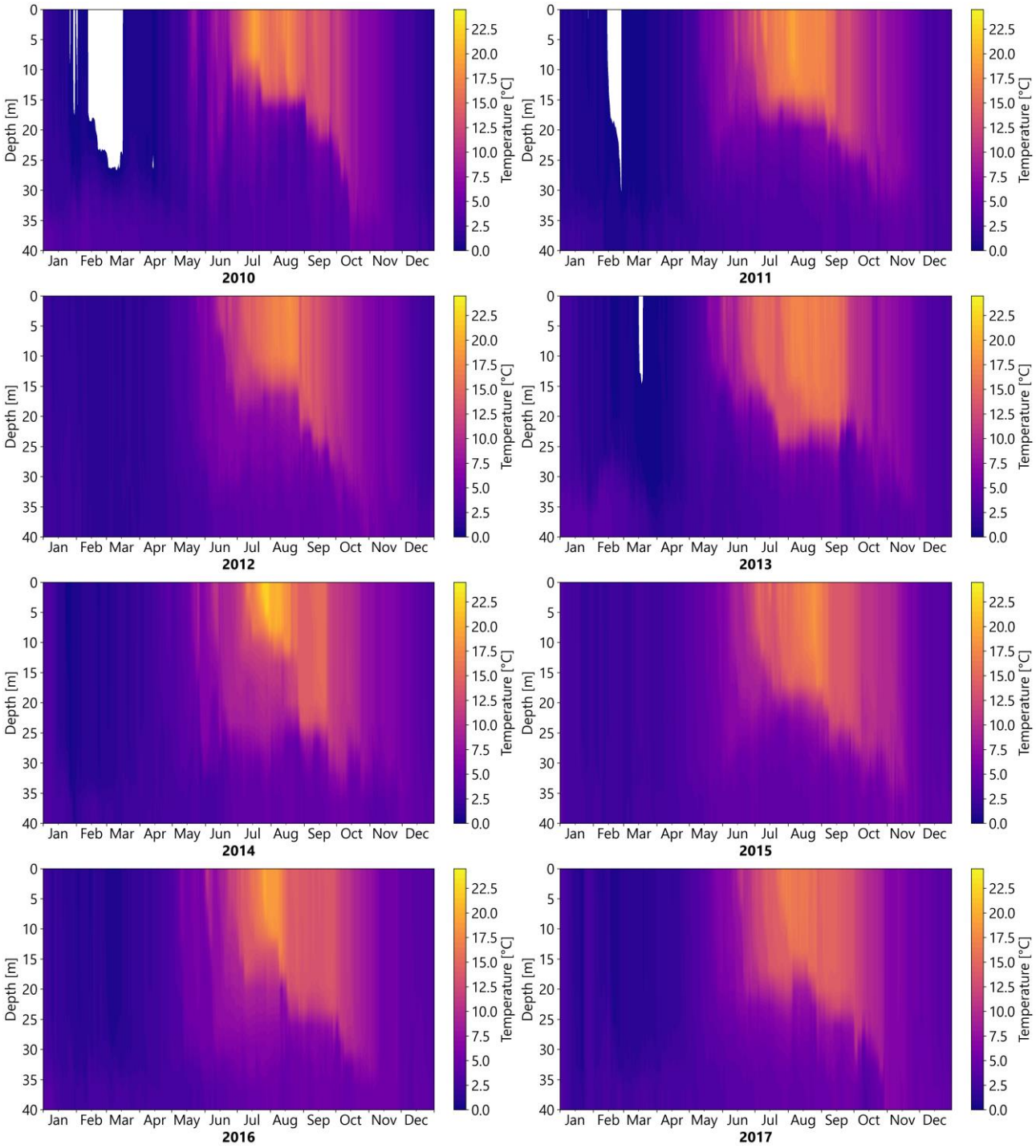
**SMHI 2x2 (daily values, depth: 20 m)**

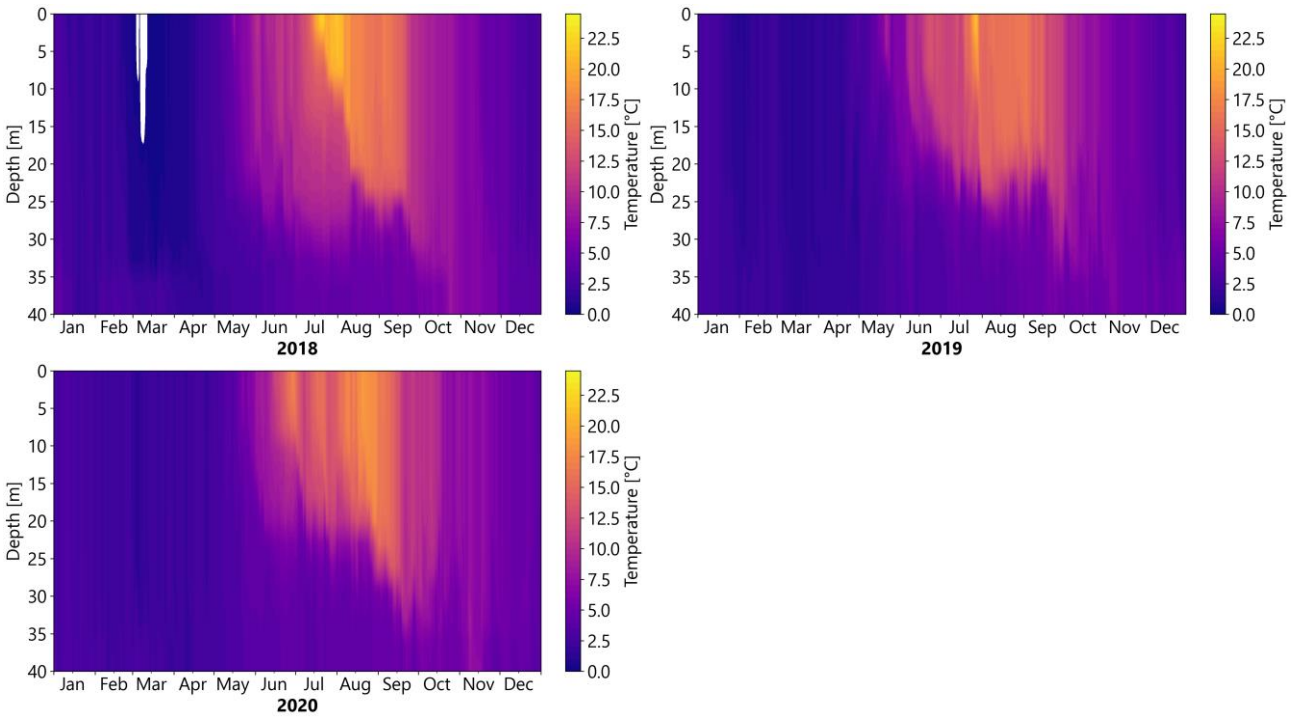


**SMHI 2x2 (daily values, depth: 20 m)**

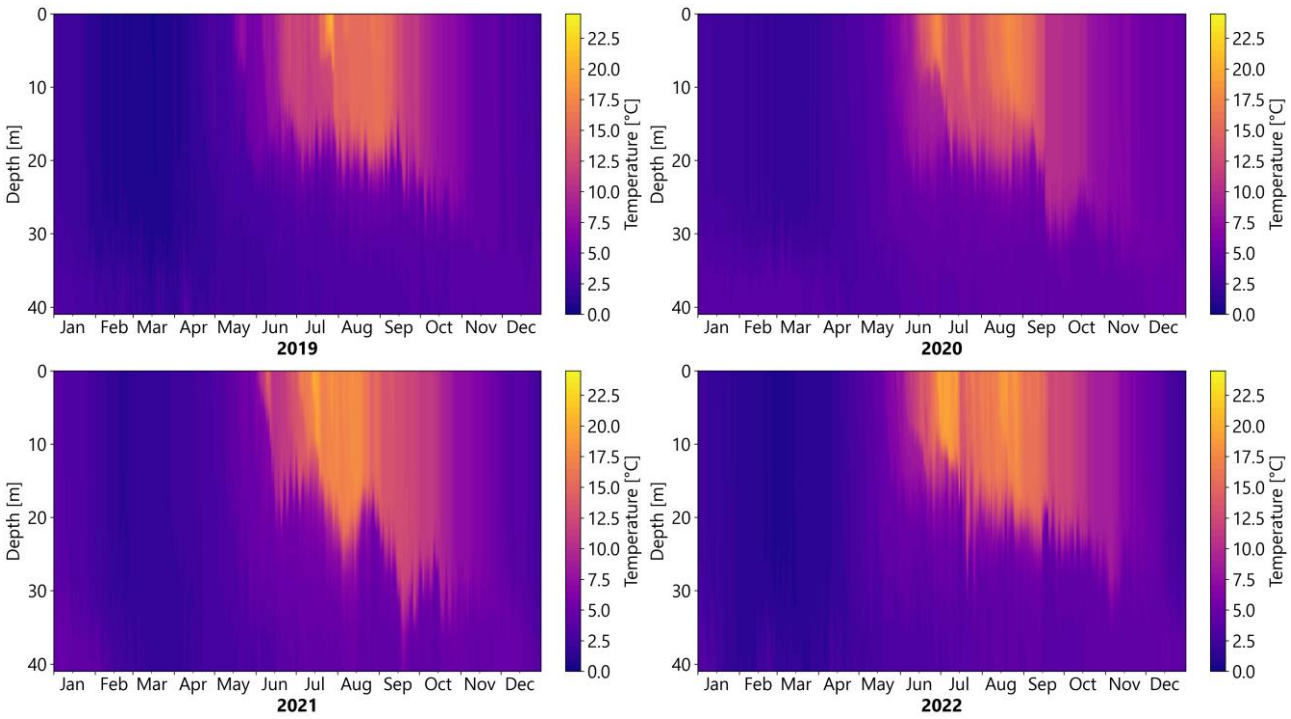


# Appendix 3: Sylen OWF, Temperature profiles (SMHI, modelled 4x4km)

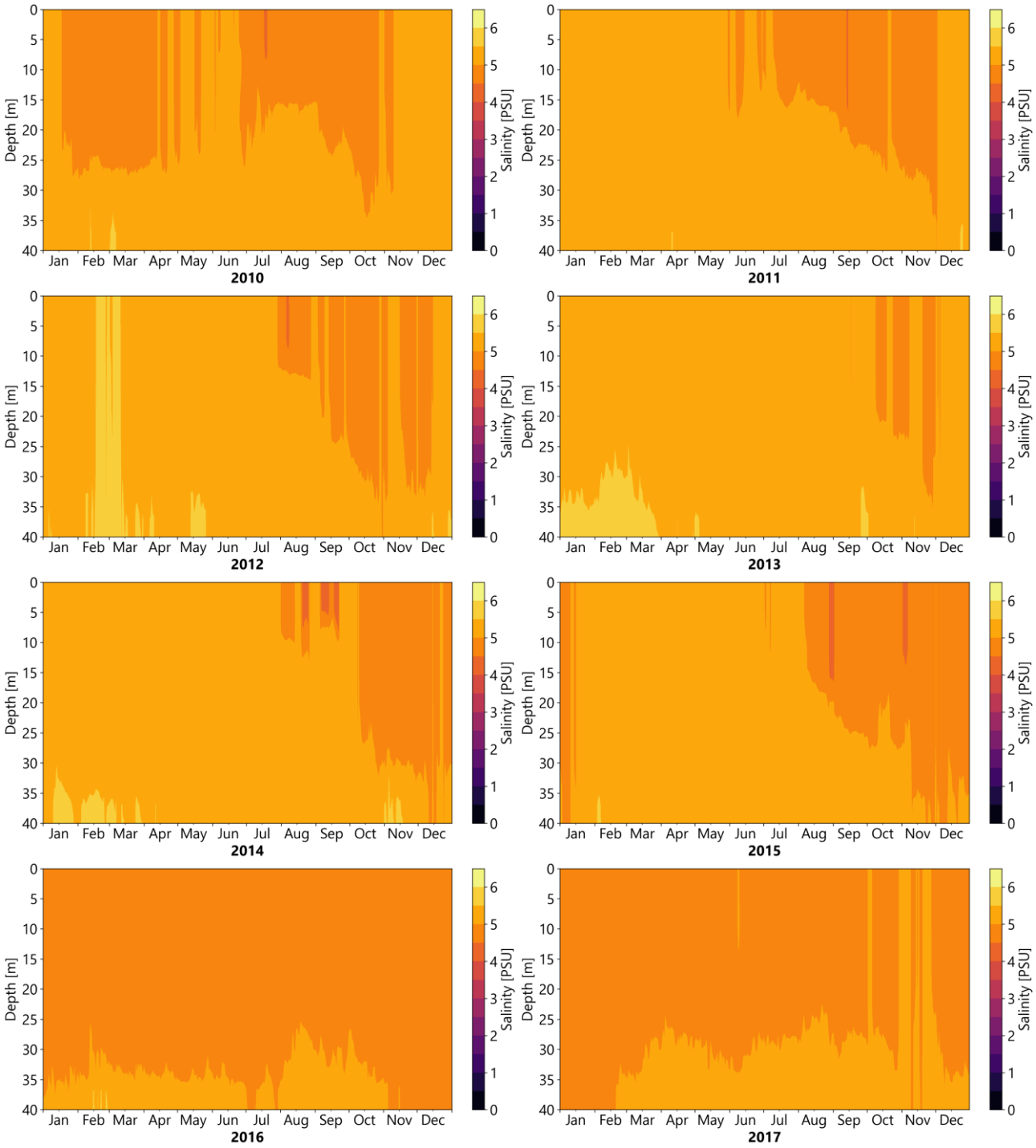

Depth [m]
0
5
10
15
20
25
30
35
40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Temperature [°C]
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
2010
2011
2012
2013
2014
2015
2016
2017

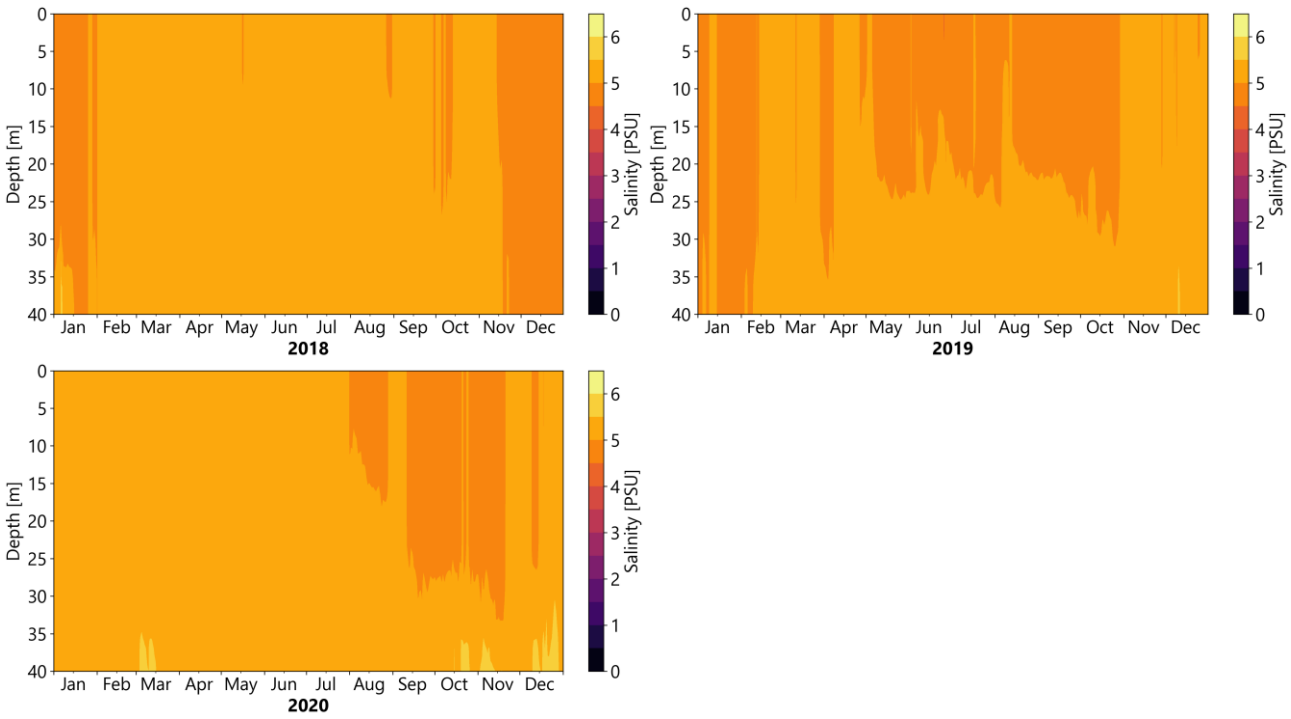

Depth [m]
0
5
10
15
20
25
30
35
40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2018
2019
2020
Temperature [°C]
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0

# Appendix 4 Sylen OWF, Temperature profiles (SMHI, modelled 2x2km)

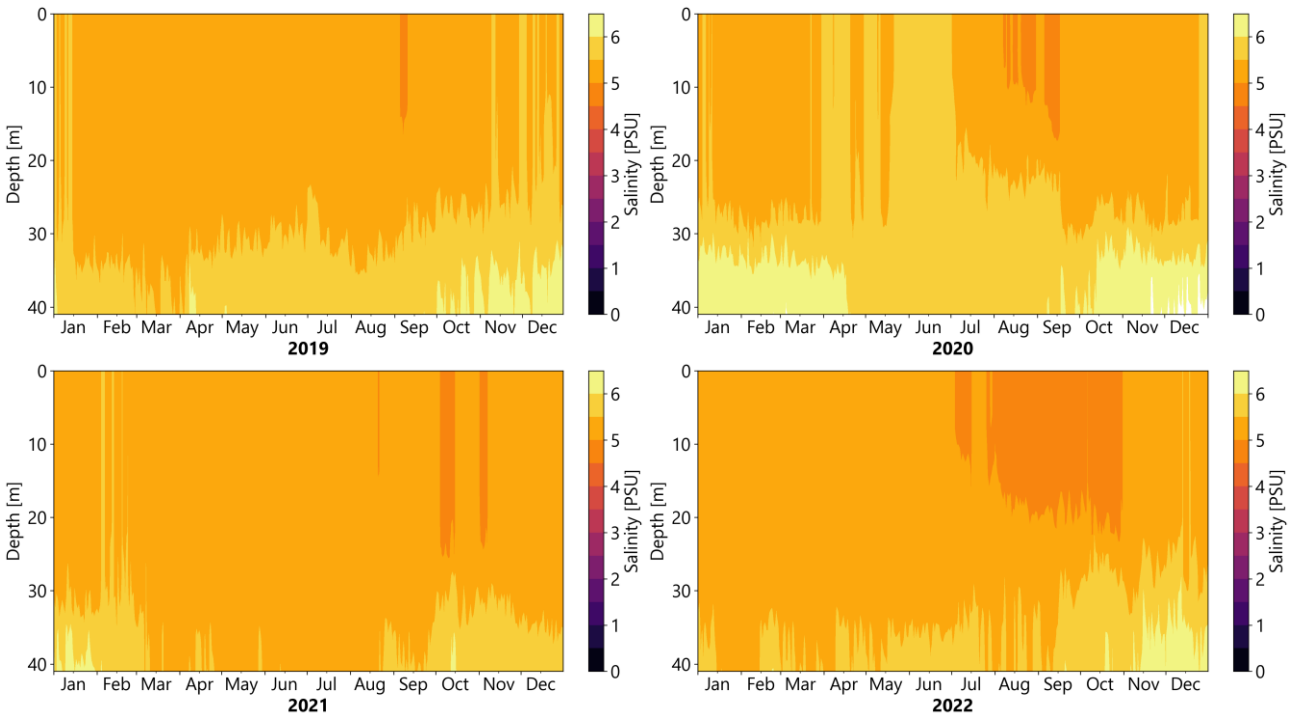

Depth [m]
0
10
20
30
40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2019
2020
2021
2022
Temperature [°C]
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0

# Appendix 5 Sylen OWF, Salinity profiles (SMHI, modelled 4x4km)


Depth [m]
0
5
10
15
20
25
30
35
40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2010
2011
2012
2013
2014
2015
2016
2017
Salinity [PSU]
0
1
2
3
4
5
6

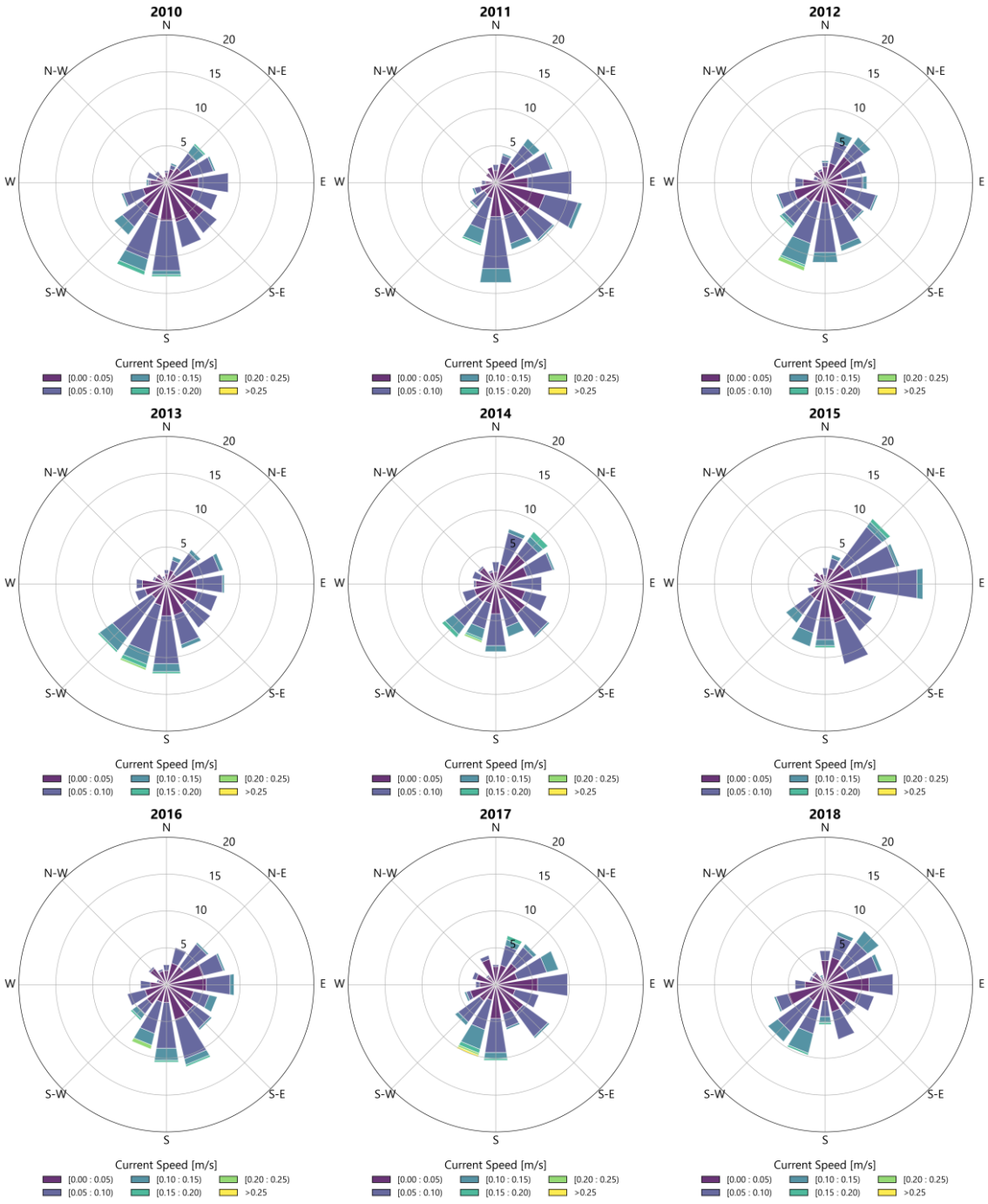

Depth [m]
0
5
10
15
20
25
30
35
40
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2018
2019
2020
Salinity [PSU]
0
1
2
3
4
5
6

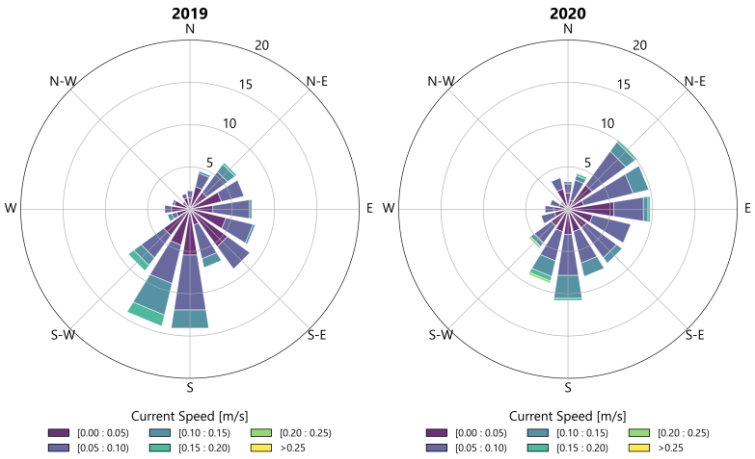
# Appendix 6 Sylen OWF, Salinity profiles (SMHI, modelled 2x2km)


Depth [m]
0
10
20
30
40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2019
2020
2021
2022
Salinity [PSU]
0
1
2
3
4
5
6

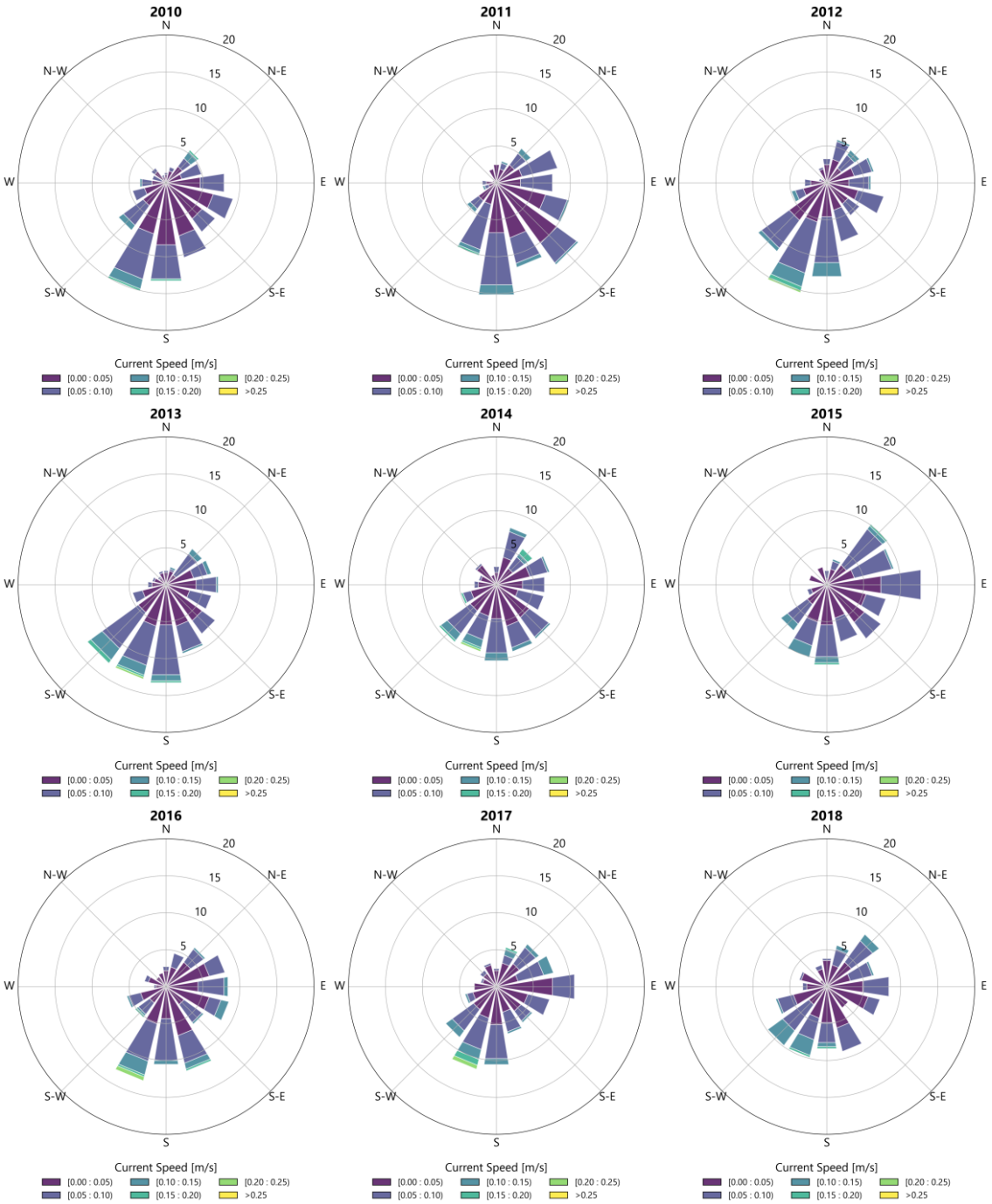
# Appendix 7 Sylen OWF, Current roses (SMHI, modelled 4x4km)

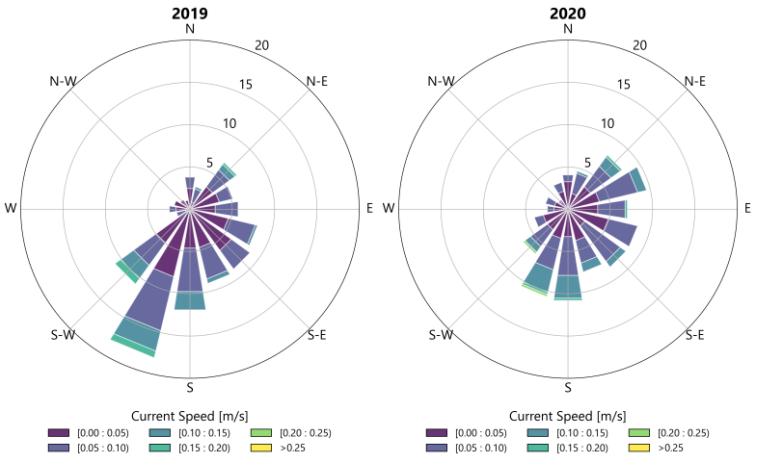
# Depth 1 m


2010
2011
2012
2013
2014
2015
2016
2017
2018
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

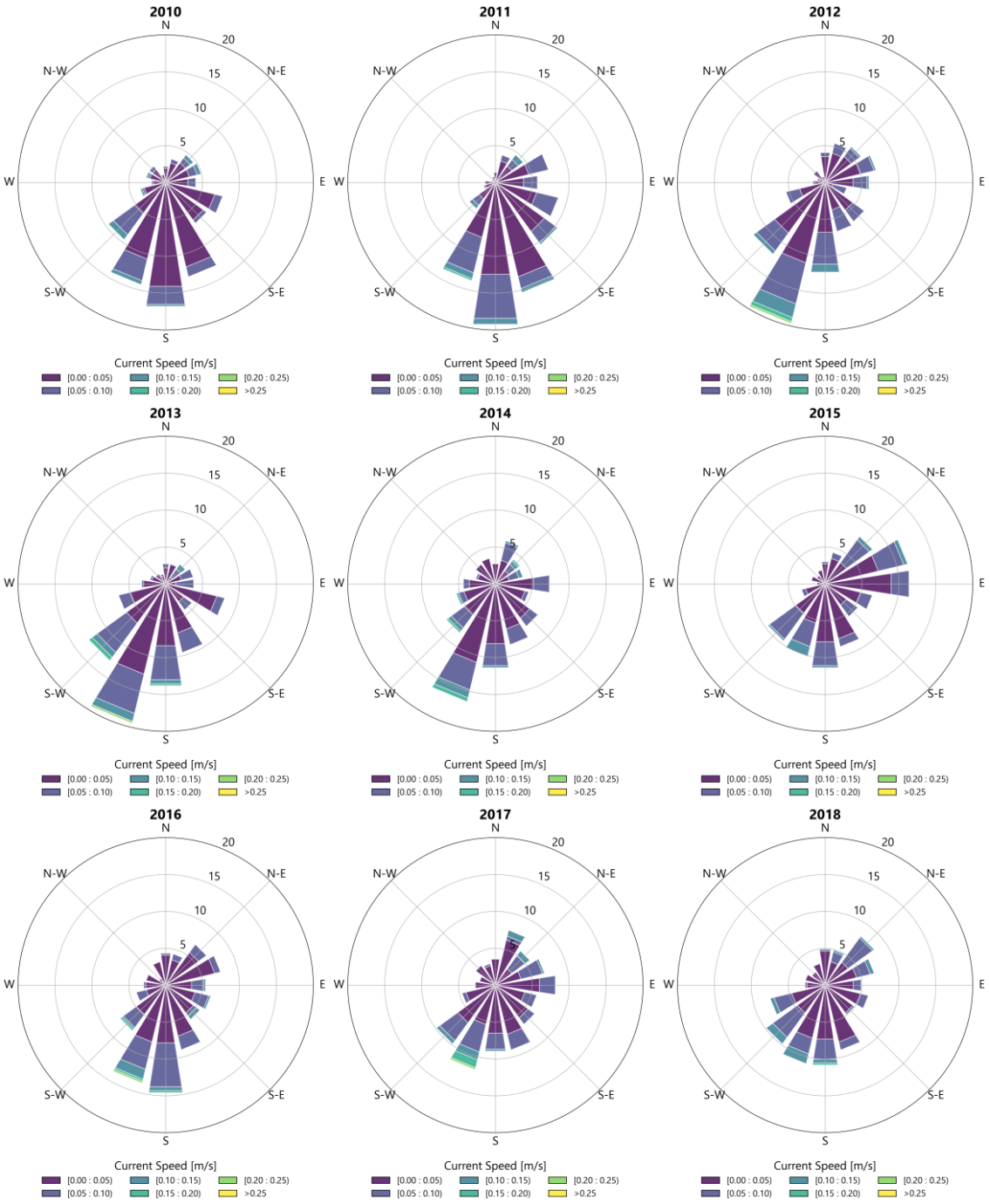

2019
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25
2020
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

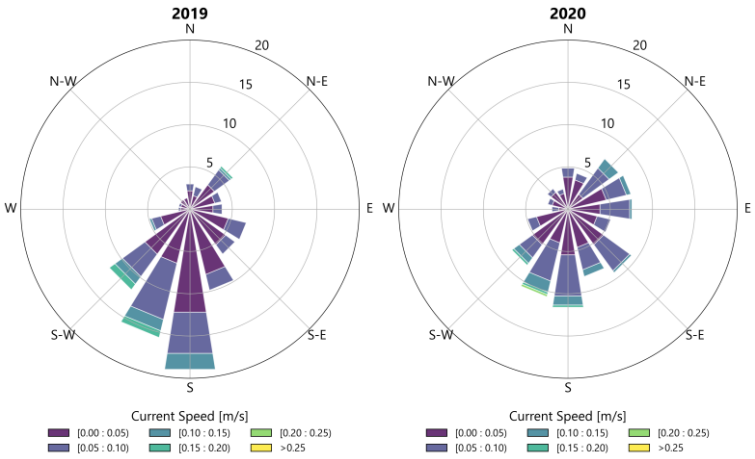
# Depth 4 m


2010
2011
2012
2013
2014
2015
2016
2017
2018
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25


2019
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25
2020
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

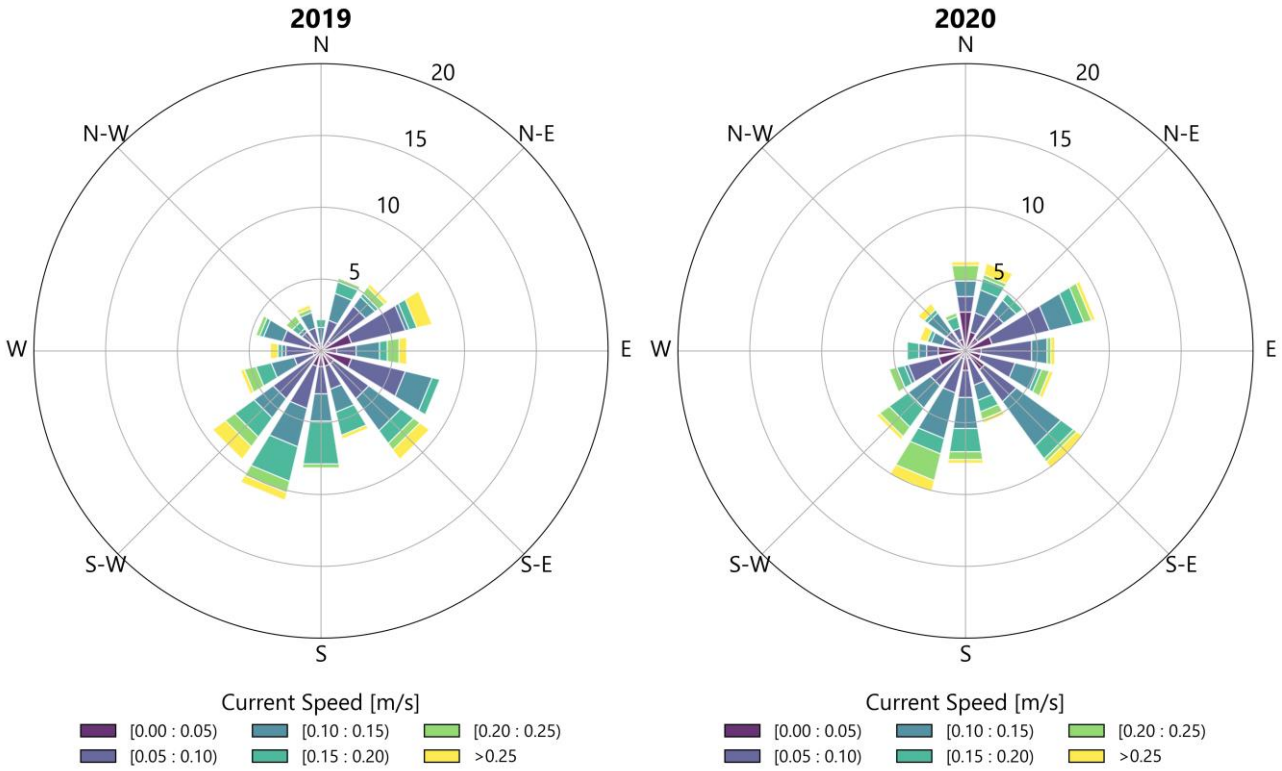
# Depth 10 m

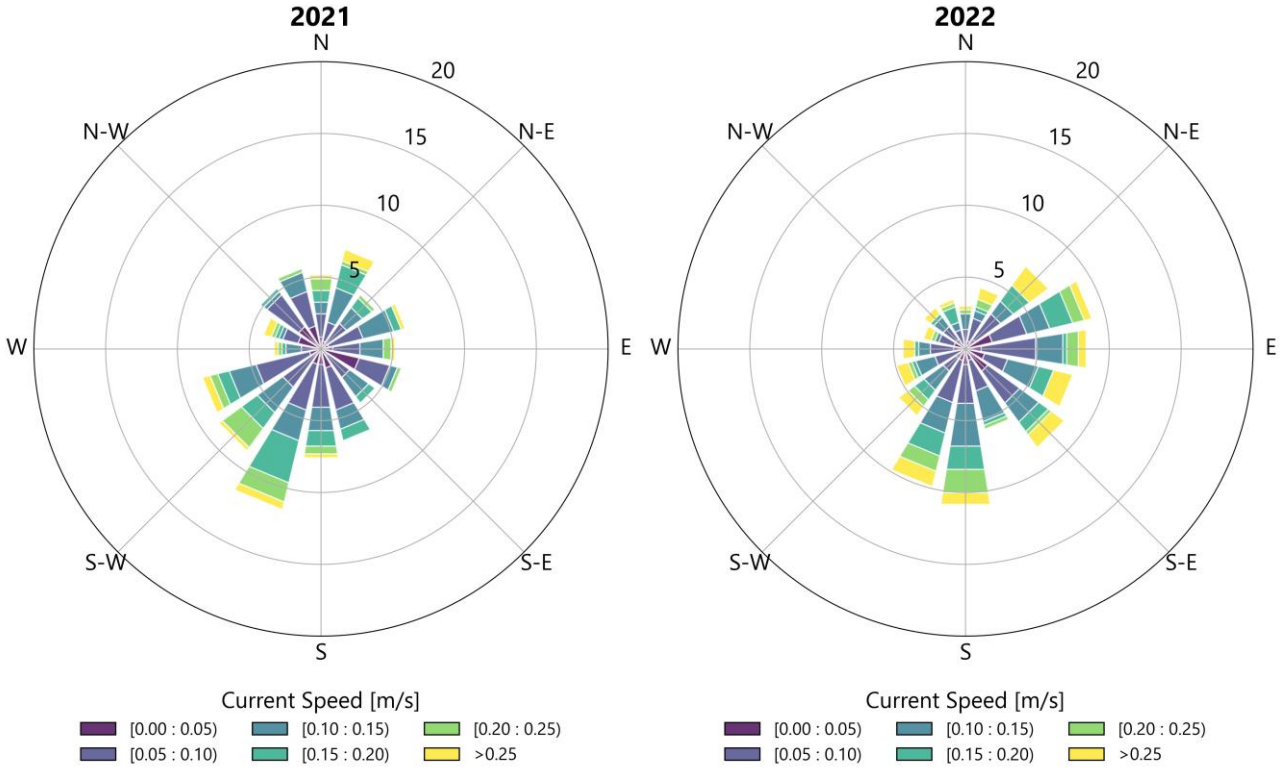

2010
2011
2012
2013
2014
2015
2016
2017
2018
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25


2019
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25
2020
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

# Appendix 8 Sylen OWF, Current roses (SMHI, modelled 2x2km)

# Depth 1 m

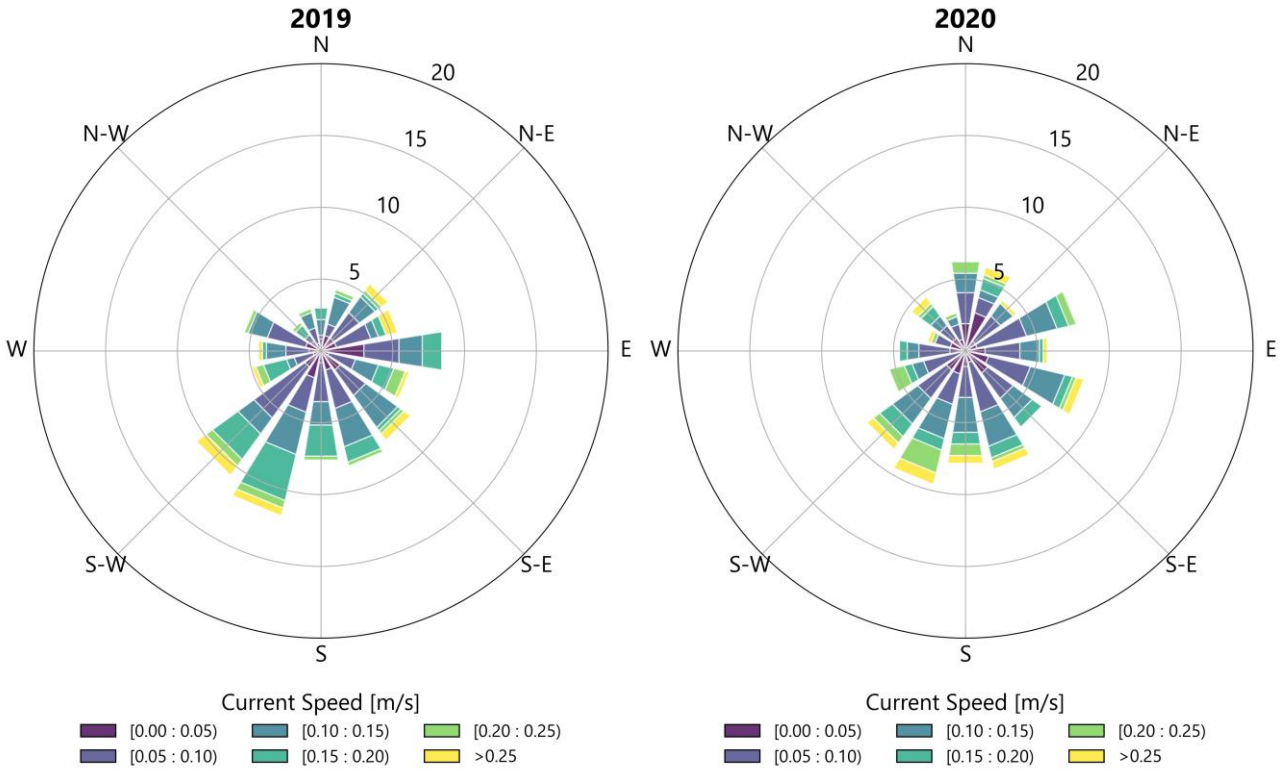

2019
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

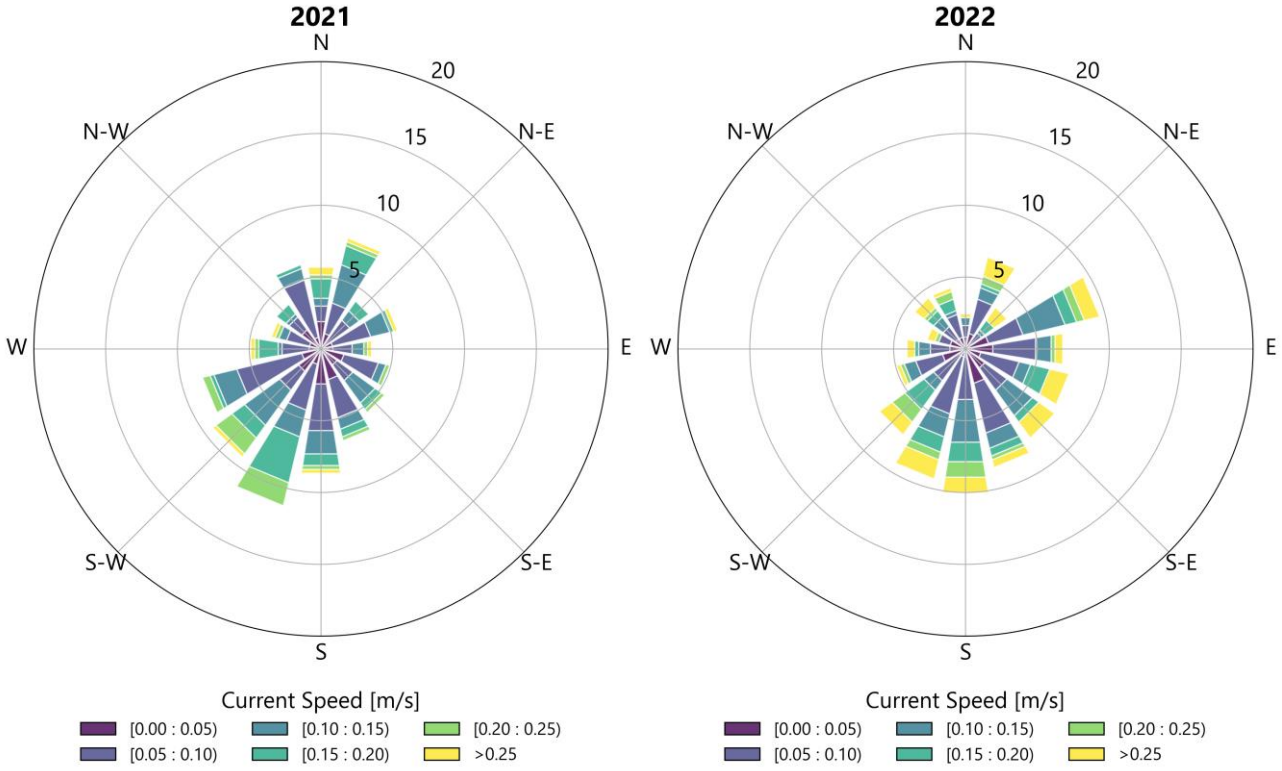

2021
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25


2020
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25


2022
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

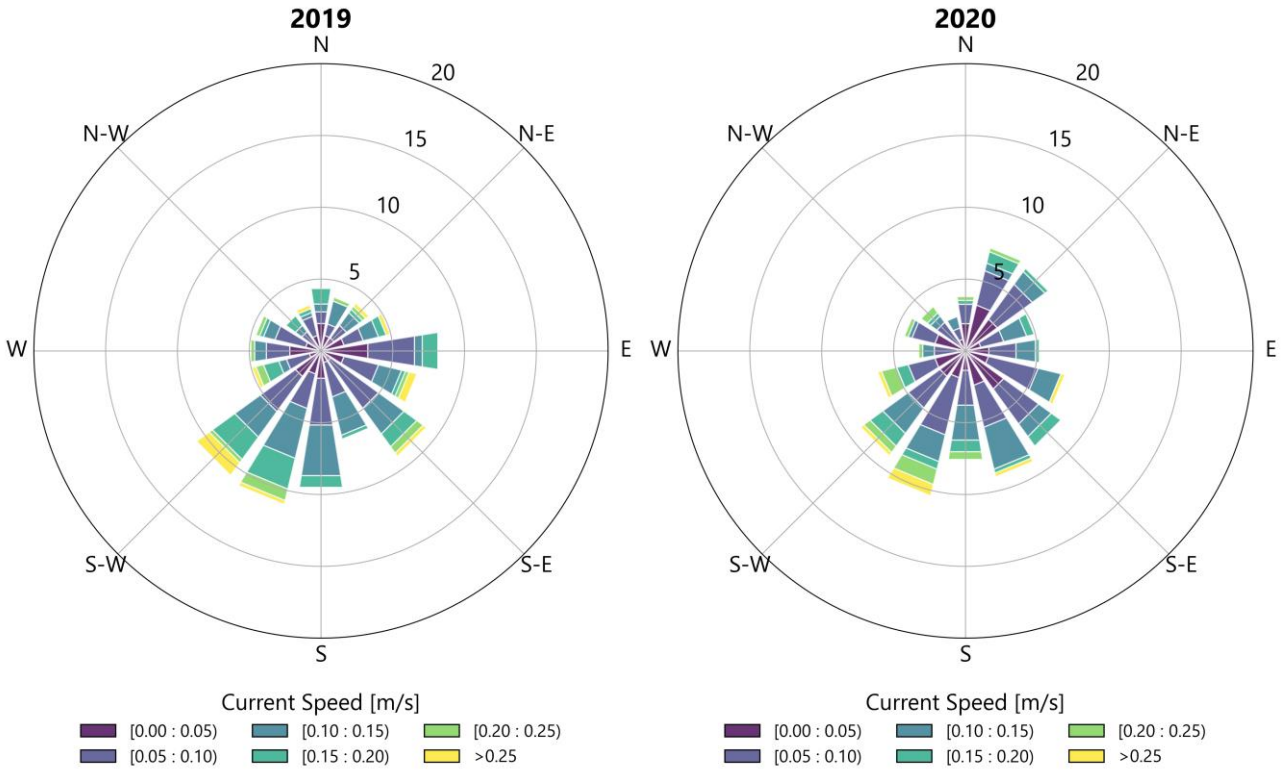
## Depth 5 m

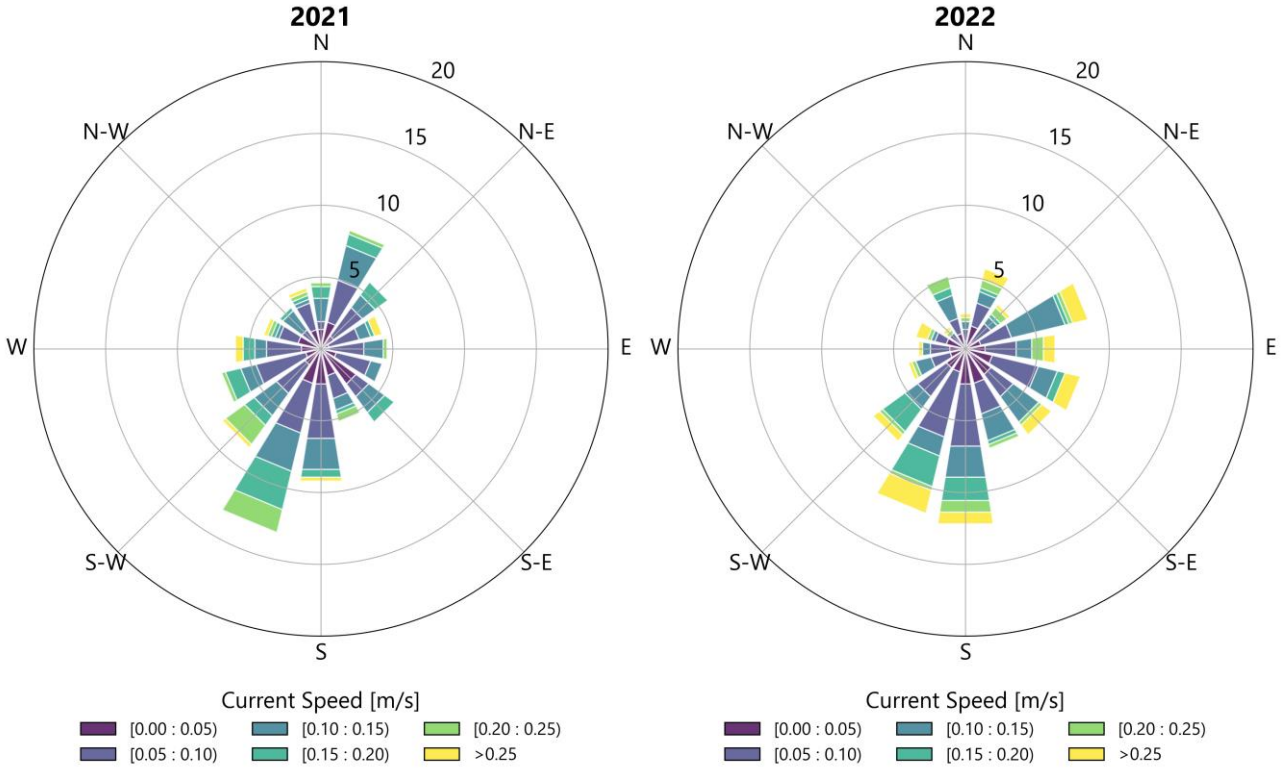

2019
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25


2021
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25


2022
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

## Depth 10 m


2019
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

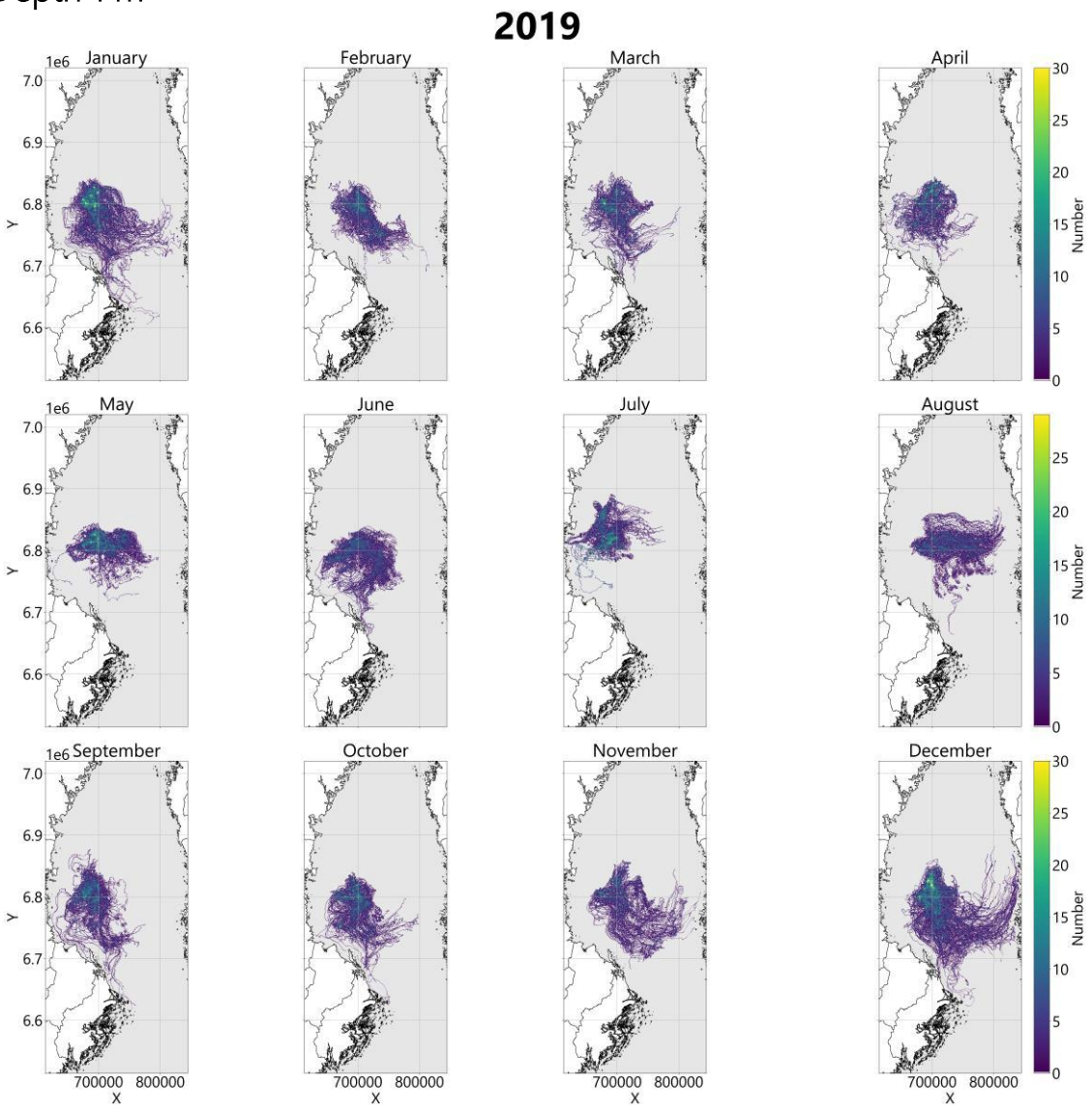

2021
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

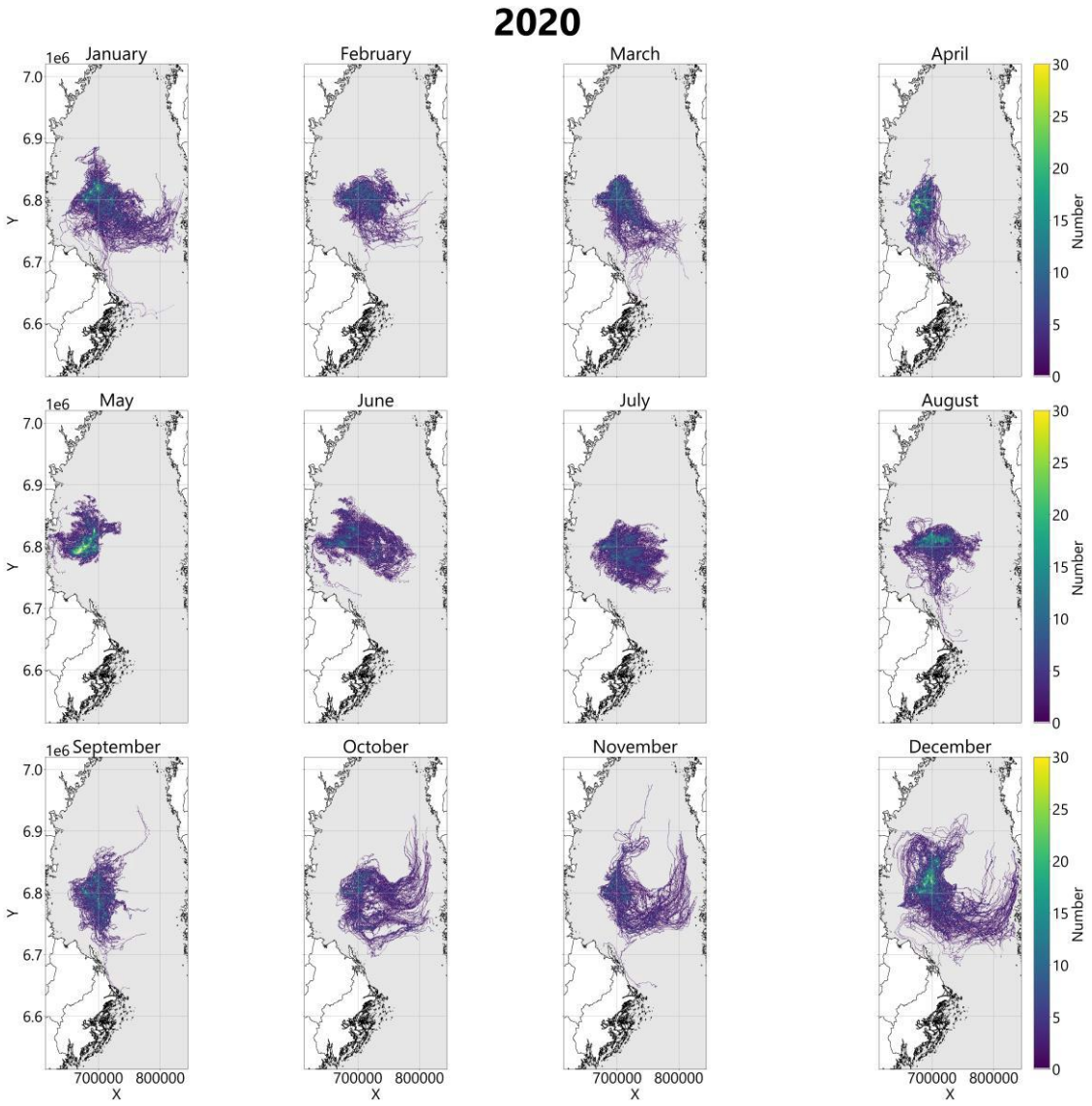

2022
N
N-E
E
S-E
S
S-W
W
N-W
5
10
15
20
Current Speed [m/s]
[0.00 : 0.05)
[0.05 : 0.10)
[0.10 : 0.15)
[0.15 : 0.20)
[0.20 : 0.25)
>0.25

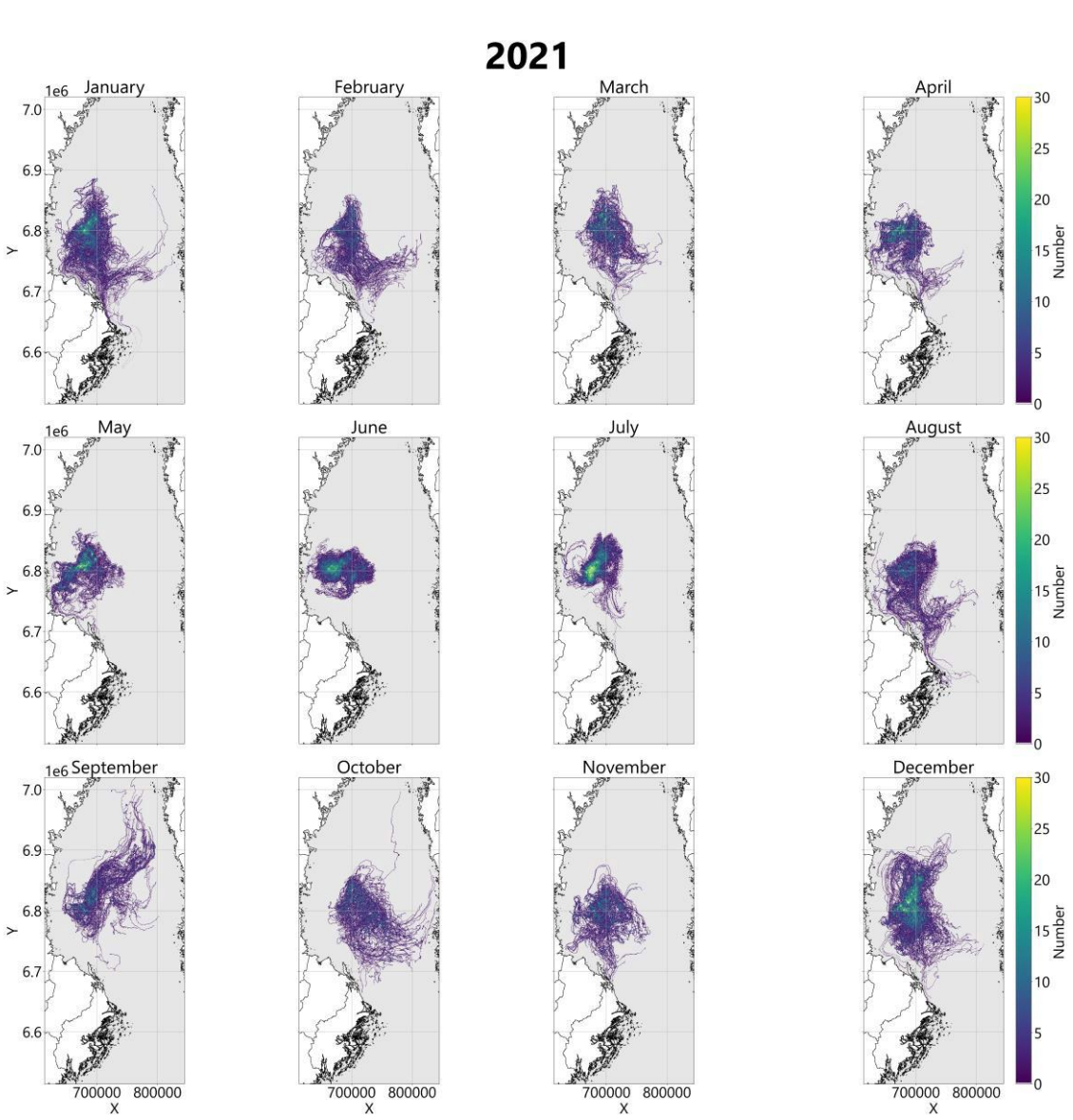
# Appendix 9 Sylen OWF, Simplified Particle Tracks

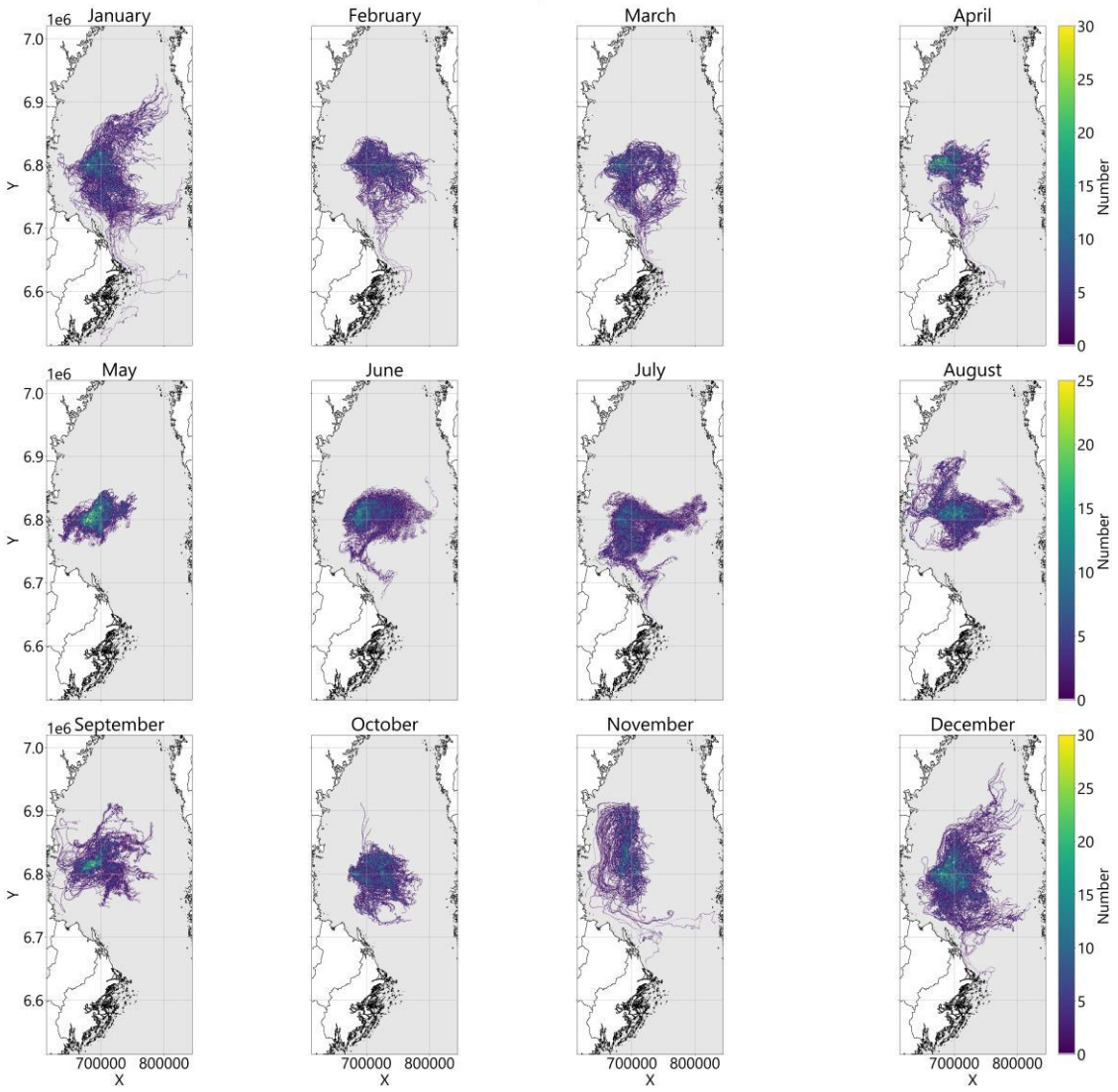
The following maps show the resulting tracks of a simplified particle tracking model based on the horizontal currents of the SMHI Baltic Sea model (Copernicus, Baltic Sea Physics Analysis and Forecast, 2x2km, 2022). Every day, one particle is released at each of five locations in the wind farm area, and its horizontal path is tracked for 30 days before the particle disappears again. The maps show all paths of the particles released in the respective month.

Depth 1 m

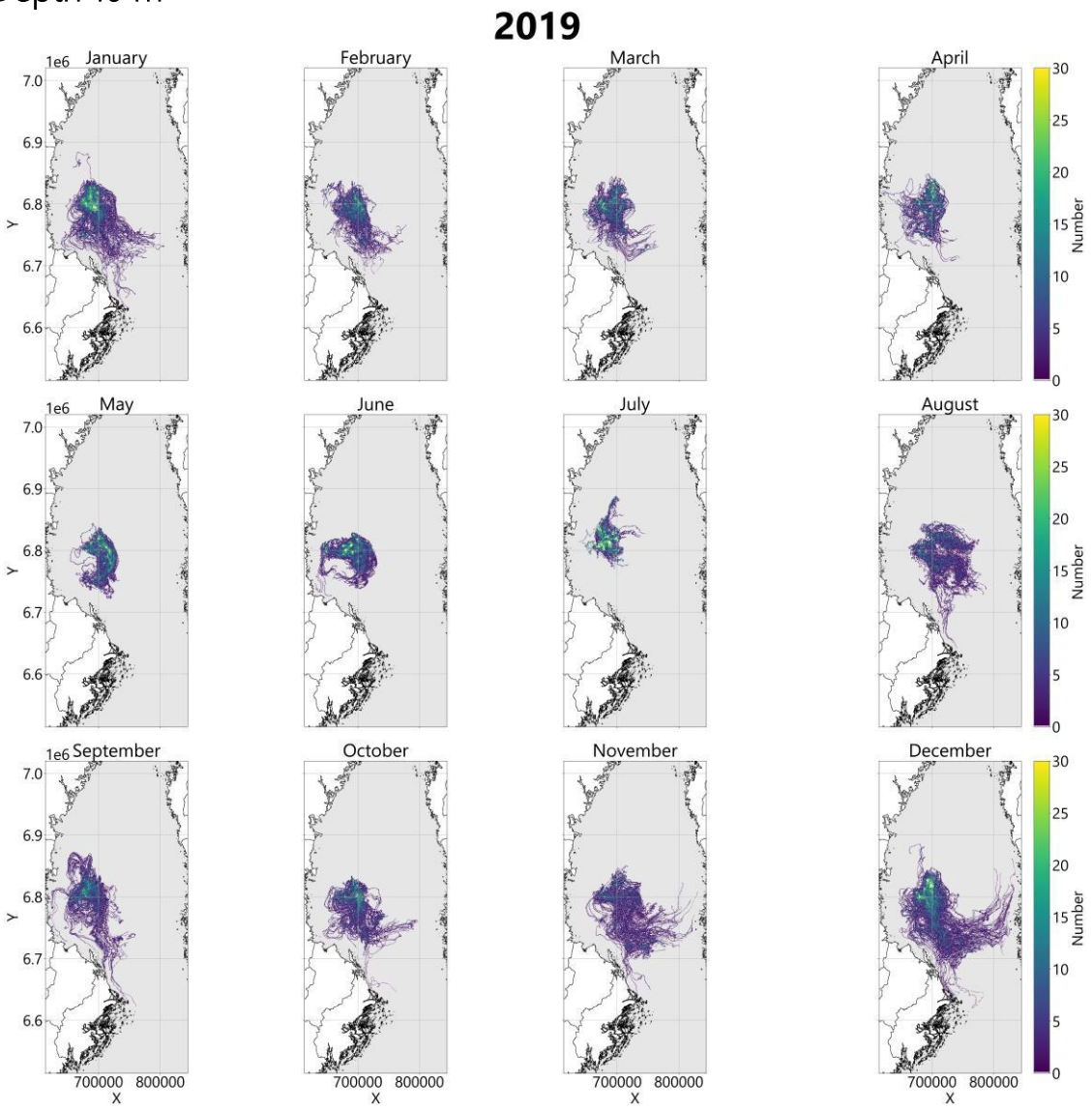

2019
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
30
25
20
15
10
5
0

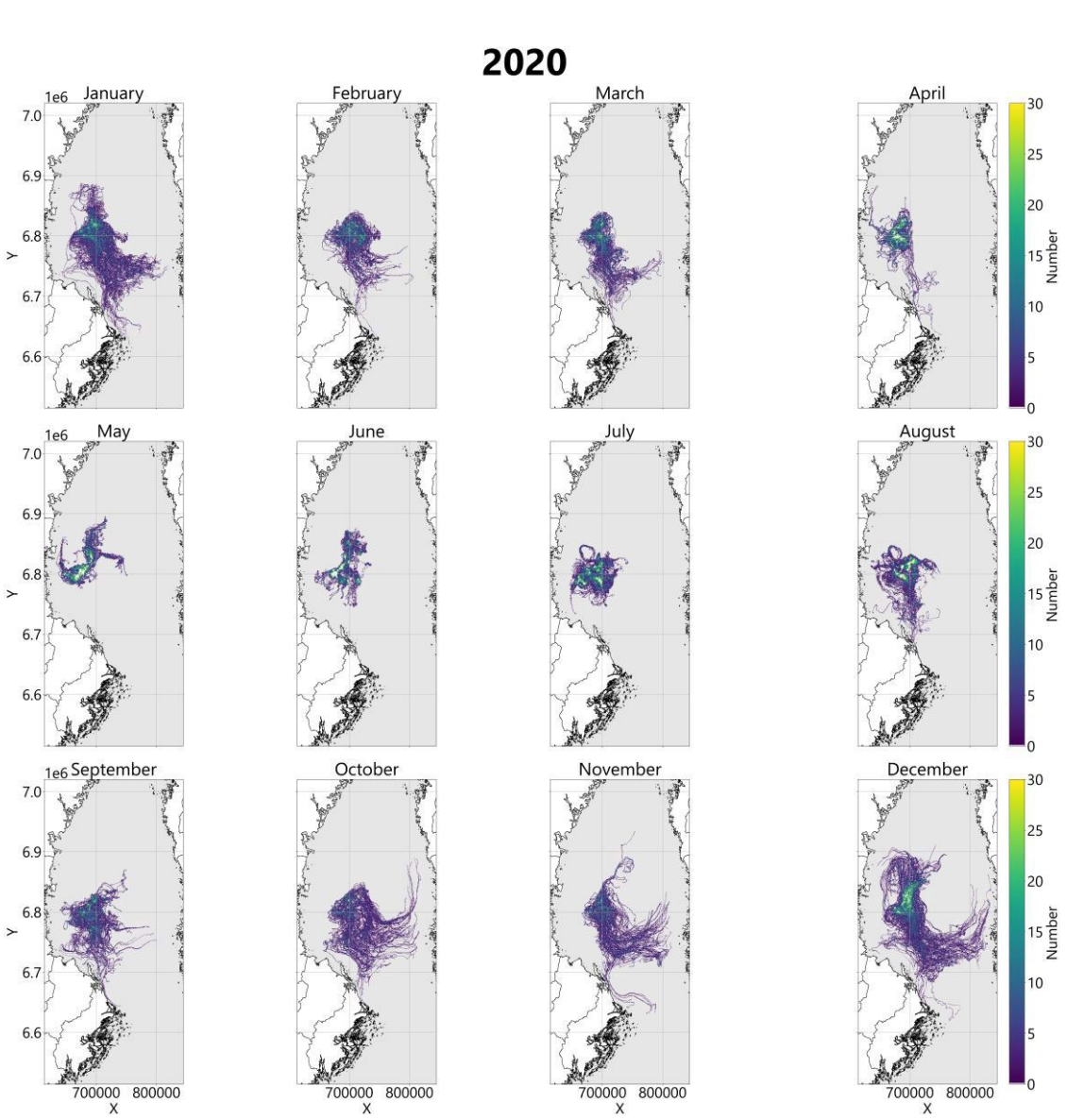

2020
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
0
5
10
15
20
25
30

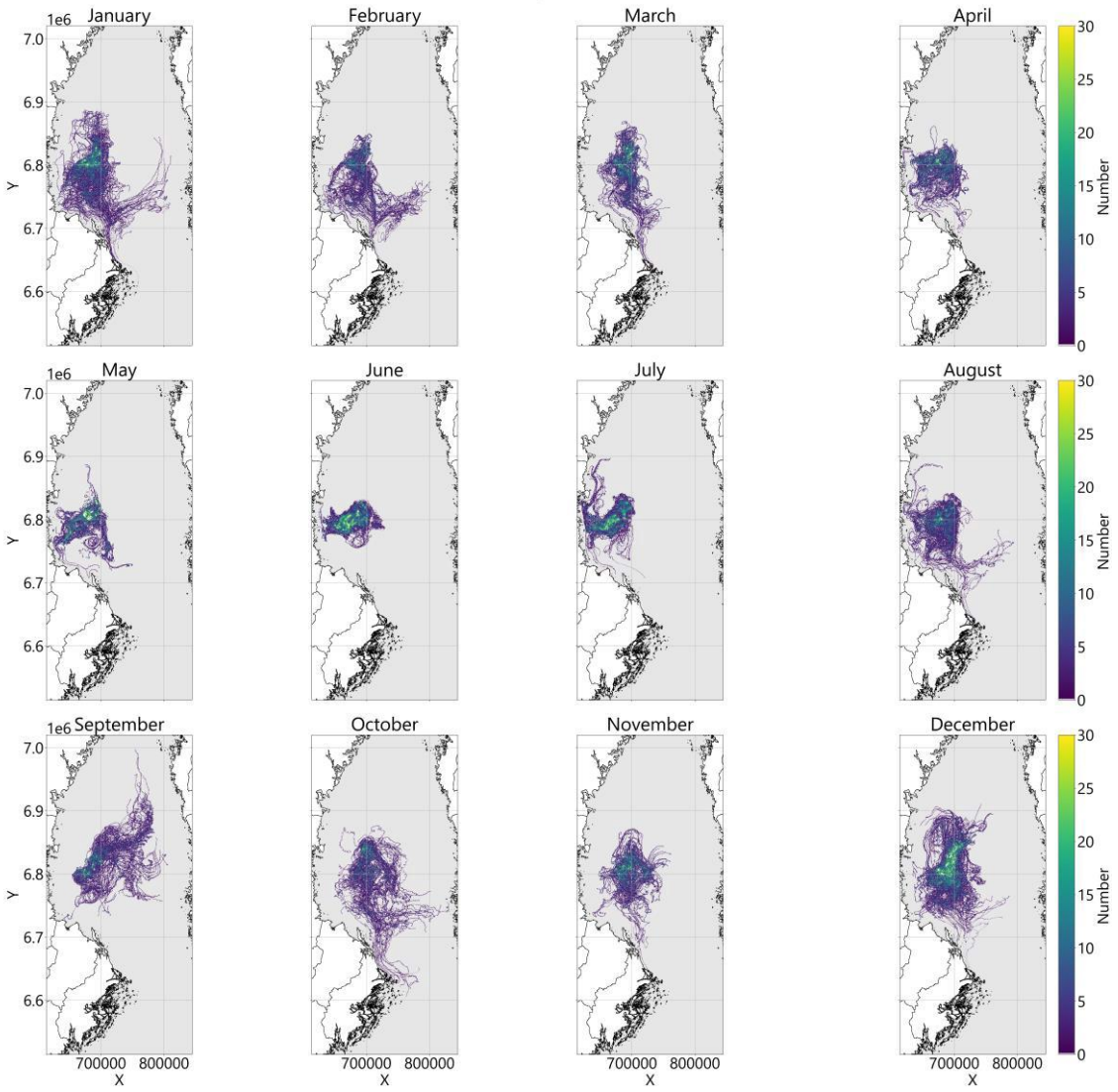

2021
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
0
5
10
15
20
25
30


2022
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
30
25
20
15
10
5
0

Depth 10 m


2019
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
30
25
20
15
10
5
0
Number


2020
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
0
5
10
15
20
25
30


2021
January
February
March
April
May
June
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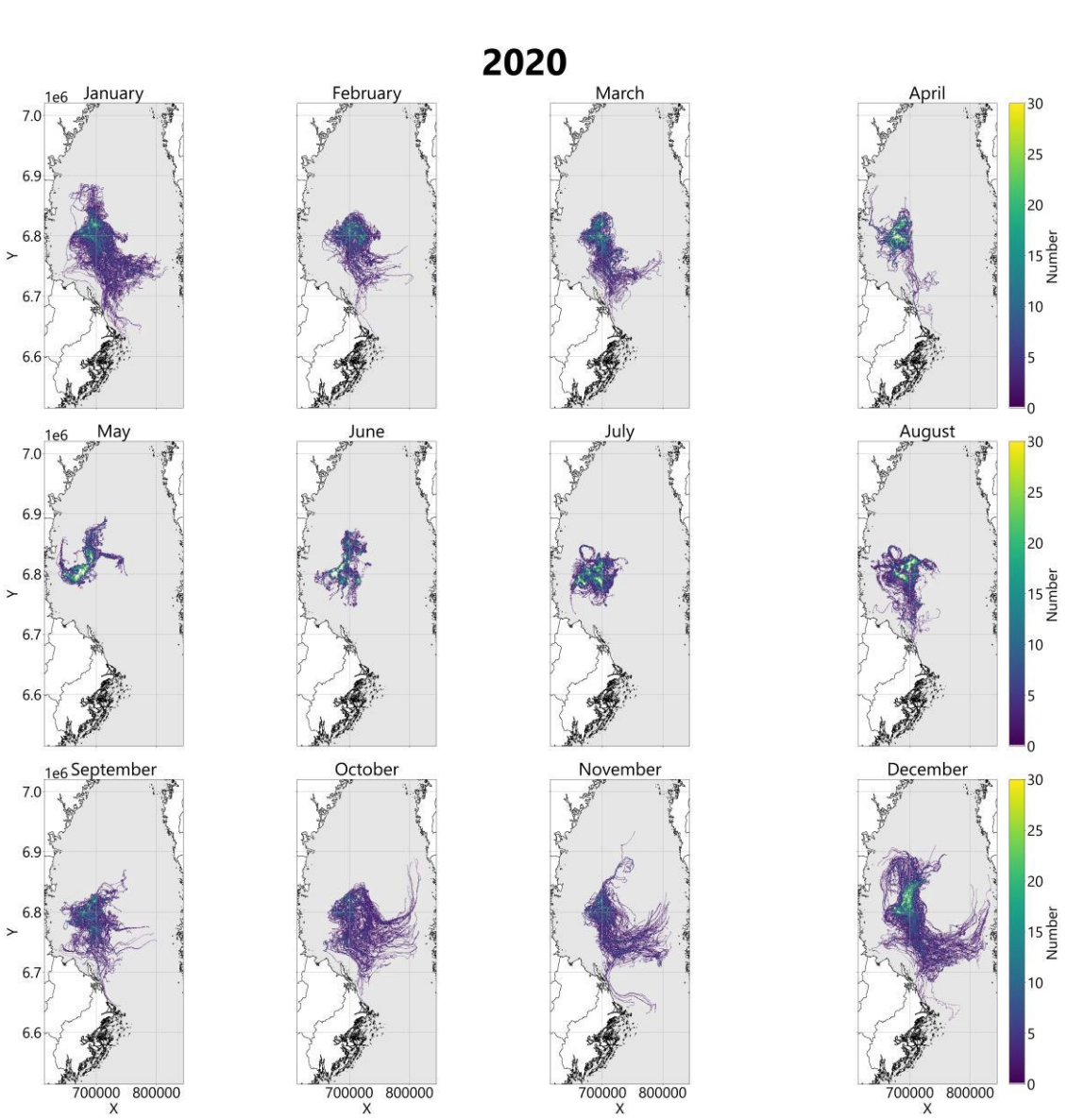
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
0
5
10
15
20
25
30


2020
January
February
March
April
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June
July
August
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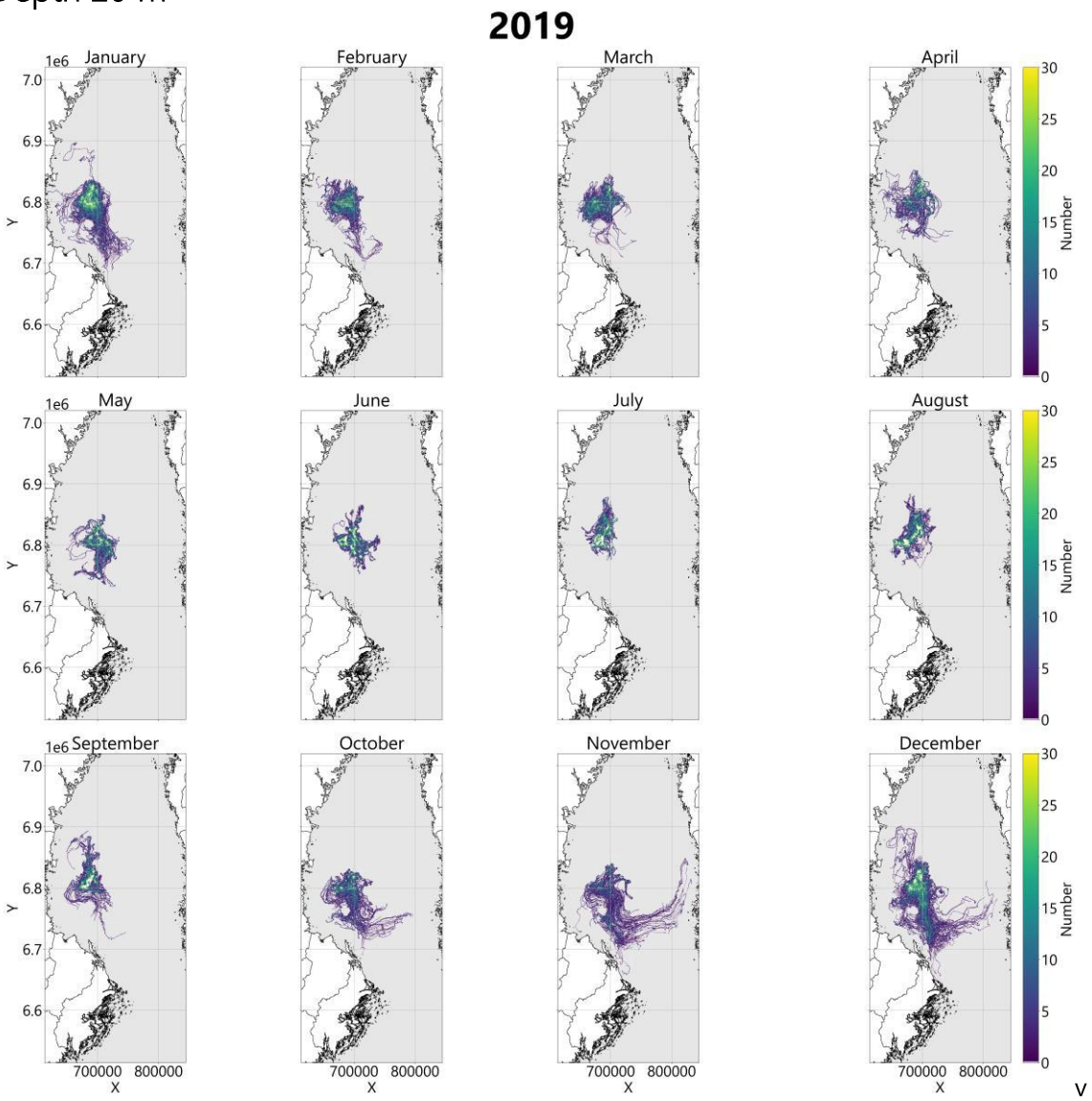
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
Number
0
5
10
15
20
25
30

Depth 20 m


2019
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
30
25
20
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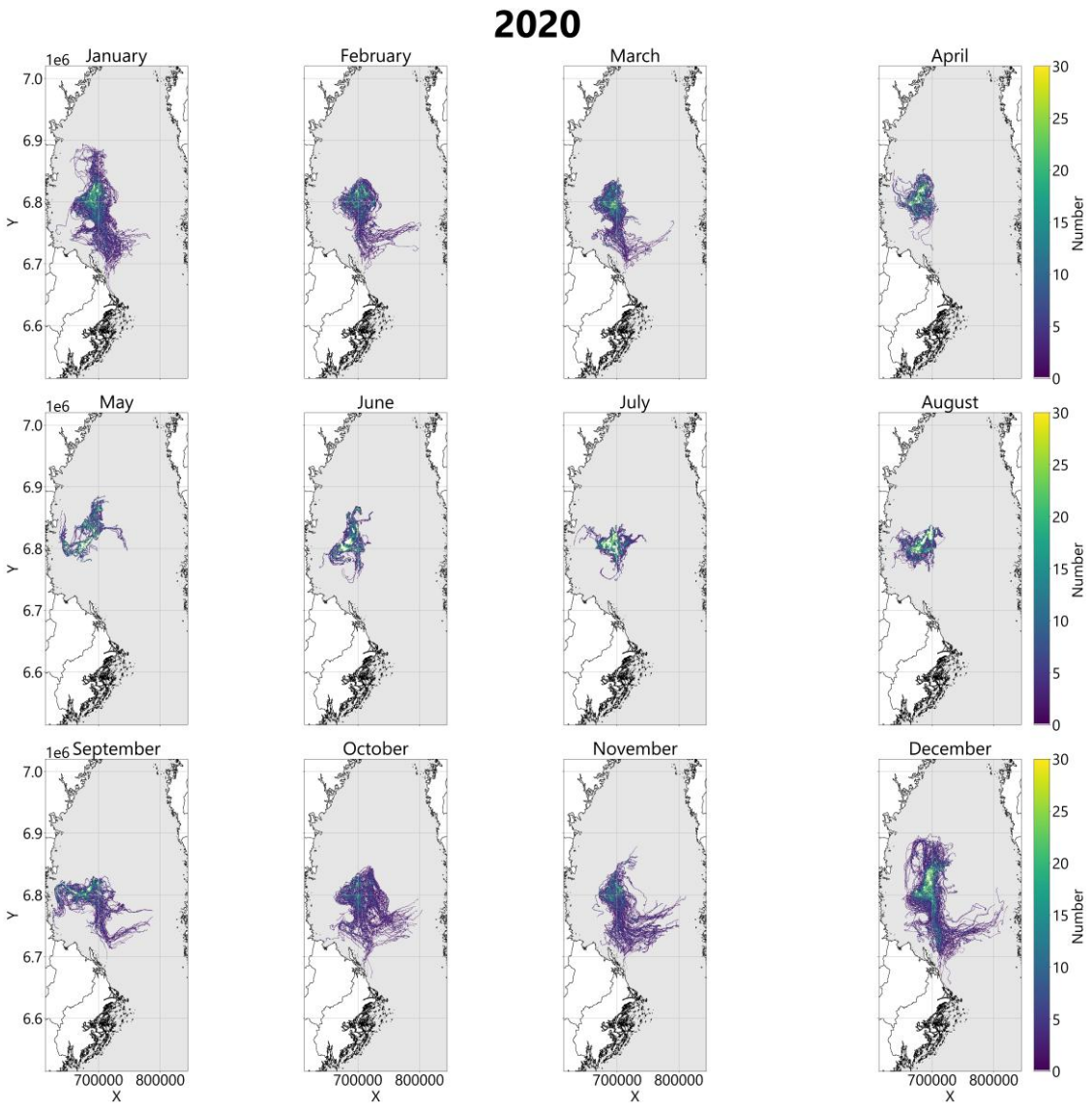
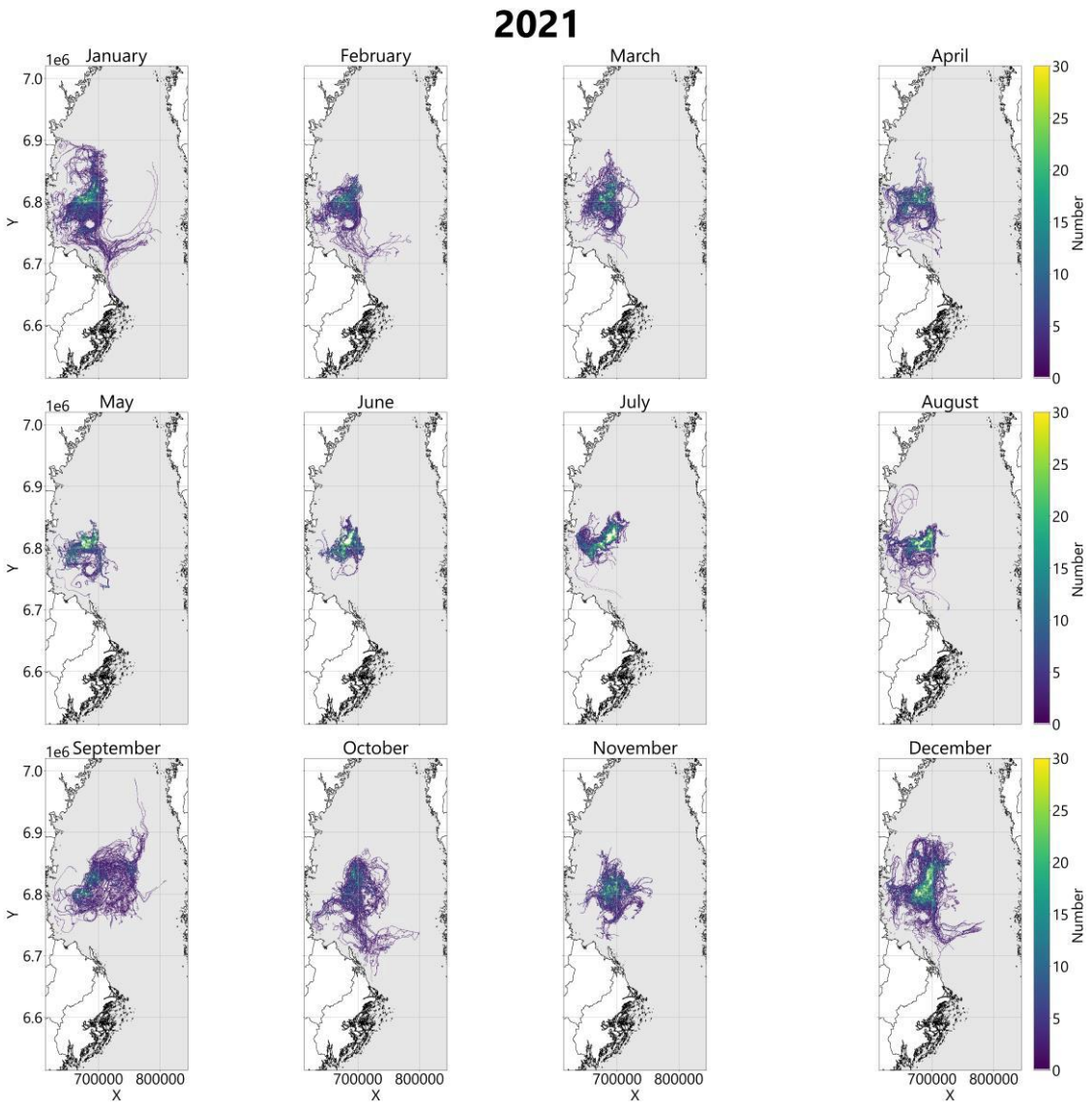
10
5
0
Number


2020
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
30
25
20
15
10
5
0
Number


2021
January
February
March
April
May
June
July
August
September
October
November
December
1e6
7.0
6.9
6.8
6.7
6.6
Y
700000
800000
X
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25
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15
10
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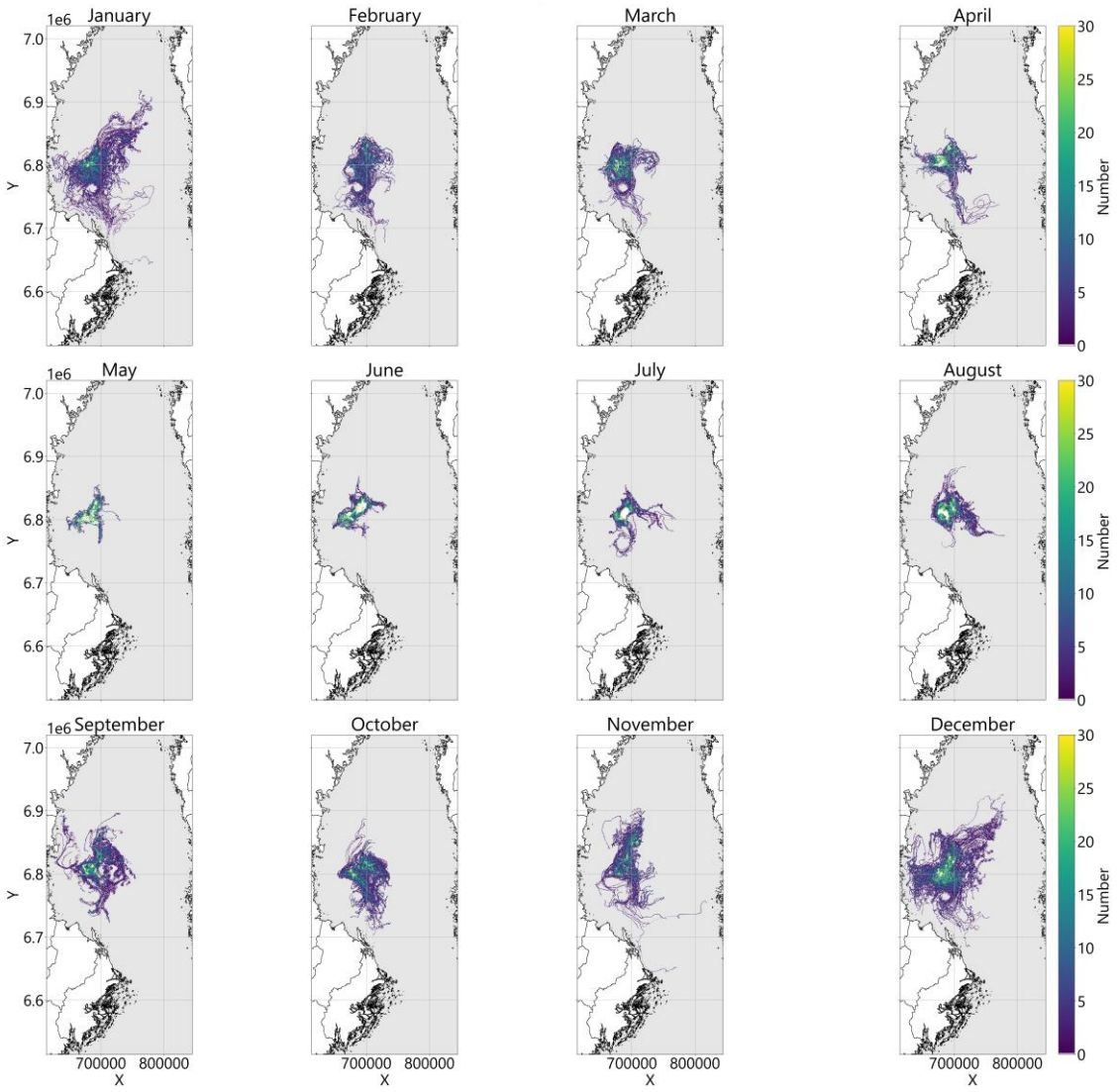
0
Number


2022
January
February
March
April
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November
December
1e6
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6.9
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6.7
6.6
Y
700000
800000
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30
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0
Number

# Appendix 10 Observations: Water levels

*Water level measuring stations used in the present study*

| Name | ID | Lat | Long | Source |
|---|---|---|---|---|
| **FURUÍGRUND** | 2055 | 64.9158 | 21.2306 | SMHI |
| **RATAN** | 2056 | 63.9861 | 20.8950 | SMHI |
| **SPIKARNA** | 2061 | 62.3633 | 17.5311 | SMHI |
| **FORSMARK** | 2179 | 60.4086 | 18.2108 | SMHI |
| **FORSMARK** | 2179 | 60.4086 | 18.2108 | SMHI |
| **SKAGSUDDE** | 2321 | 63.1906 | 19.0125 | SMHI |
| **KALIX-KARLSBORG SJÍV** | 35103 | 65.7887 | 23.3027 | SMHI |
| **BÍNAN SJÍV** | 35119 | 60.7384 | 17.3186 | SMHI |
| **Holmsund** | 35124 | 63.6803 | 20.3331 | SMHI |
| **LJUSNE SJÍV** | 35127 | 61.2067 | 17.1452 | SMHI |
| **SKAGSUDDE SJÍV** | 35138 | 63.1906 | 19.0119 | SMHI |
| **STRÍMÍREN SJÍV** | 35183 | 65.5497 | 22.2383 | SMHI |
| **Kemi Ajos** | 100539 | 65.6734 | 24.5153 | FMI |
| **Raahe Lapaluoto** | 100540 | 64.6663 | 24.4071 | FMI |
| **Vaasa Vaskiluoto** | 134223 | 63.0815 | 21.5712 | FMI |
| **Rauma Petäjäs** | 134224 | 61.1339 | 21.4426 | FMI |
| **Oulu Toppila** | 134248 | 65.0403 | 25.4182 | FMI |
| **Pietarsaari Leppäluoto** | 134250 | 63.7086 | 22.6896 | FMI |
| **Kaskinen Ådskär** | 134251 | 62.3440 | 21.2148 | FMI |
| **Pori Mäntyluoto Kallo** | 134266 | 61.5944 | 21.4634 | FMI |

# Appendix 11 Observations: CTD-Measuring sites

*Location of CTD-Measurements used in the present study*

| Name | ID | Lat | Long | Source |
|---|---|---|---|---|
| **MAME61** | 91607 | 60.9119 | 20.3272 | Merihavainnot.fi |
| **SR5** | 70676 | 61.0833 | 19.5833 | Merihavainnot.fi |
| **SR7** | 70677 | 61.0835 | 20.5965 | Merihavainnot.fi |
| **SR8** | 78292 | 61.1265 | 20.9300 | Merihavainnot.fi |
| **SR3** | 71073 | 61.1833 | 18.2300 | Merihavainnot.fi |
| **MS9** | 77892 | 61.7668 | 20.5305 | Merihavainnot.fi |
| **F26** | 77178 | 61.9835 | 20.0630 | Merihavainnot.fi |
| **MS6** | 70670 | 61.9837 | 19.1635 | Merihavainnot.fi |
| **MS3** | 77880 | 62.1345 | 18.1630 | Merihavainnot.fi |
| **US5B** | 70683 | 62.5862 | 19.9688 | Merihavainnot.fi |
| **US6B** | 70684 | 62.6002 | 20.2630 | Merihavainnot.fi |
| **US7** | 70685 | 62.6002 | 20.8297 | Merihavainnot.fi |
| **US3** | 70681 | 62.7588 | 19.1957 | Merihavainnot.fi |
| **F18** | 70656 | 63.3143 | 20.2727 | Merihavainnot.fi |
| **F18** | 70656 | 63.3143 | 20.2727 | Merihavainnot.fi |
| **F16** | 70679 | 63.5168 | 21.0628 | Merihavainnot.fi |
| **F13** | 77162 | 63.7835 | 21.4795 | Merihavainnot.fi |
| **BO3** | 70647 | 64.3050 | 22.3583 | Merihavainnot.fi |
| **F9** | 77223 | 64.7003 | 22.0628 | Merihavainnot.fi |
| **RR7** | 78138 | 64.7337 | 23.8128 | Merihavainnot.fi |
| **RR6** | 70674 | 64.8003 | 23.4795 | Merihavainnot.fi |
| **RR5** | 70673 | 64.8337 | 23.1628 | Merihavainnot.fi |
| **RR3** | 70644 | 64.9337 | 22.3460 | Merihavainnot.fi |
| **CV** | 77045 | 65.0003 | 23.2462 | Merihavainnot.fi |
| **CVI** | 70650 | 65.2337 | 23.5620 | Merihavainnot.fi |
| **F2** | 70658 | 65.3837 | 23.4627 | Merihavainnot.fi |
| **A5** | | 65.2690 | 22.8618 | SMHI |
| **F13** | | 63.7912 | 21.4836 | SMHI |
| **F16** | | 63.5257 | 21.0817 | SMHI |
| **F18 SYDOSTBROTTEN** | | 63.3092 | 20.2803 | SMHI |
| **F33 GRUNDKALLEN** | | 60.5402 | 18.9309 | SMHI |
| **MS2** | | 62.1320 | 17.8736 | SMHI |
| **MS6** | | 61.9835 | 19.1646 | SMHI |
| **RR1** | | 64.9680 | 21.8680 | SMHI |
| **RR5** | | 64.8376 | 23.1696 | SMHI |

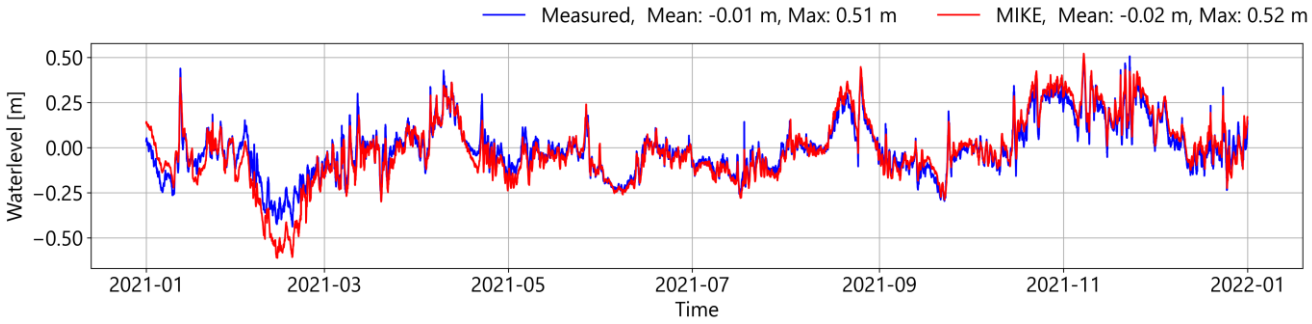
| Name | ID | Lat | Long | Source |
|---|---|---|---|---|
| **RR7** | | 64.7320 | 23.8167 | SMHI |
| **SR1A** | | 61.2321 | 17.6620 | SMHI |
| **SR3** | | 61.1838 | 18.2323 | SMHI |
| **SS29** | | 61.1096 | 20.2654 | SMHI |

# Appendix 12 Observations: Surface temperature

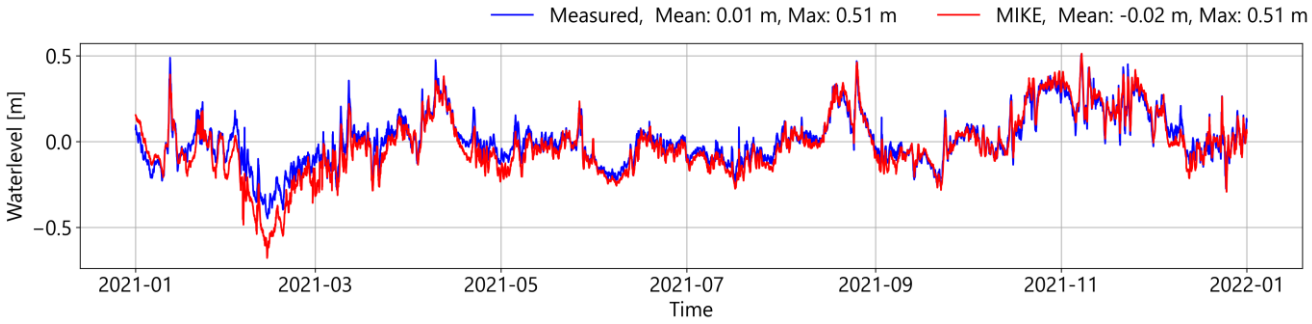
*Surface temperature measuring stations used in the present study*

| Name | ID | Lat | Long | Source |
|---|---|---|---|---|
| **FORSMARK** | 2179 | 60.4086 | 18.2108 | SMHI |
| **FINNGRUNDET WR BOJ** | 33003 | 60.9000 | 18.6167 | SMHI |
| **NORRBYN BOJ** | 33021 | 63.4990 | 19.8044 | SMHI |
| **KALIX-KARLSBORG SJÖV** | 35103 | 65.7887 | 23.3027 | SMHI |
| **BÍNAN SJÍV** | 35119 | 60.7384 | 17.3186 | SMHI |
| **Holmsund** | 35124 | 63.6803 | 20.3331 | SMHI |
| **LJUSNE SJÍV** | 35127 | 61.2067 | 17.1452 | SMHI |
| **STRÍMÍREN SJÍV** | 35183 | 65.5497 | 22.2383 | SMHI |
| **NORRBYN SST** | 37110 | 63.5642 | 19.8331 | SMHI |
| **Oulu Santapankki** | 103807 | 65.2340 | 24.9692 | FMI |
| **Kalajoki Maakalla** | 103808 | 64.2938 | 23.5506 | FMI |
| **Pori Kaijakari** | 104600 | 61.6218 | 21.3956 | FMI |
| **Uusikaupunki Vekara** | 106631 | 60.8670 | 21.0494 | FMI |
| **Maalahti Storskõret** | 107033 | 63.1076 | 20.8185 | FMI |
| **Selkõmeri aaltopoiju** | 134246 | 61.8001 | 20.2327 | FMI |
| **Perõmeri aaltopoiju** | 137228 | 64.6841 | 23.2380 | FMI |

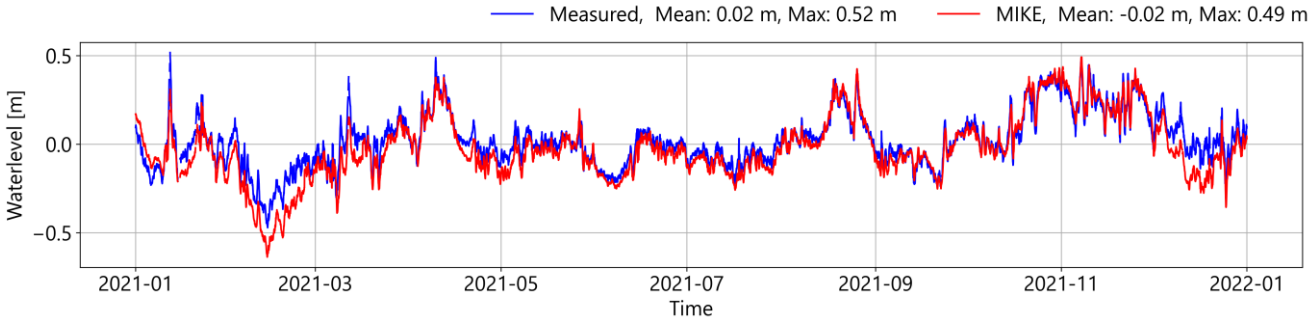
# Appendix 13 Model verification: Water levels



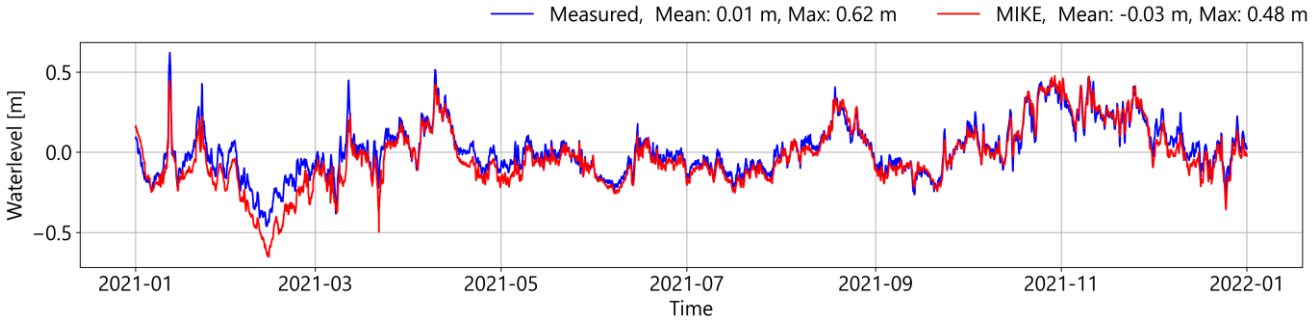

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for FORSMARK (SMHI-Station).*



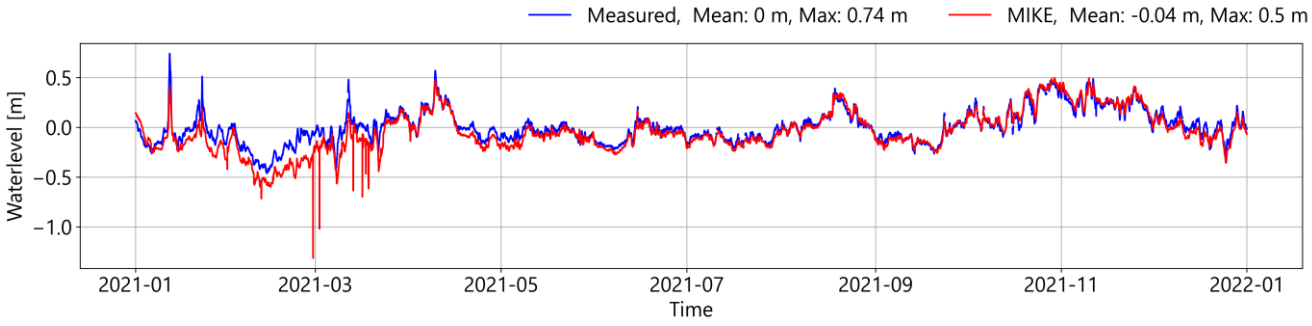

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for BÖNAN SJÖV. (SMHI-Station).*



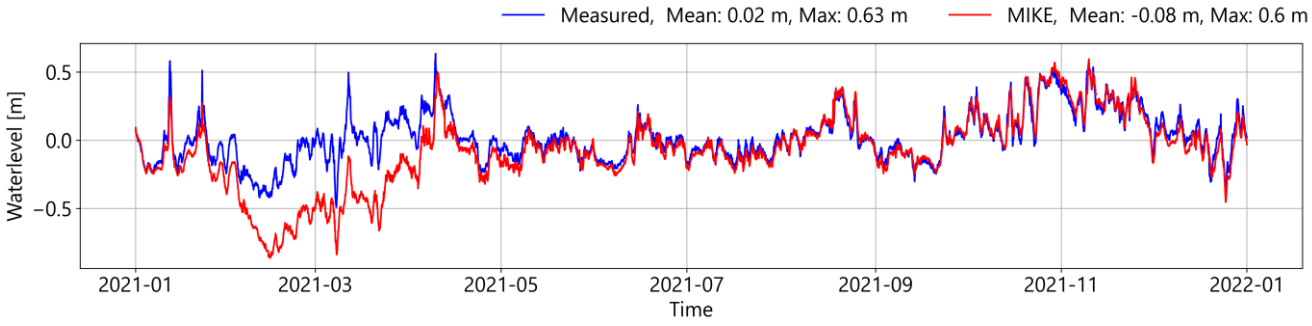

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for LJUSNE SJÖV (SMHI-Station).*



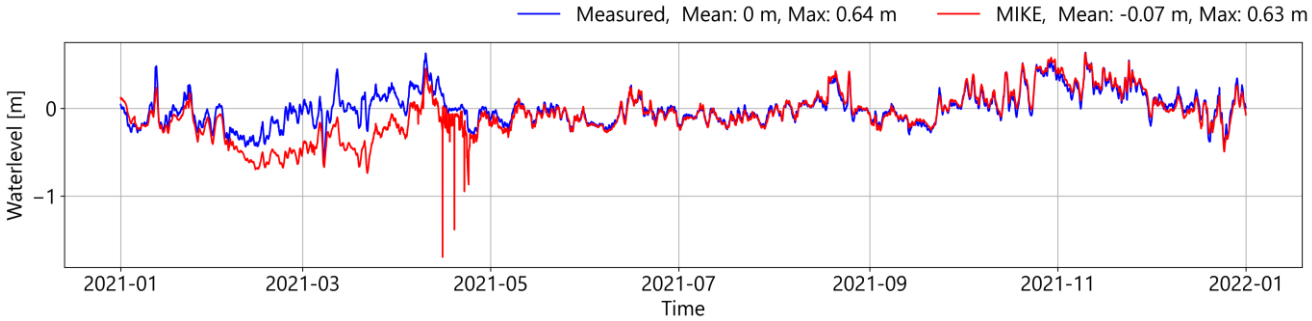

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for SPIKARNA (SMHI-Station).*



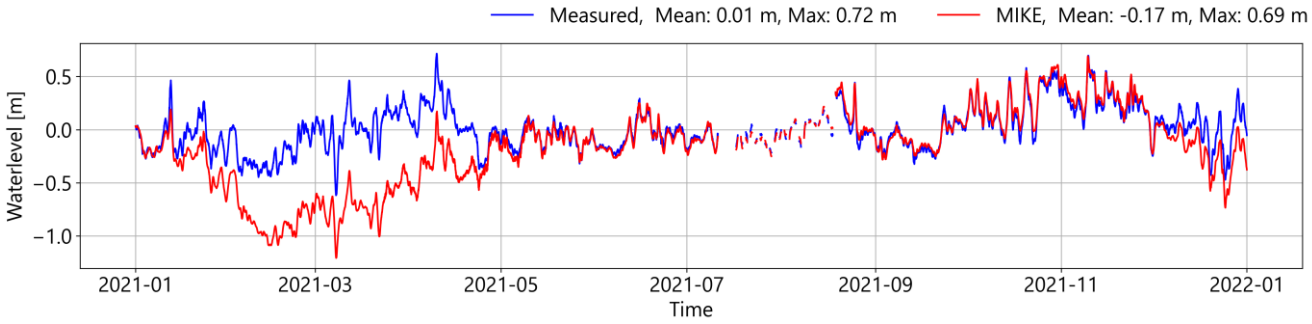

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for SKAGSUDDE SJÖV (SMHI-Station).*



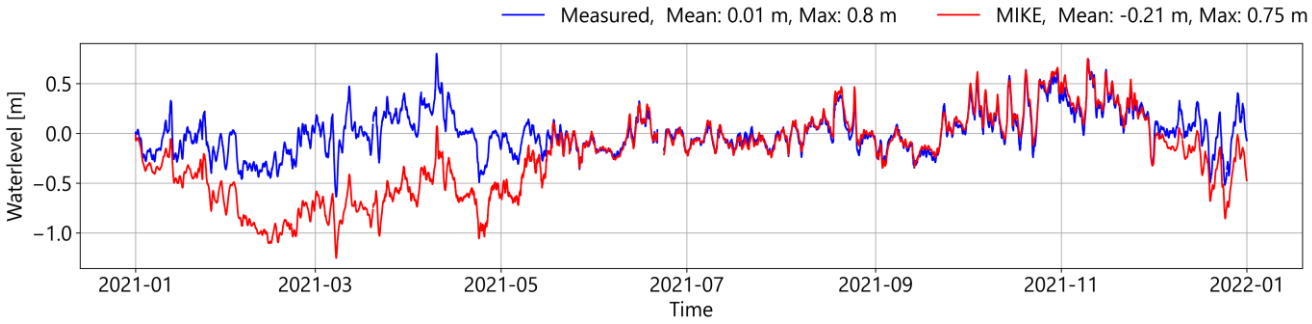

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Holmsund (SMHI-Station).*



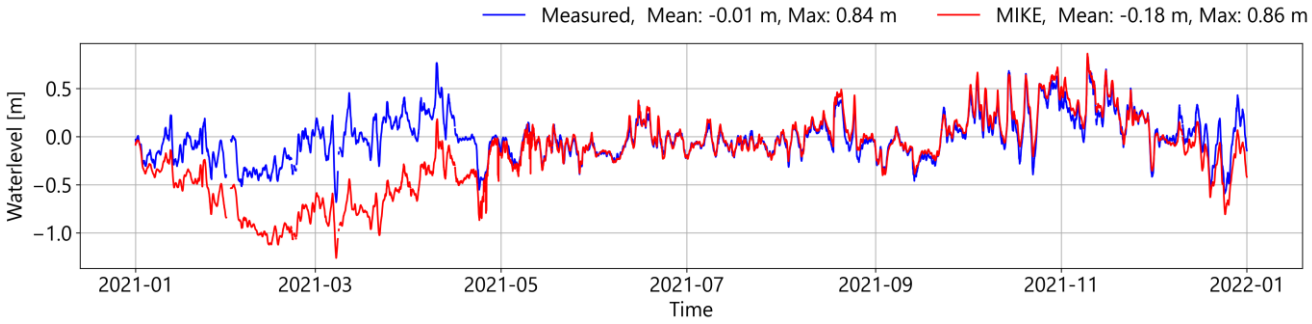

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for RATAN (SMHI-Station).*



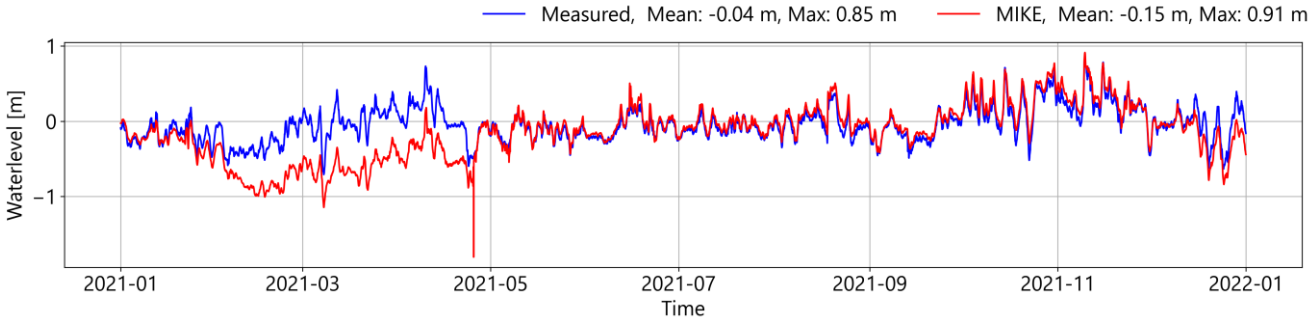

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for FURUGÖRUND (SMHI-Station).*



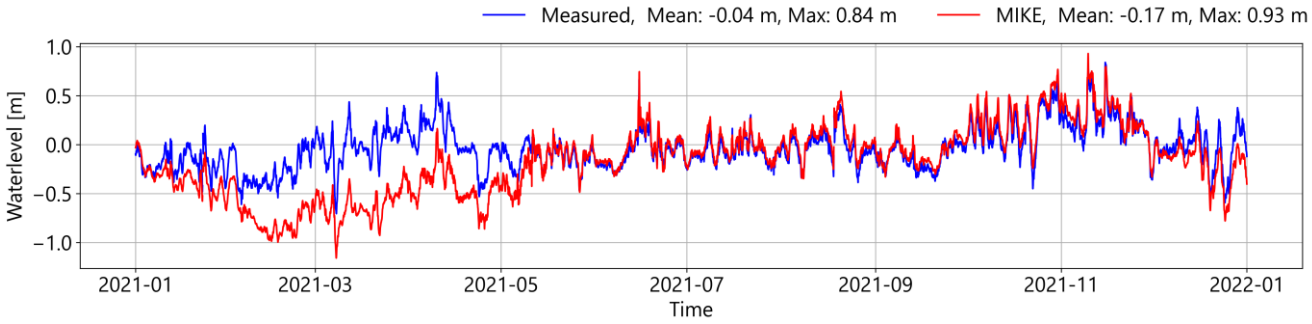

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for STRÖMÖREN SJÖV (SMHI-Station).*



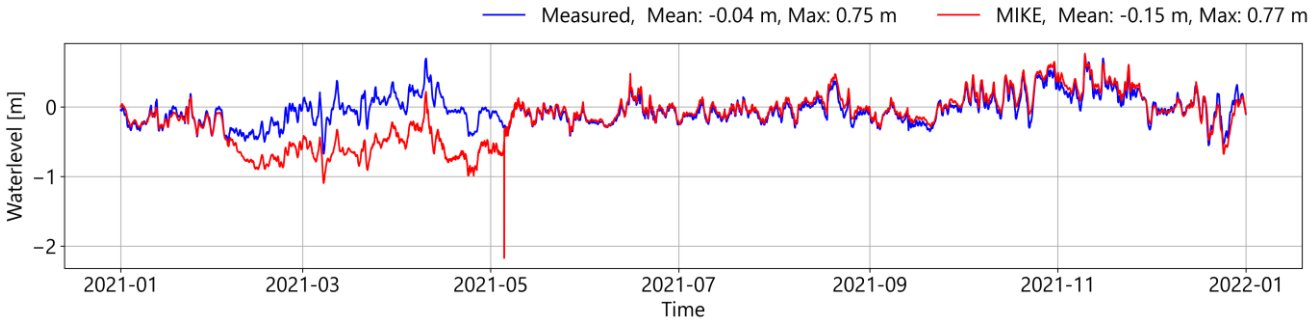

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for KALIX-KARLSBORG SJÖV (SMHI-Station).*



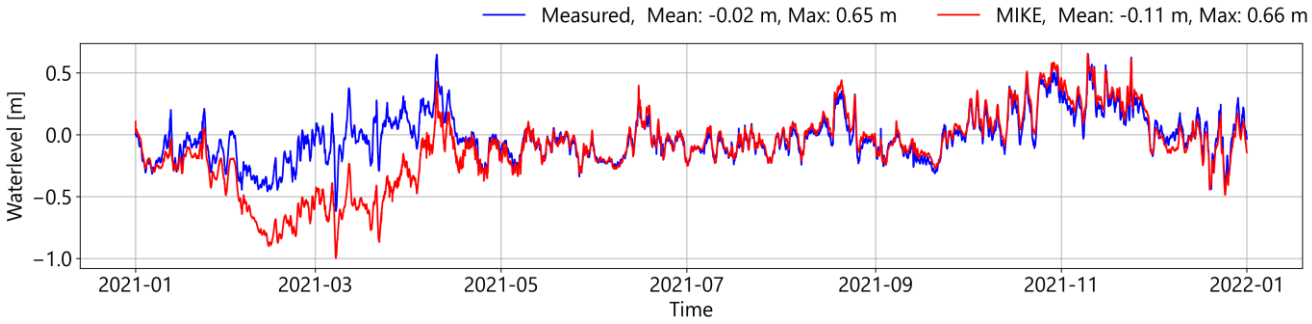

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Kemi Ajos (FMI-Station).*



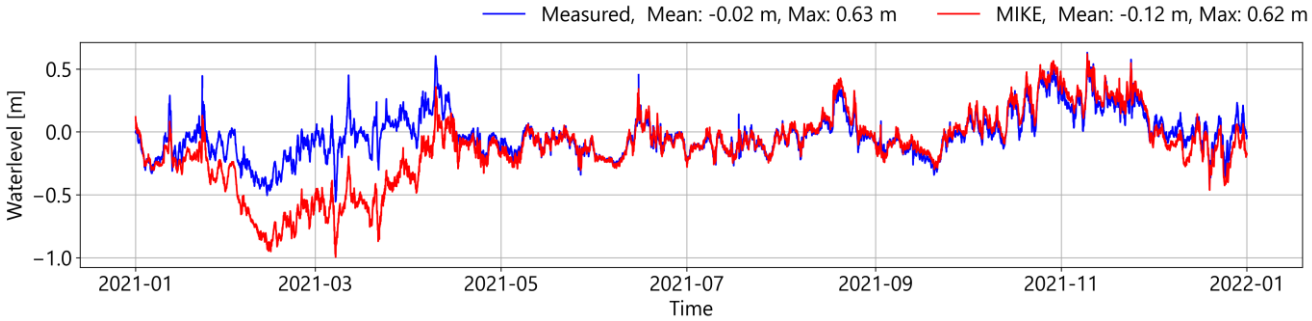

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Oulu Toppila (FMI-Station).*



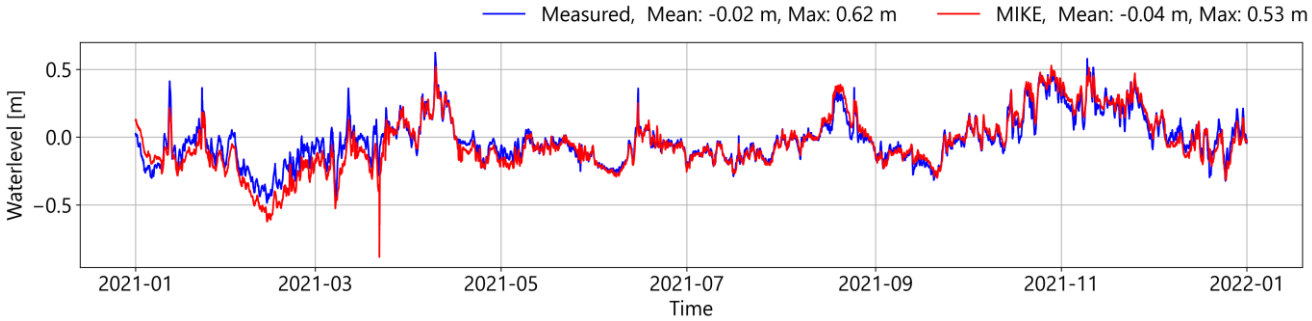

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Raahe Lapaluoto (FMI-Station).*



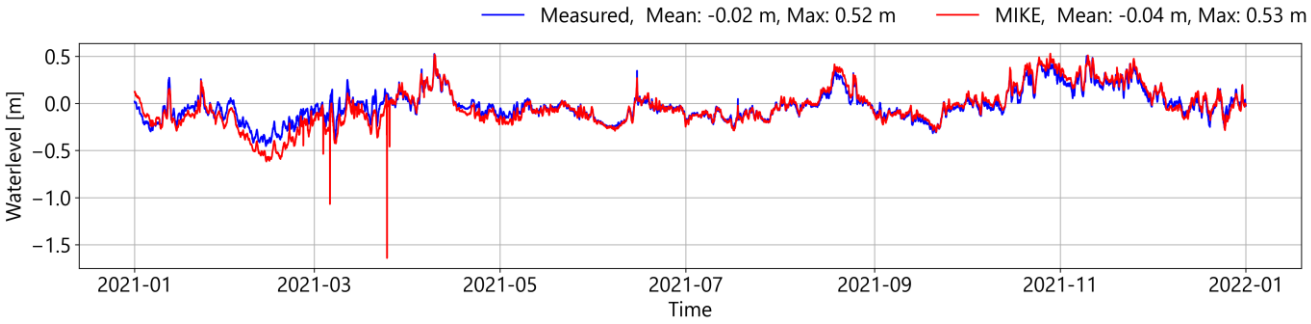

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Pietarsaari Leppäluoto (FMI-Station).*



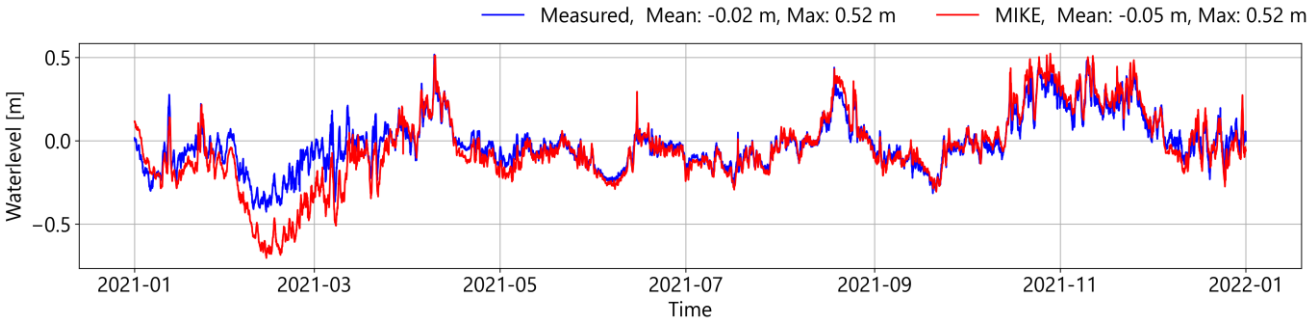

*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Vaasa Vaskiluoto (FMI-Station).*




*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Kaskinen Ådskär (FMI-Station).*




*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Pori Mäntyluoto Kallo (FMI-Station).*




*Comparison between observed water level in mMSL (blue line) and modelled water level (red line) for Rauma Petäjäs (FMI-Station).*

*Performance Metrics of the HD-Model in respect to the Waterlevels (March 2021)*

| Name | ME [m] | MAE [m] | RMSE [m] | Std. of Residuals [m] | Correlation Coefficients [-] |
|---|---|---|---|---|---|
| **FORSMARK** | -0.03 | 0.04 | 0.05 | 0.04 | 0.90 |
| **BÖNAN SJÖV** | -0.06 | 0.06 | 0.08 | 0.05 | 0.88 |
| **LJUSNE SJÖV** | -0.07 | 0.07 | 0.09 | 0.06 | 0.87 |
| **SPIKARNA** | -0.07 | 0.07 | 0.10 | 0.07 | 0.87 |
| **SKAGSUDDE SJÖV** | -0.11 | 0.11 | 0.15 | 0.10 | 0.79 |
| **Holmsund** | -0.43 | 0.43 | 0.44 | 0.06 | 0.92 |
| **RATAN** | -0.39 | 0.39 | 0.41 | 0.11 | 0.75 |
| **FURUÖGRUND** | -0.73 | 0.73 | 0.73 | 0.06 | 0.94 |
| **STRÖMÖREN SJÖV** | -0.76 | 0.76 | 0.77 | 0.07 | 0.95 |
| **KALIX-KARLSBORG SJÖV** | -0.75 | 0.75 | 0.75 | 0.07 | 0.93 |
| **Kemi Ajos** | -0.62 | 0.62 | 0.62 | 0.08 | 0.93 |
| **Oulu Toppila** | -0.63 | 0.63 | 0.64 | 0.08 | 0.91 |
| **Raahe Lapaluoto** | -0.59 | 0.59 | 0.60 | 0.07 | 0.93 |
| **Pietarsaari Leppäluoto** | -0.52 | 0.52 | 0.53 | 0.06 | 0.92 |

*Performance Metrics of the HD-Model in respect to the Waterlevels (July 2021)*

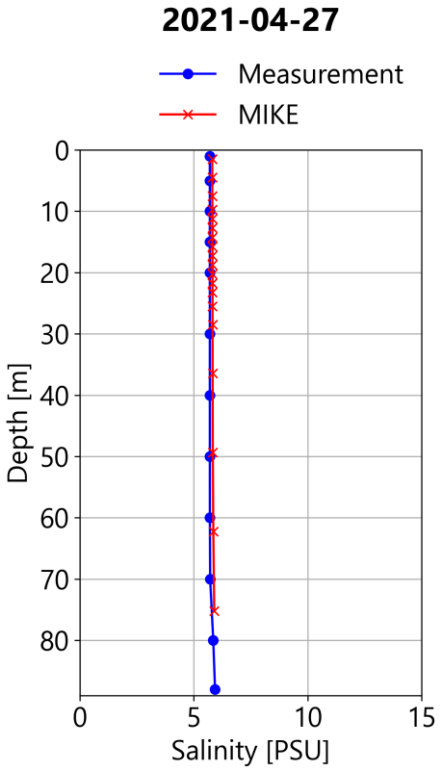
| Name | ME [m] | MAE [m] | RMSE [m] | Std. of Residuals [m] | Correlation Coefficients [-] |
|---|---|---|---|---|---|
| **FORSMARK** | -0.02 | 0.03 | 0.03 | 0.02 | 0.91 |
| **BÖNAN SJÖV** | -0.04 | 0.04 | 0.05 | 0.02 | 0.89 |
| **LJUSNE SJÖV** | -0.05 | 0.05 | 0.05 | 0.02 | 0.89 |
| **SPIKARNA** | -0.04 | 0.04 | 0.04 | 0.02 | 0.93 |
| **SKAGSUDDE SJÖV** | -0.03 | 0.03 | 0.04 | 0.02 | 0.93 |
| **Holmsund** | -0.03 | 0.03 | 0.04 | 0.02 | 0.93 |
| **RATAN** | -0.02 | 0.02 | 0.03 | 0.02 | 0.94 |
| **FURUÖGRUND** | -0.02 | 0.02 | 0.03 | 0.02 | 0.95 |
| **STRÖMÖREN SJÖV** | -0.01 | 0.03 | 0.03 | 0.03 | 0.92 |
| **KALIX-KARLSBORG SJÖV** | 0.00 | 0.02 | 0.03 | 0.03 | 0.94 |
| **Kemi Ajos** | 0.04 | 0.04 | 0.05 | 0.03 | 0.95 |
| **Oulu Toppila** | 0.04 | 0.04 | 0.05 | 0.04 | 0.94 |
| **Raahe Lapaluoto** | 0.03 | 0.03 | 0.04 | 0.03 | 0.95 |
| **Pietarsaari Leppäluoto** | 0.01 | 0.02 | 0.03 | 0.02 | 0.95 |

*Performance Metrics of the HD-Model in respect to the Waterlevels (September 2021)*

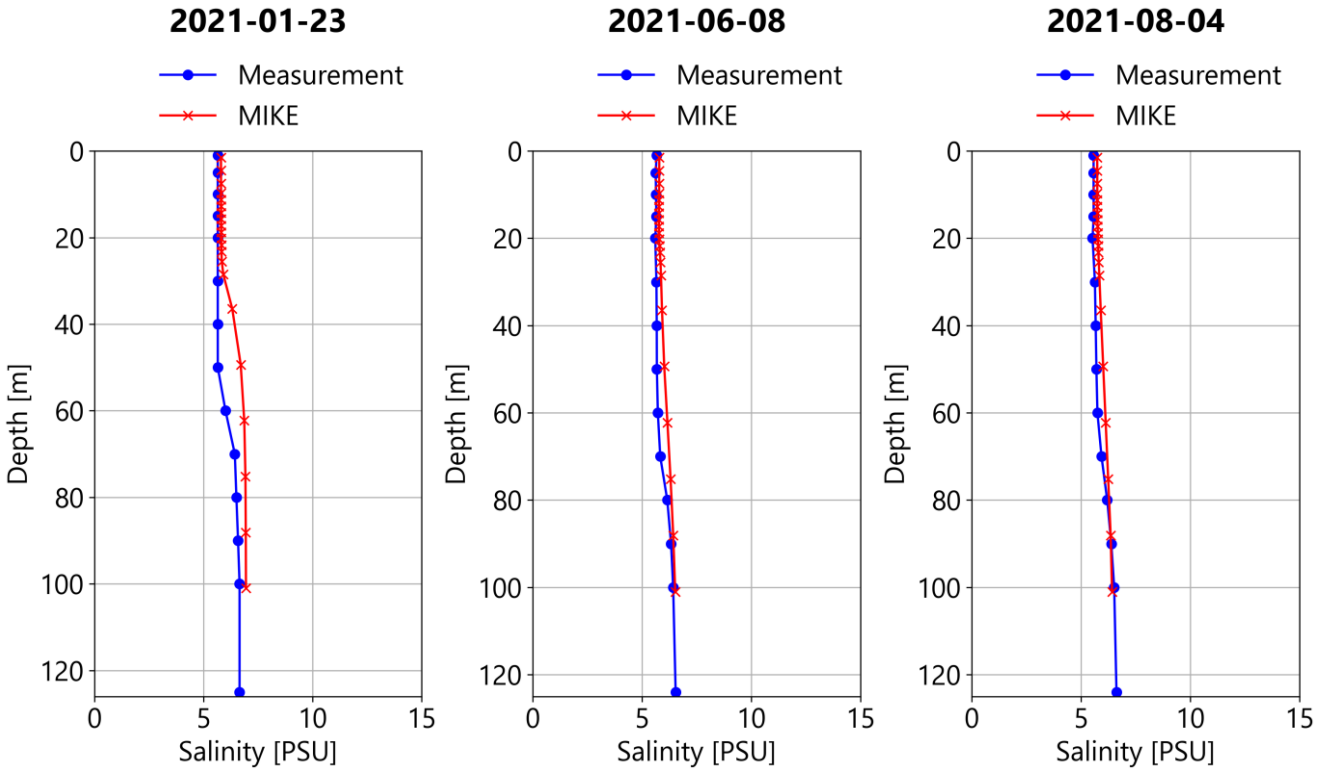
| Name | ME [m] | MAE [m] | RMSE [m] | Std. of Residuals [m] | Correlation Coefficients [-] |
|---|---|---|---|---|---|
| **FORSMARK** | 0.01 | 0.03 | 0.03 | 0.03 | 0.92 |
| **BÖNAN SJÖV** | -0.01 | 0.03 | 0.03 | 0.03 | 0.92 |
| **LJUSNE SJÖV** | -0.02 | 0.03 | 0.04 | 0.03 | 0.92 |
| **SPIKARNA** | -0.01 | 0.02 | 0.03 | 0.03 | 0.94 |
| **SKAGSUDDE SJÖV** | -0.01 | 0.02 | 0.03 | 0.03 | 0.95 |
| **Holmsund** | -0.01 | 0.03 | 0.03 | 0.03 | 0.95 |
| **RATAN** | 0.01 | 0.03 | 0.03 | 0.03 | 0.95 |
| **FURUÖGRUND** | 0.00 | 0.03 | 0.03 | 0.03 | 0.96 |
| **STRÖMÖREN SJÖV** | 0.01 | 0.03 | 0.04 | 0.04 | 0.96 |
| **KALIX-KARLSBORG SJÖV** | 0.02 | 0.03 | 0.04 | 0.04 | 0.97 |
| **Kemi Ajos** | 0.05 | 0.05 | 0.06 | 0.04 | 0.97 |
| **Oulu Toppila** | 0.04 | 0.05 | 0.06 | 0.04 | 0.95 |
| **Raahe Lapaluoto** | 0.04 | 0.05 | 0.06 | 0.03 | 0.96 |
| **Pietarsaari Leppäluoto** | 0.02 | 0.03 | 0.04 | 0.03 | 0.95 |

# Appendix 14 Model verification: Salinity profiles

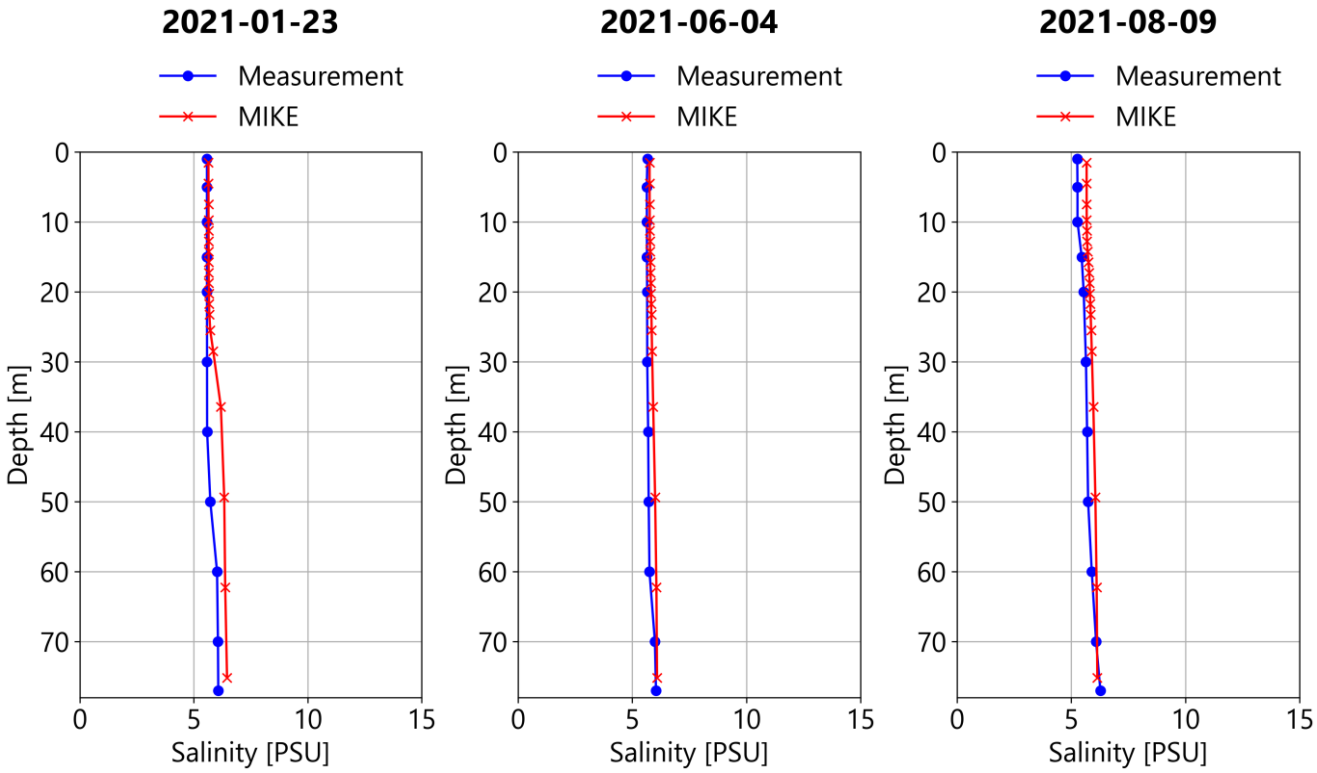
## Profiles from merihavainnot.fi



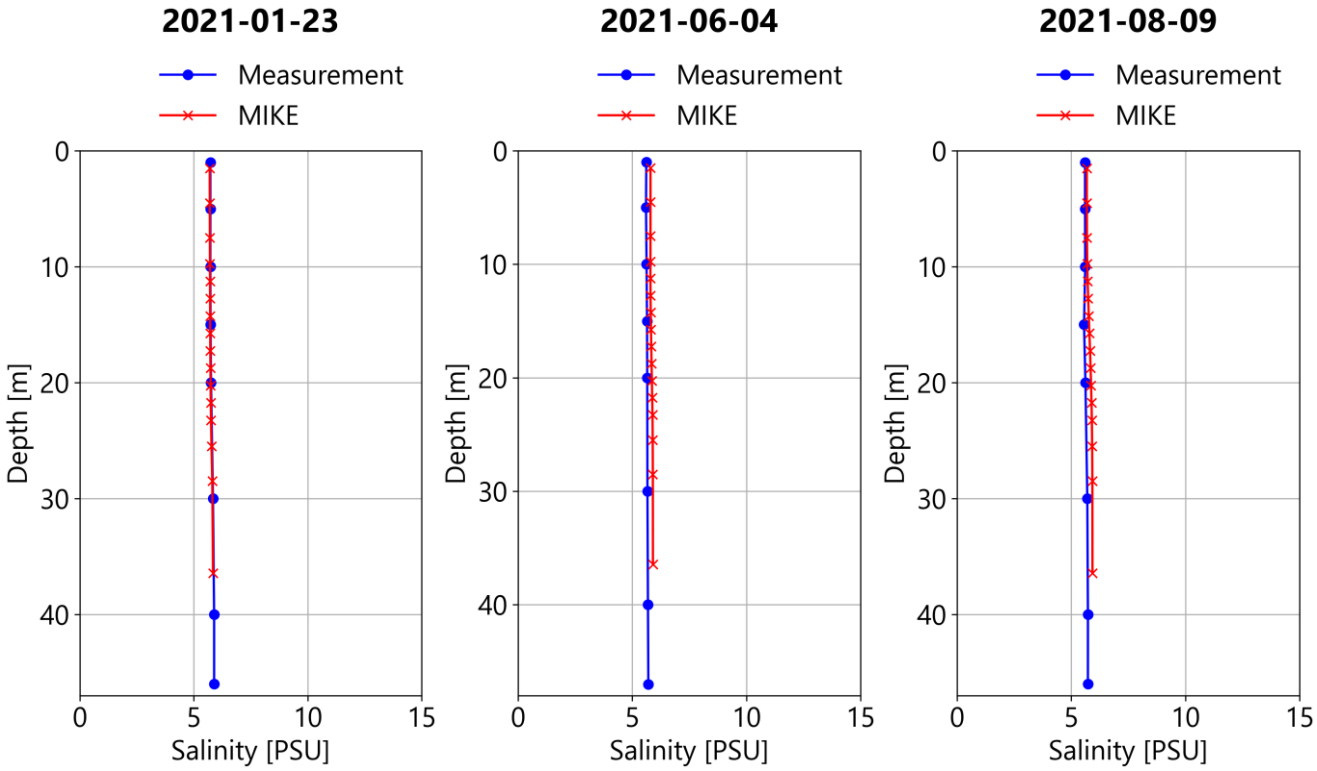

*Comparison between modelled and measured salinity profiles at location MAME61 (source: merihavainnot.fi)*



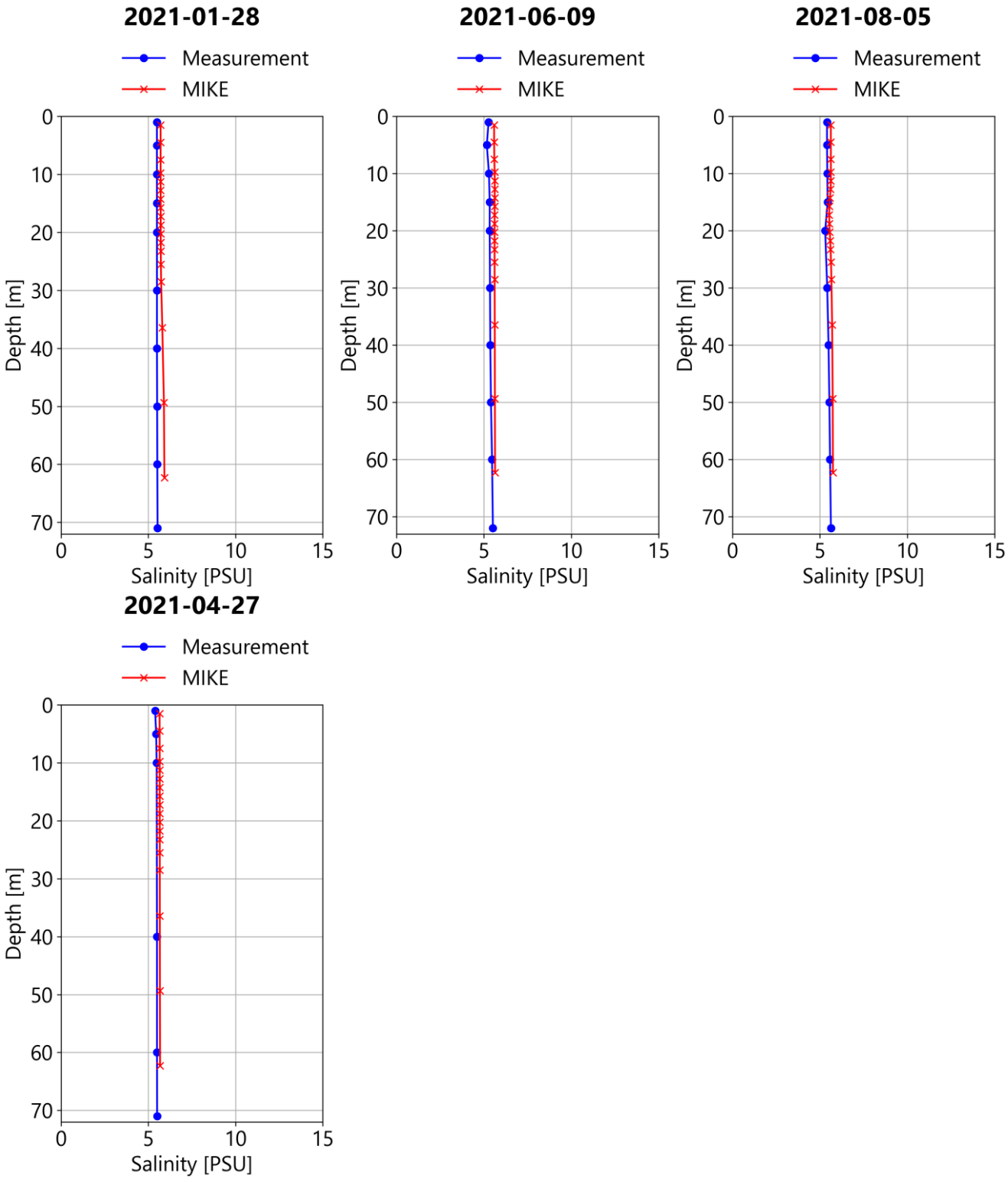

*Comparison between modelled and measured salinity profiles at location SR5 (source: merihavainnot.fi)*



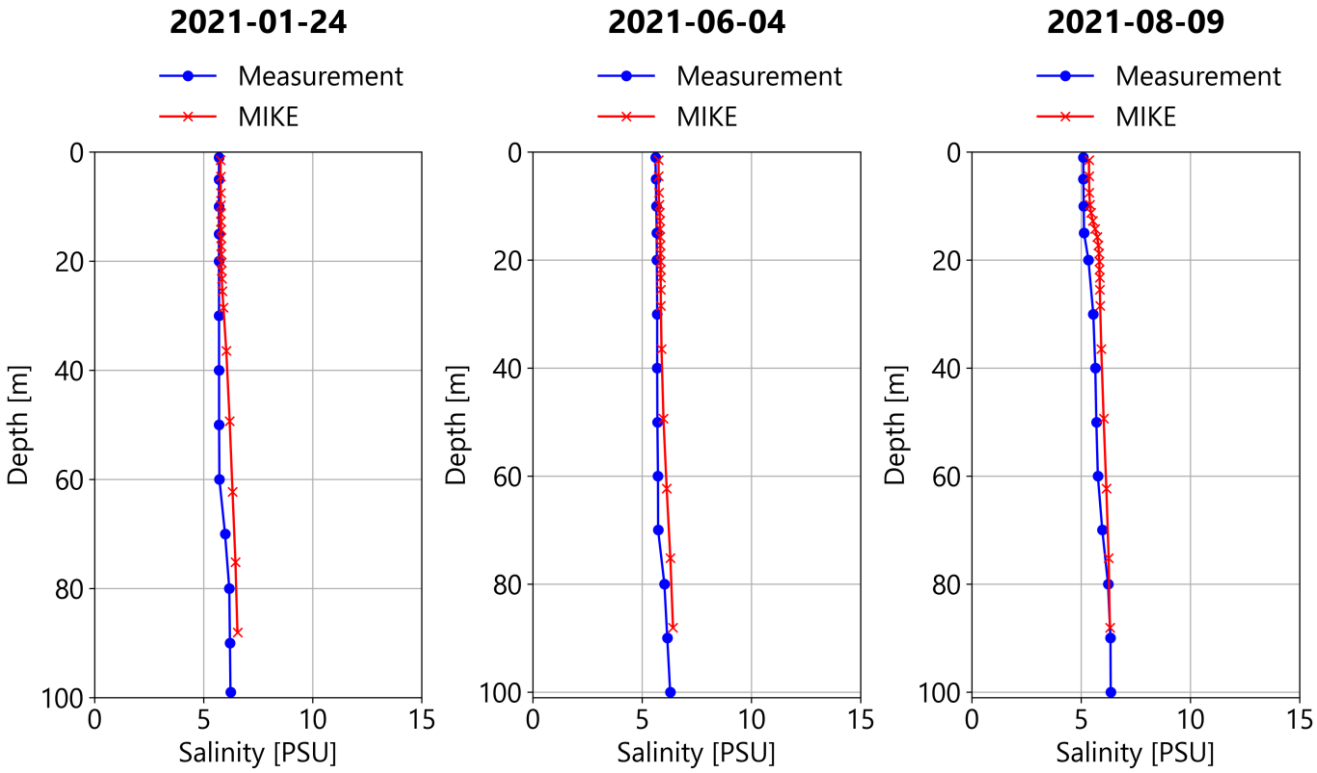

*Comparison between modelled and measured salinity profiles at location SR7 (source: merihavainnot.fi)*



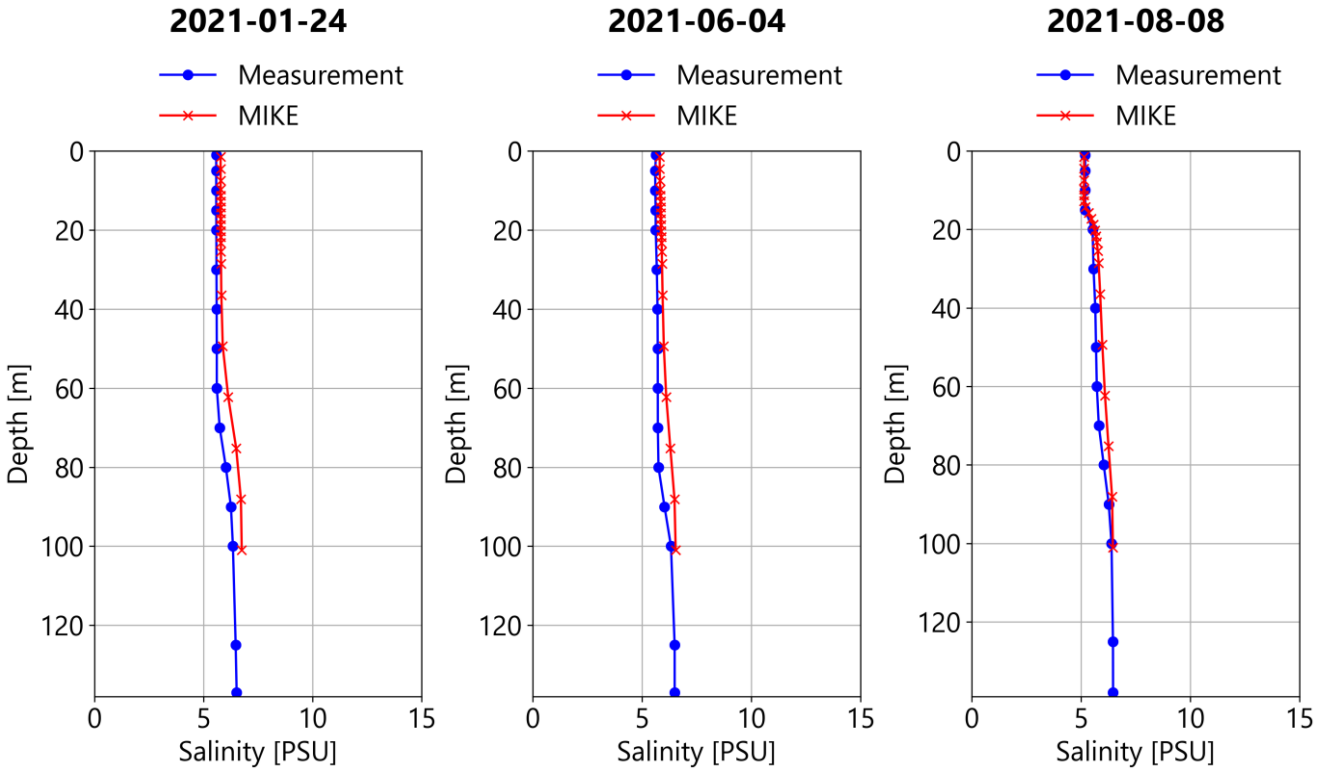

*Comparison between modelled and measured salinity profiles at location SR8 (source: merihavainnot.fi)*



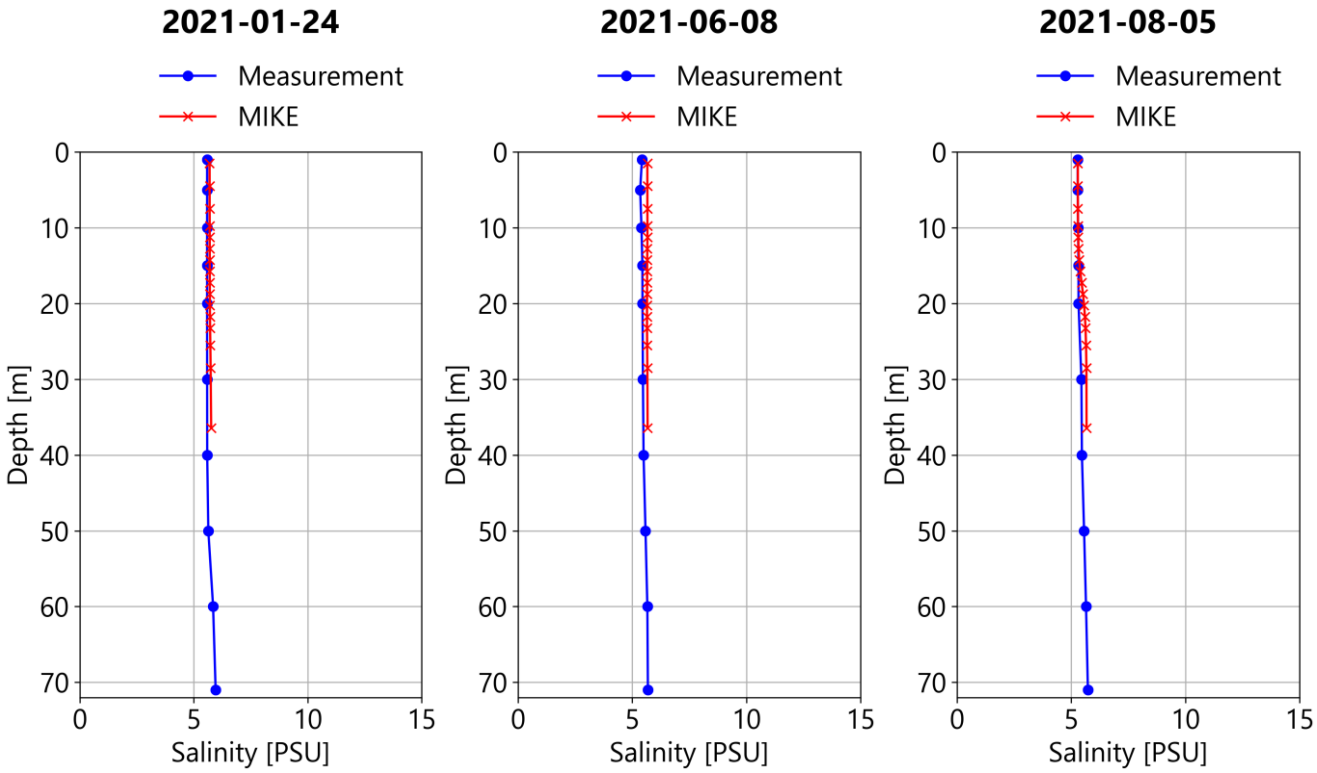

*Comparison between modelled and measured salinity profiles at location SR3 (source: merihavainnot.fi)*



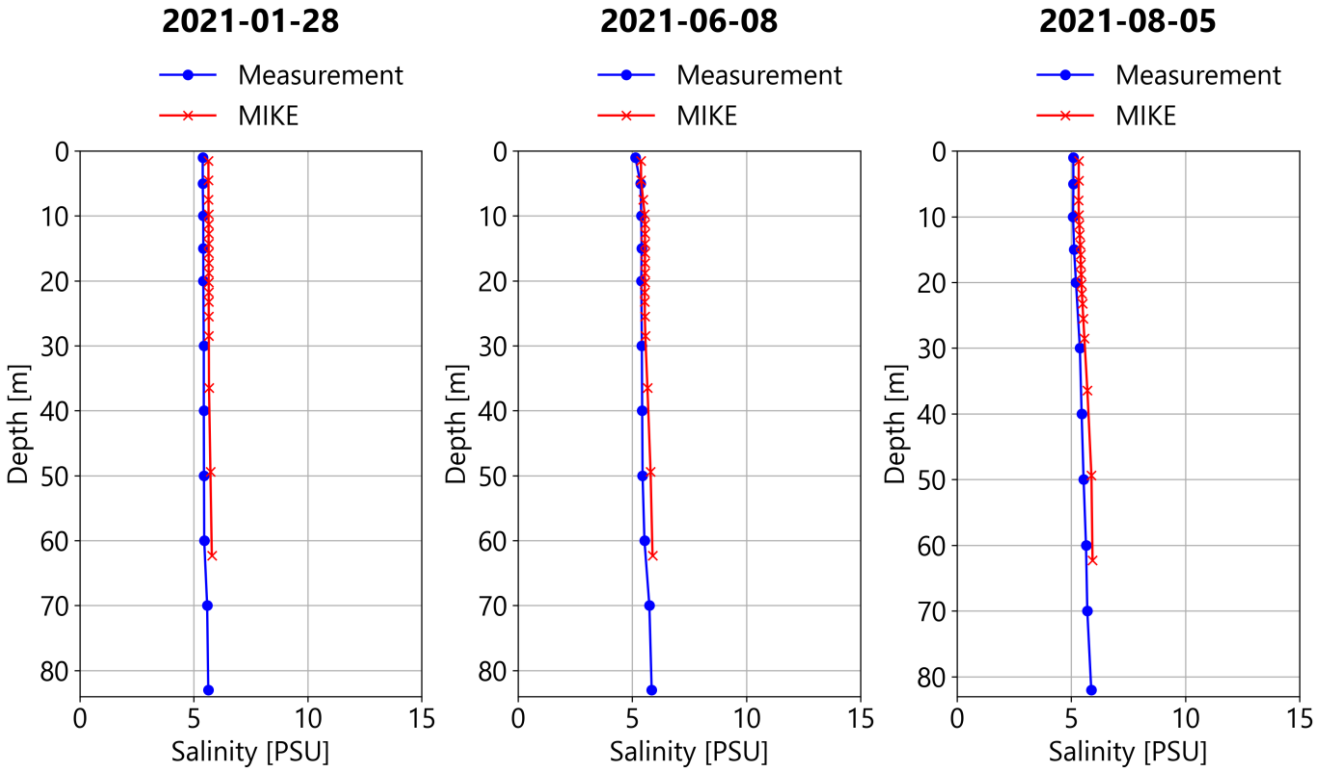

*Comparison between modelled and measured salinity profiles at location MS9 (source: merihavainnot.fi)*



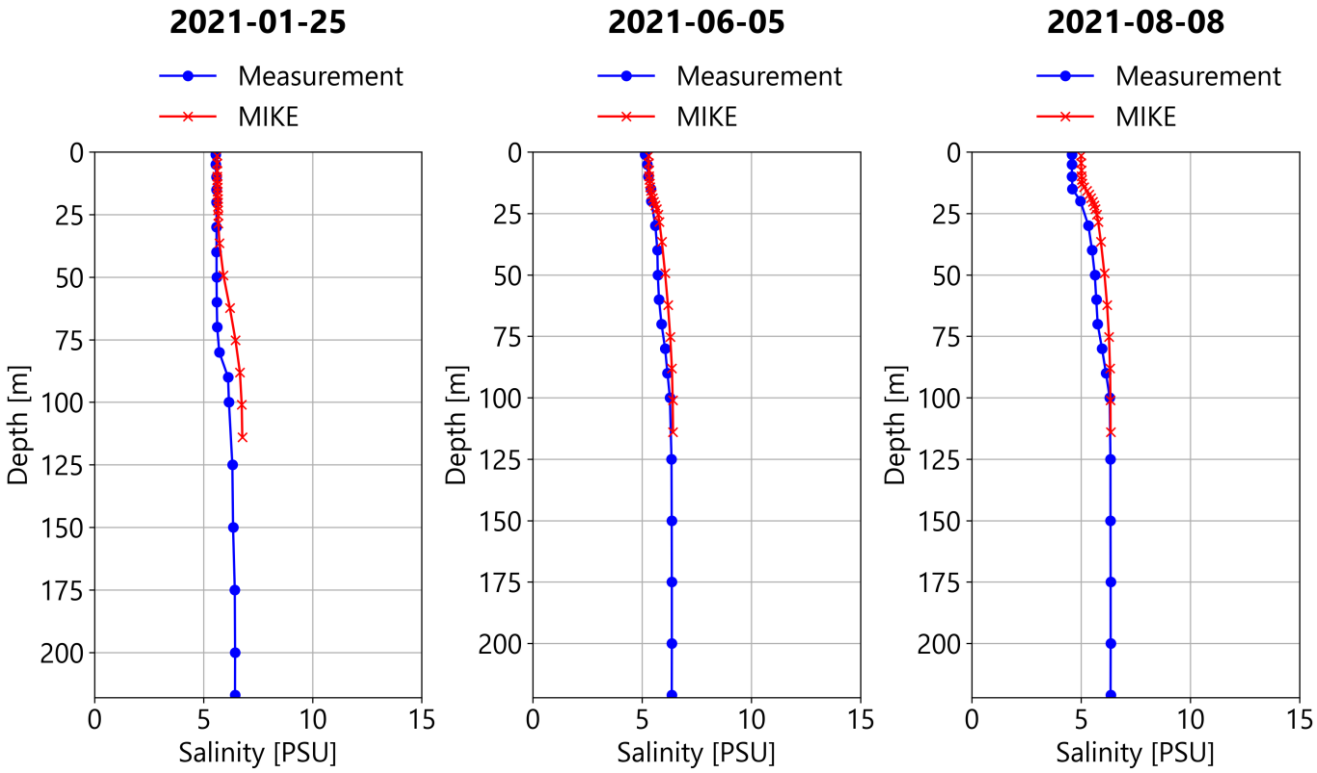

*Comparison between modelled and measured salinity profiles at location F26 (source: merihavainnot.fi)*



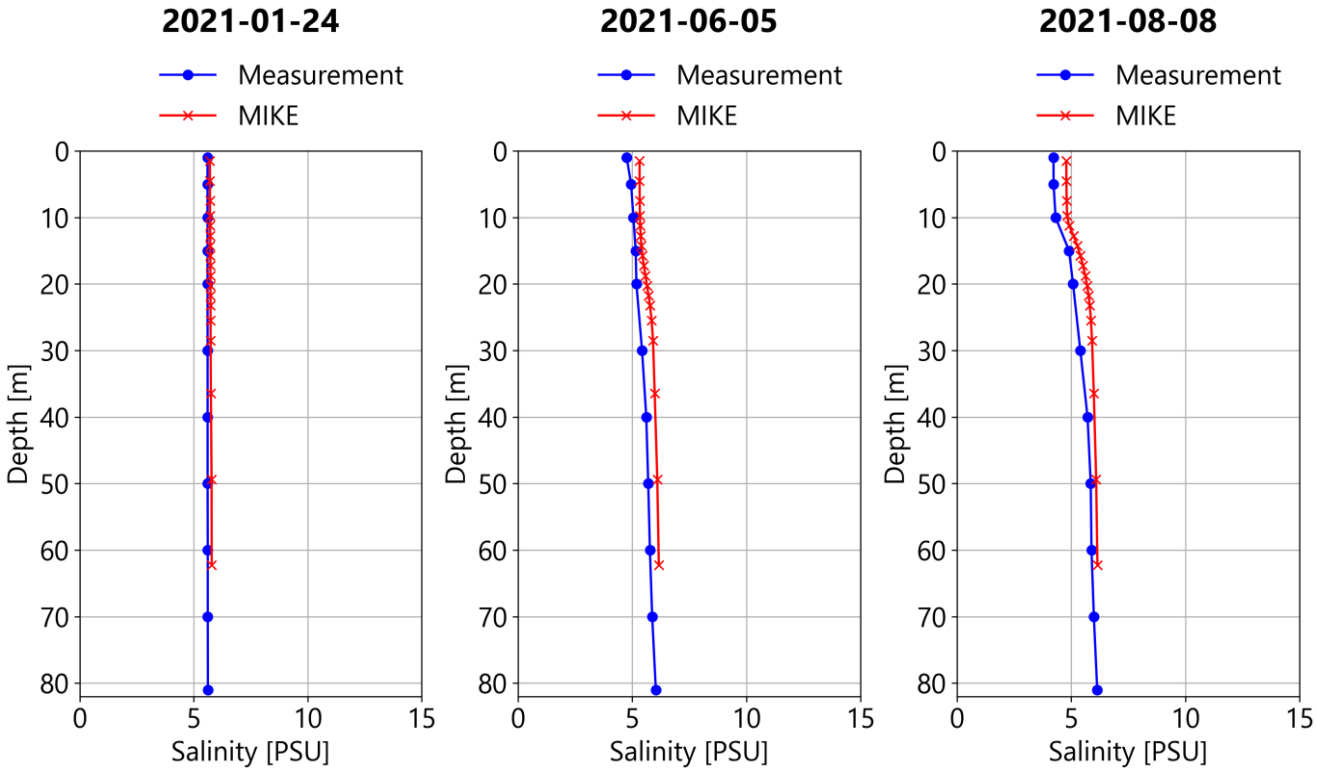

*Comparison between modelled and measured salinity profiles at location MS6 (source: merihavainnot.fi)*



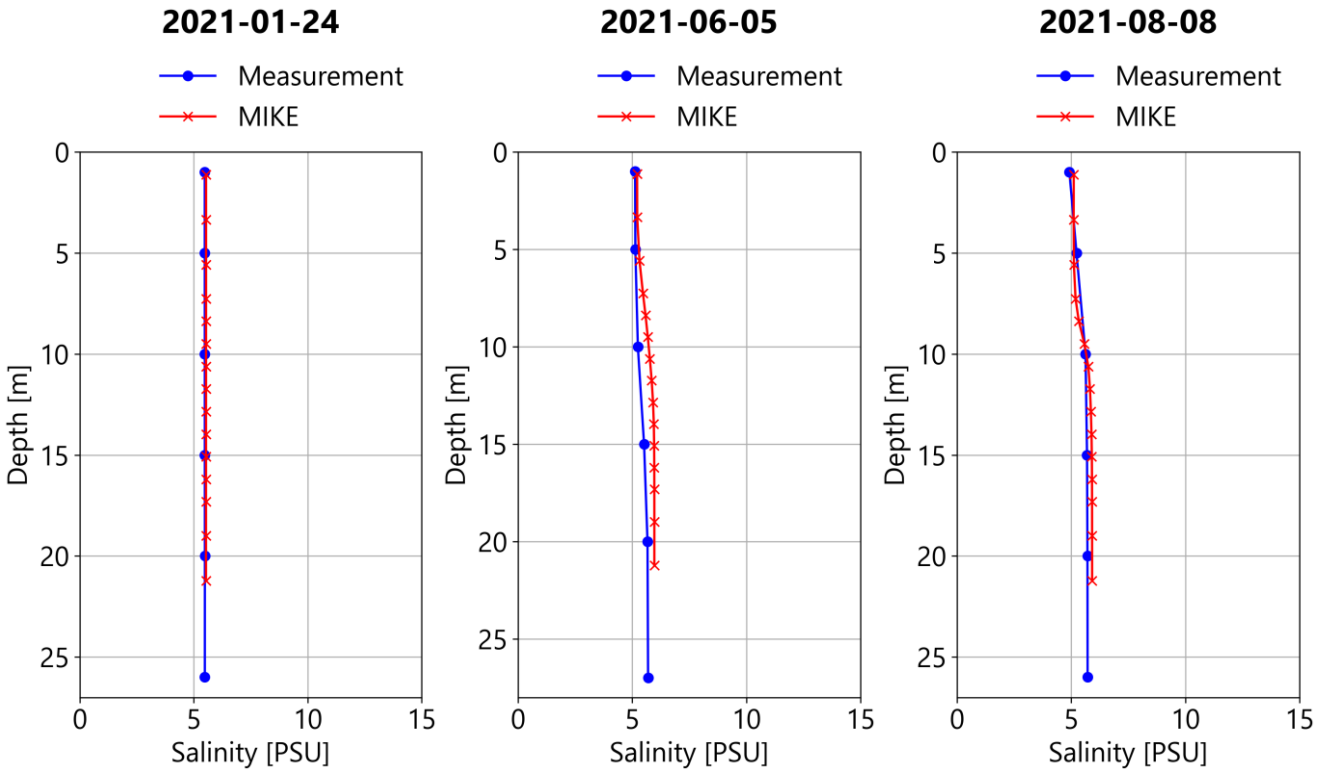

*Comparison between modelled and measured salinity profiles at location MS3 (source: merihavainnot.fi)*



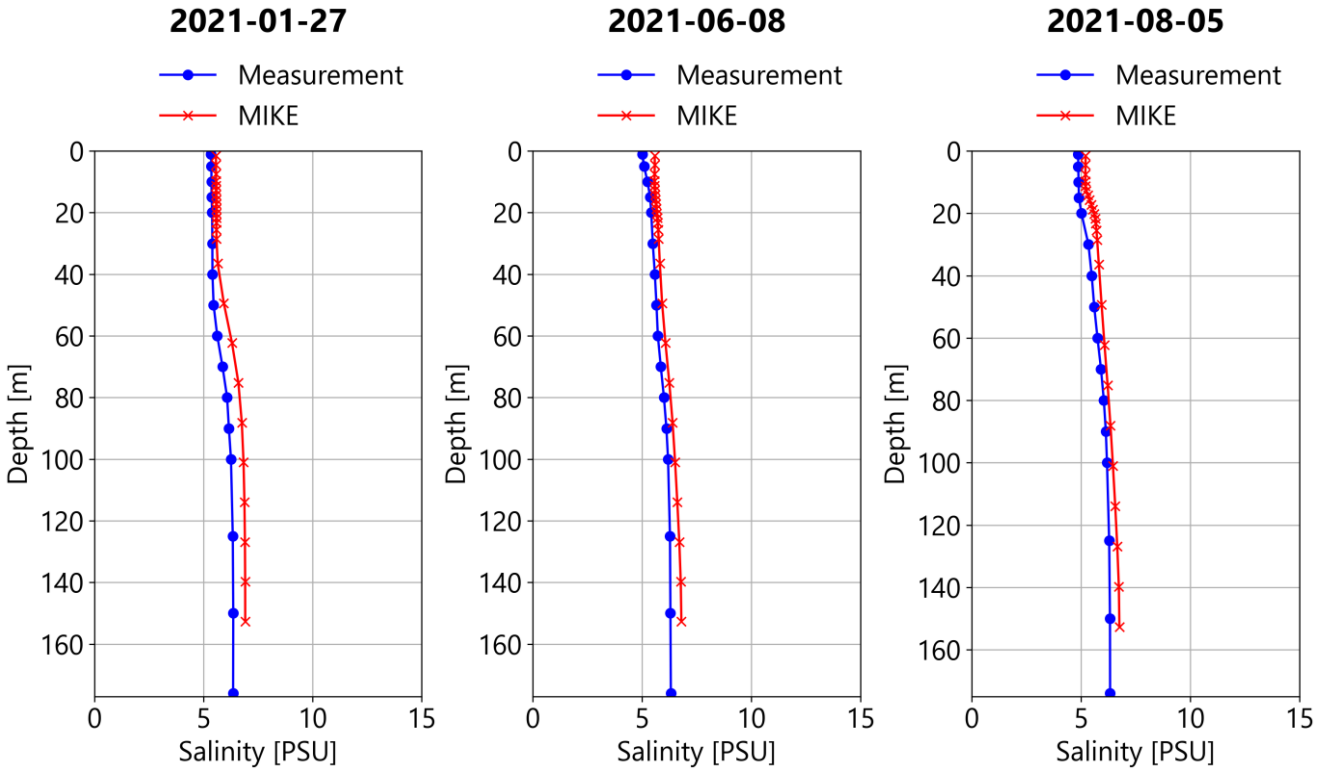

*Comparison between modelled and measured salinity profiles at location US5B (source: merihavainnot.fi)*



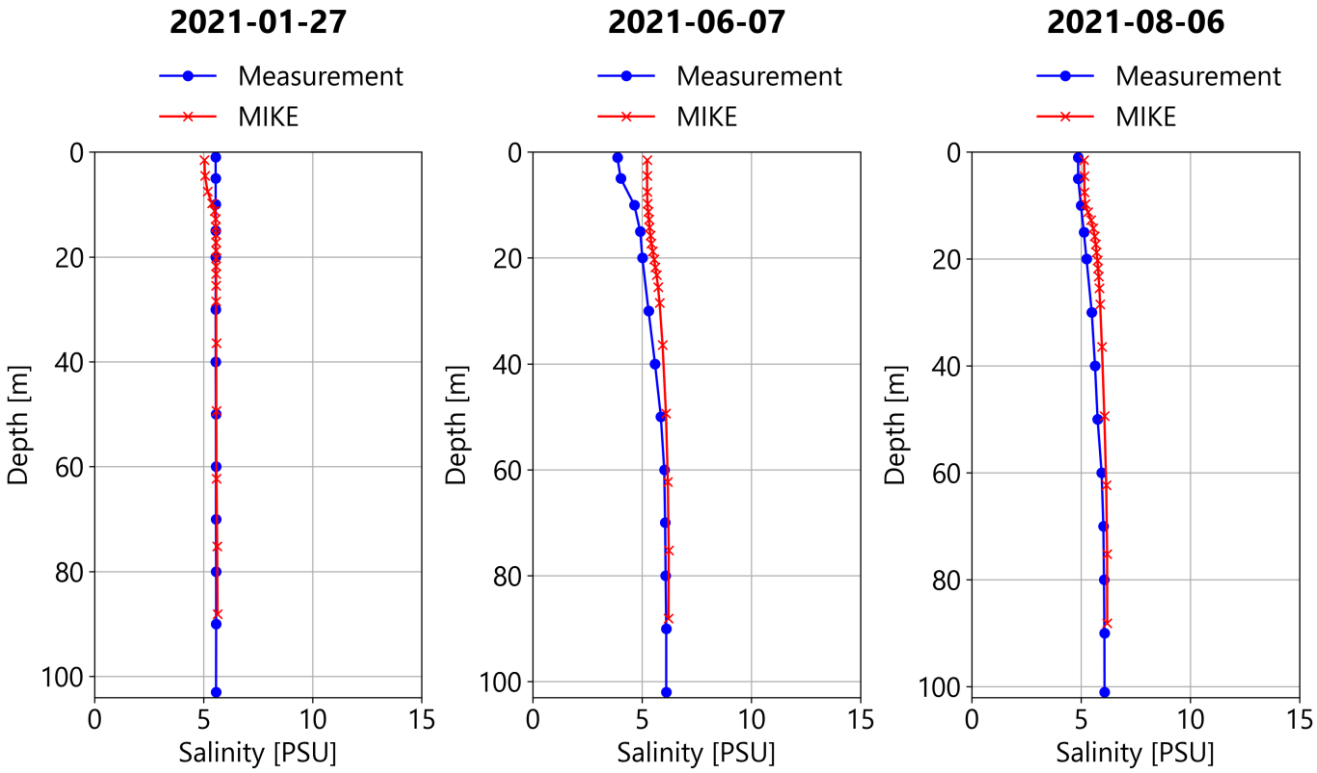

*Comparison between modelled and measured salinity profiles at location US6B (source: merihavainnot.fi)*



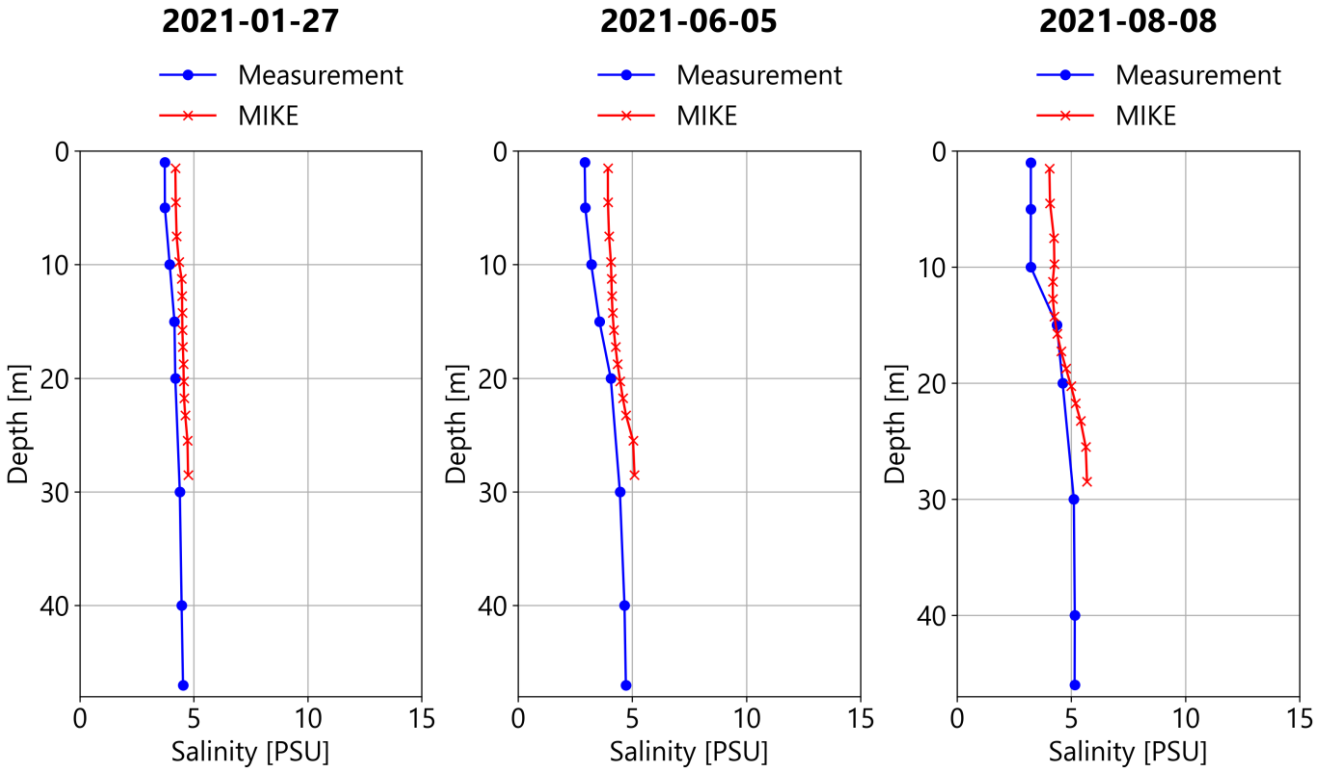

*Comparison between modelled and measured salinity profiles at location US7 (source: merihavainnot.fi)*



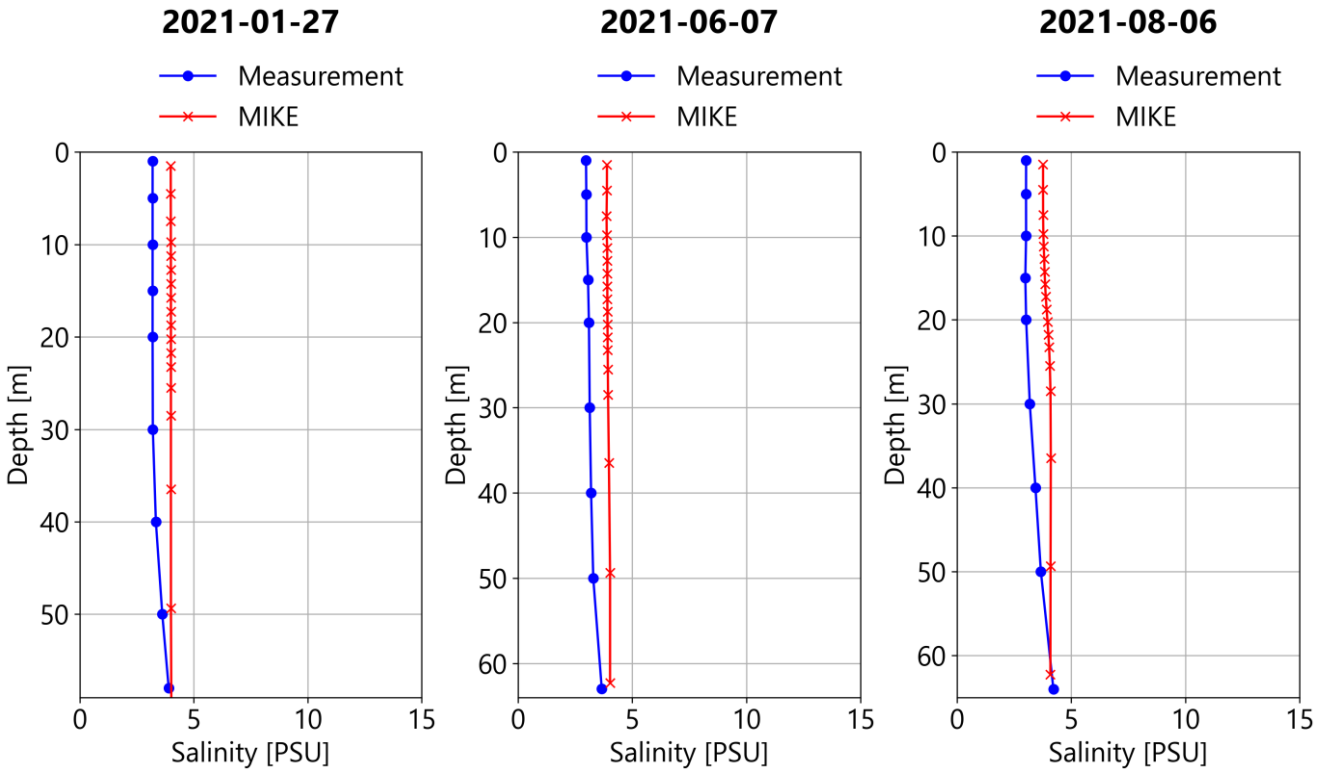

*Comparison between modelled and measured salinity profiles at location US3 (source: merihavainnot.fi)*



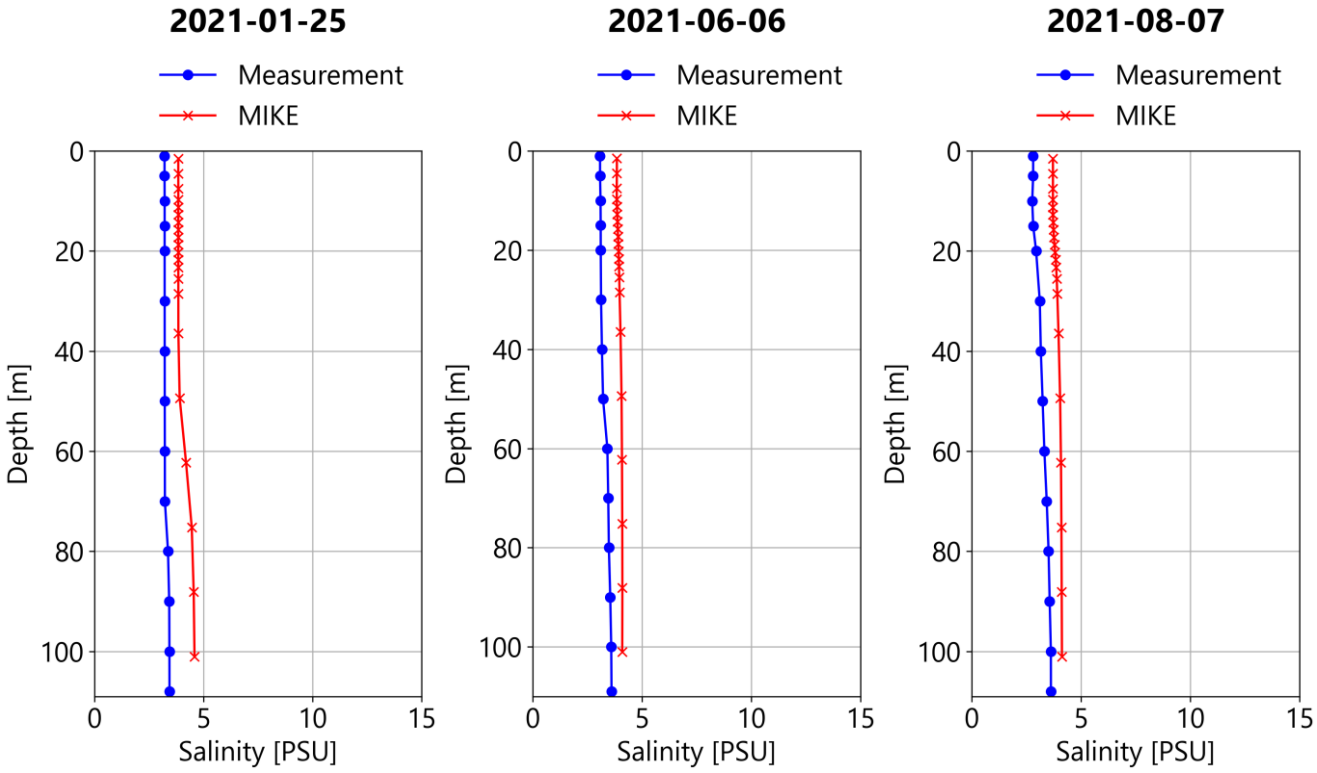

*Comparison between modelled and measured salinity profiles at location F18 (source: merihavainnot.fi)*



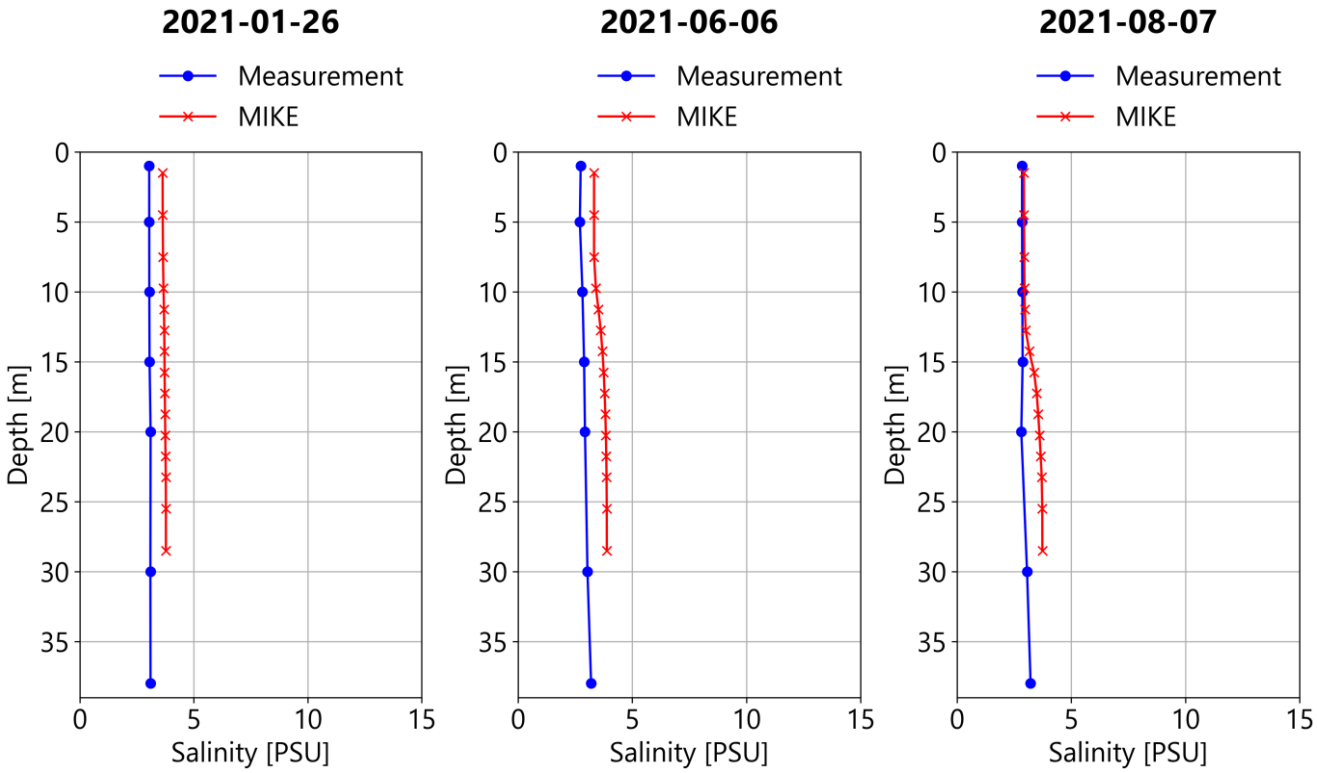

*Comparison between modelled and measured salinity profiles at location F16 (source: merihavainnot.fi)*



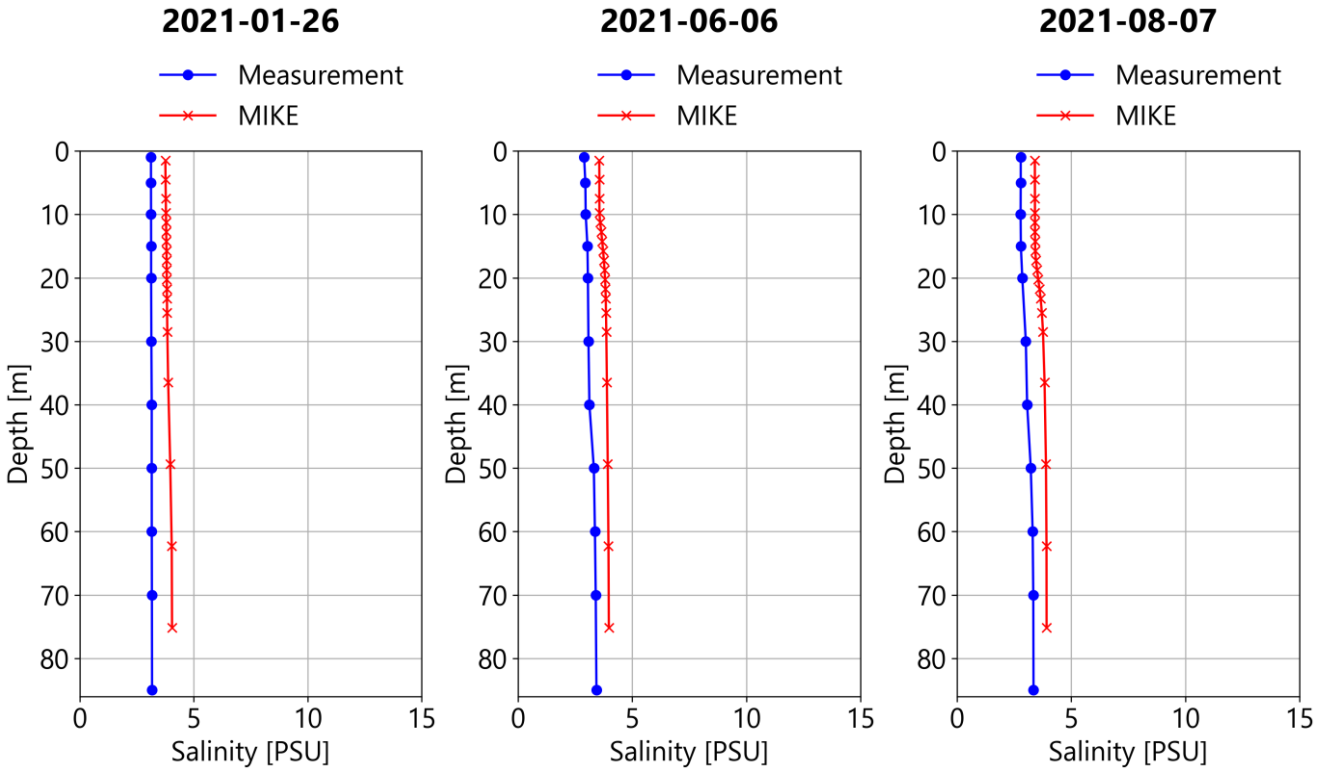

*Comparison between modelled and measured salinity profiles at location F13 (source: merihavainnot.fi)*



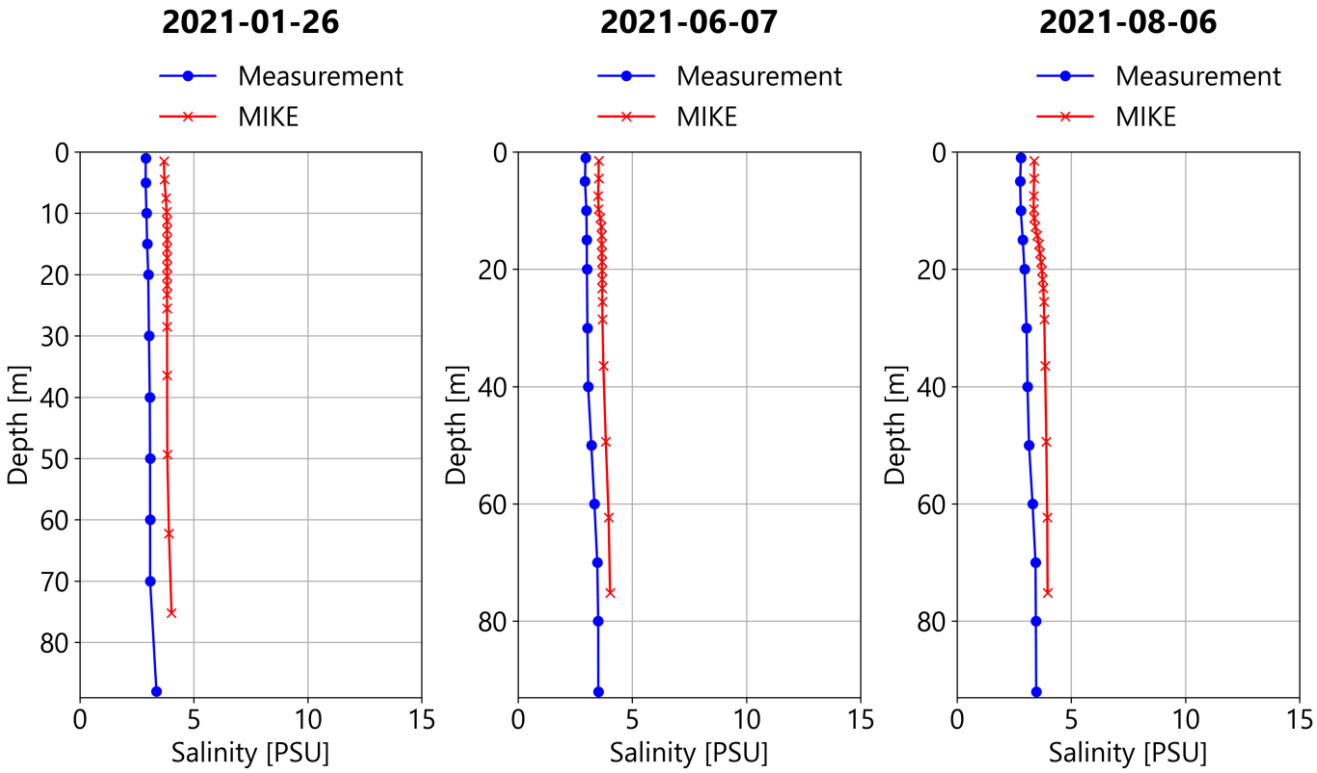

*Comparison between modelled and measured salinity profiles at location BO3 (source: merihavainnot.fi)*



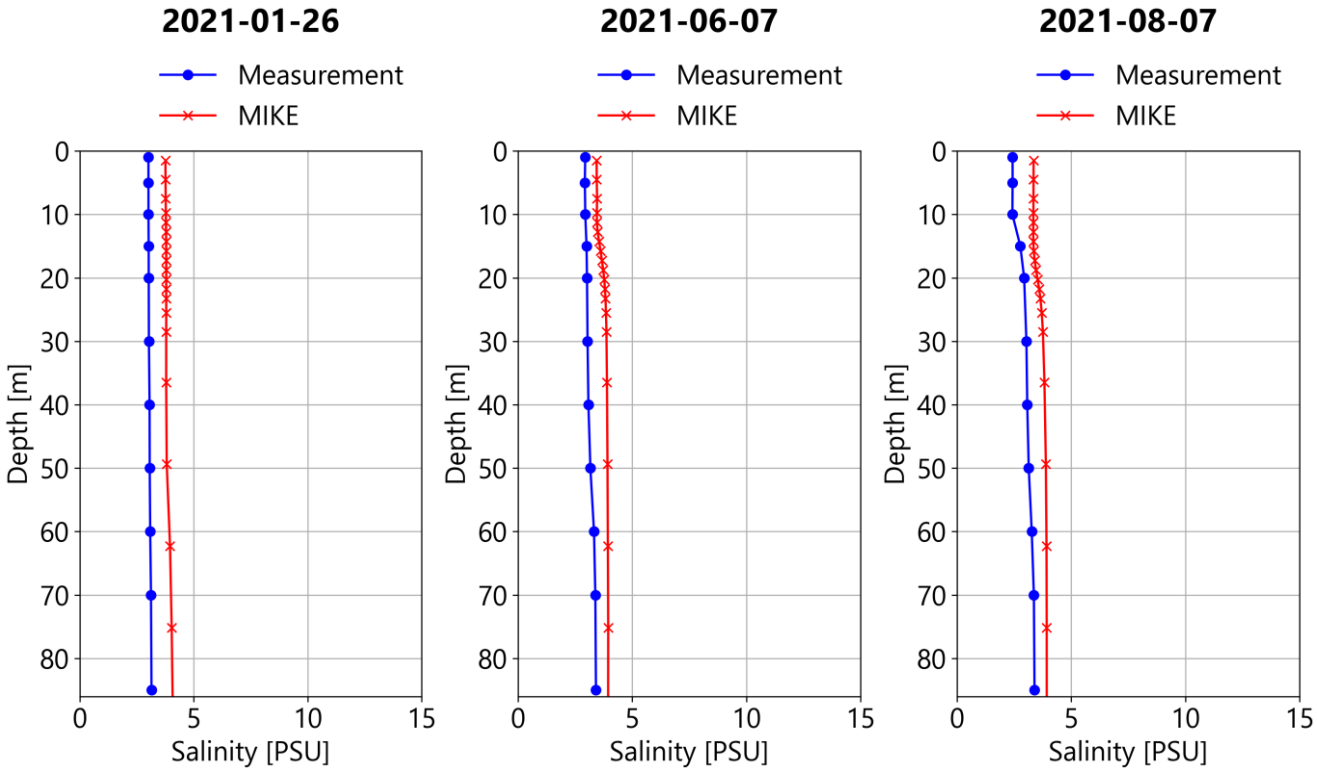

*Comparison between modelled and measured salinity profiles at location RR7 (source: merihavainnot.fi)*



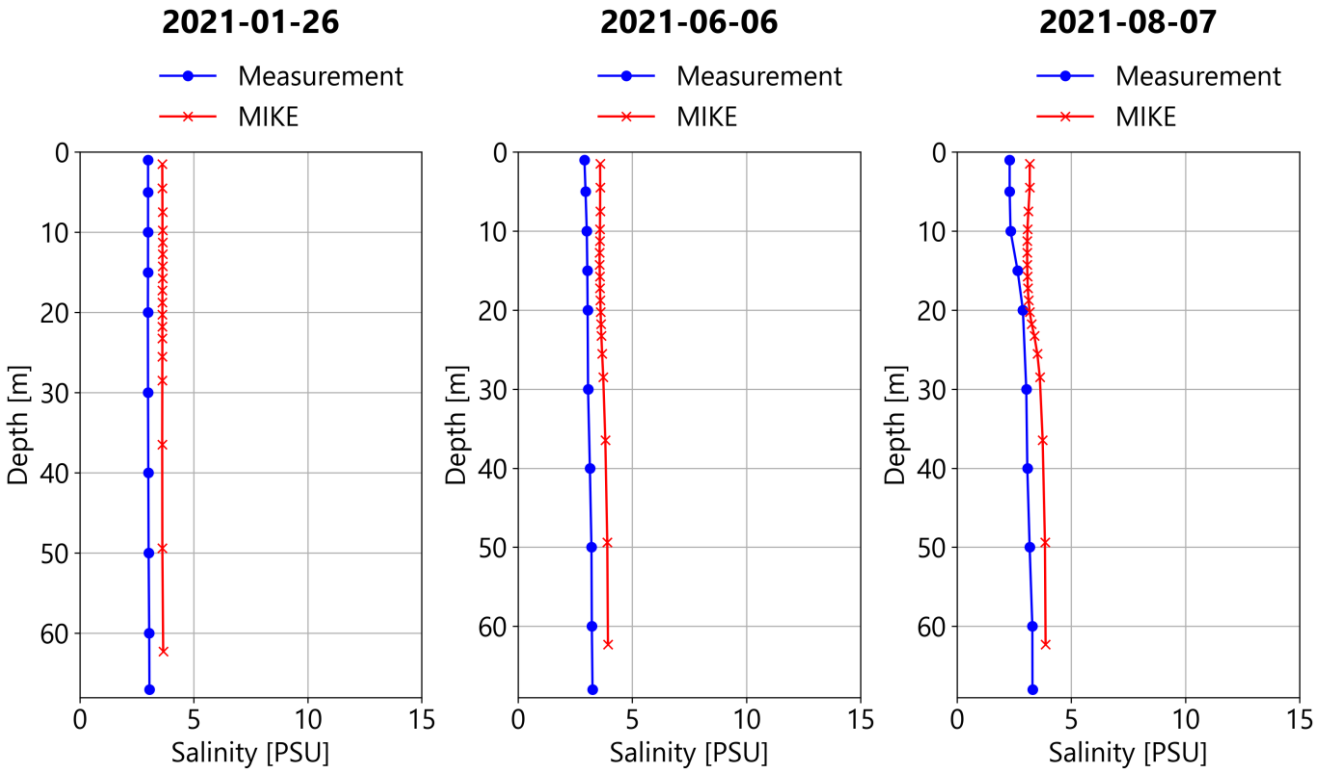

*Comparison between modelled and measured salinity profiles at location RR6 (source: merihavainnot.fi)*



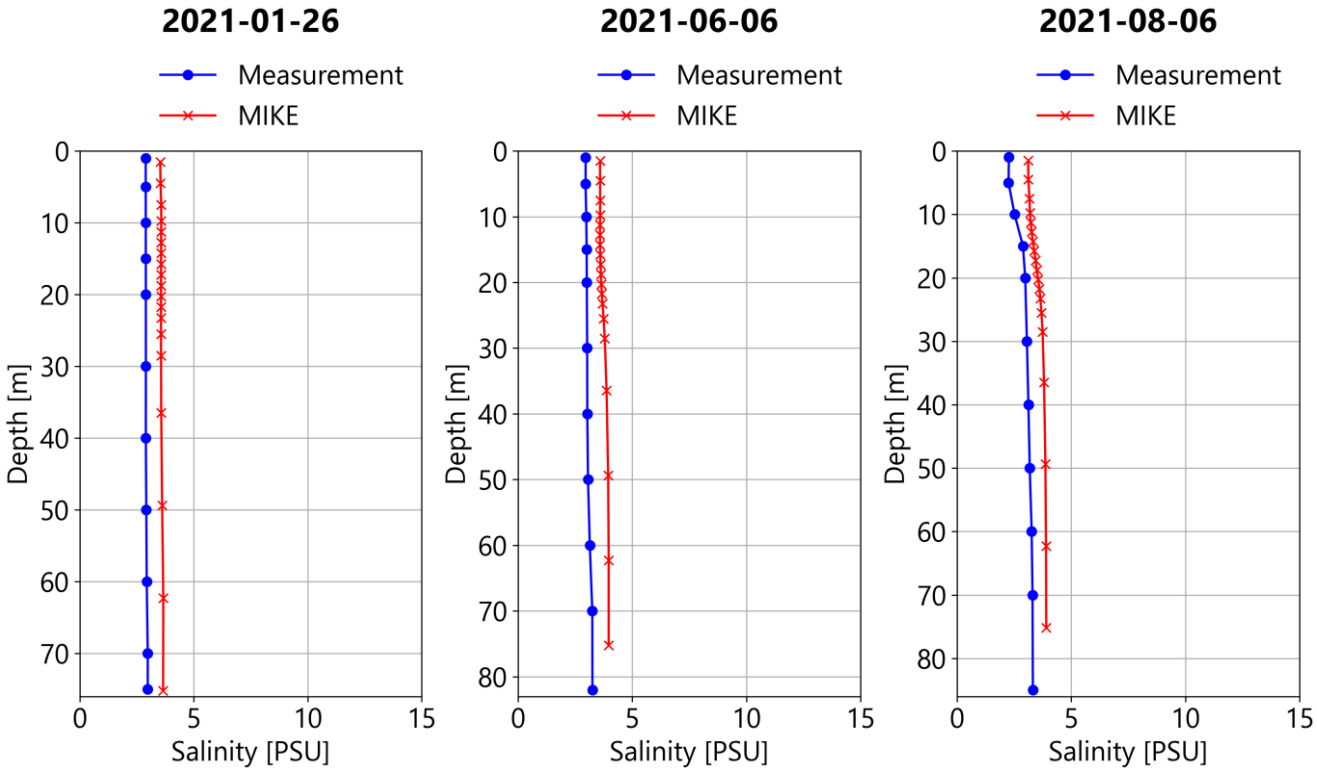

*Comparison between modelled and measured salinity profiles at location RR3 (source: merihavainnot.fi)*




*Comparison between modelled and measured salinity profiles at location CV (source: merihavainnot.fi)*

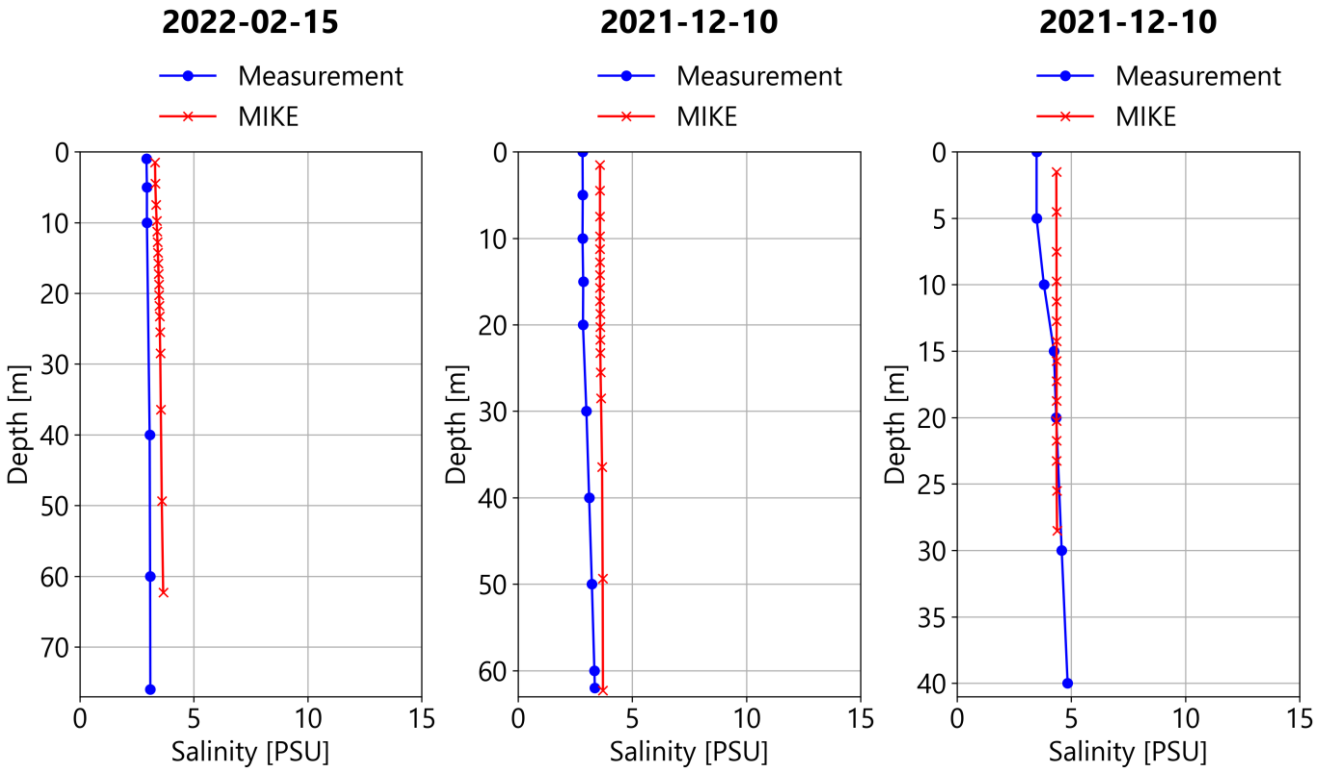



*Comparison between modelled and measured salinity profiles at location CVI (source: merihavainnot.fi)*

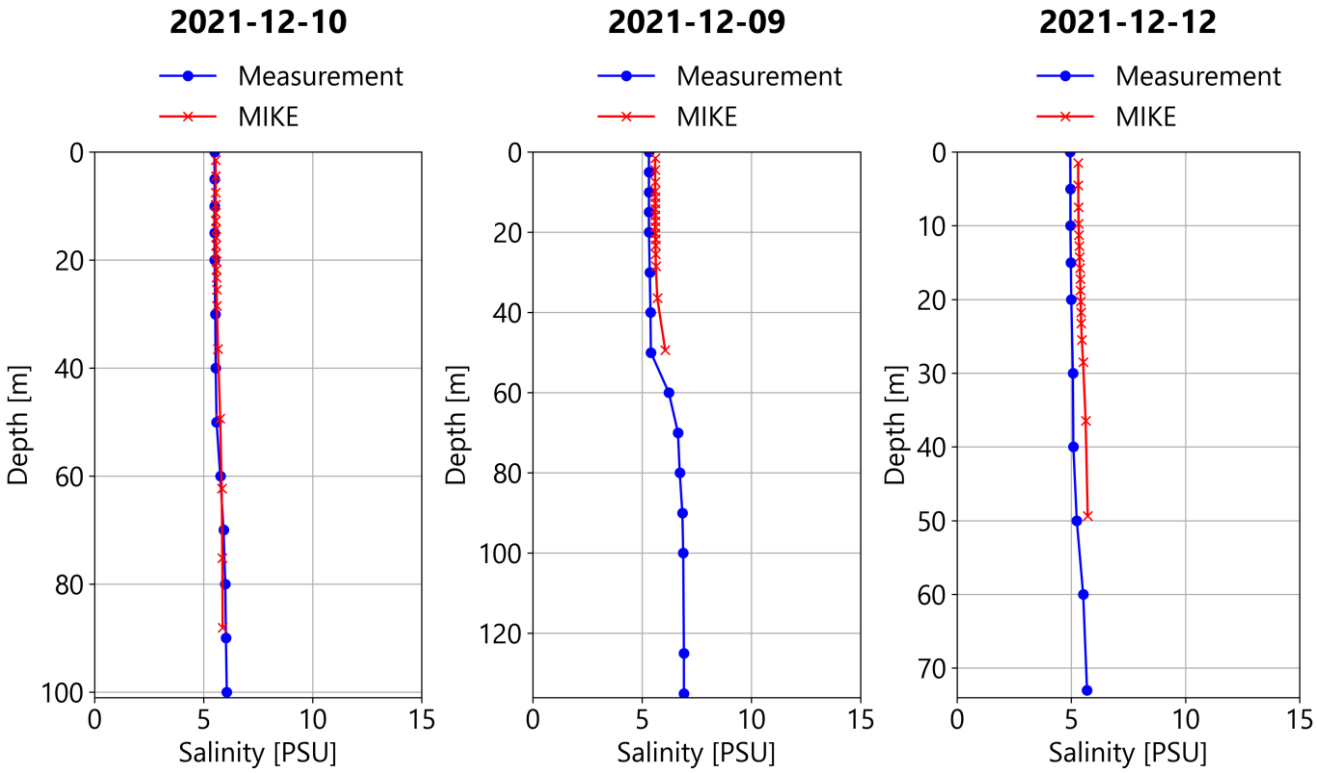



*Comparison between modelled and measured salinity profiles at location F2 (source: merihavainnot.fi)*

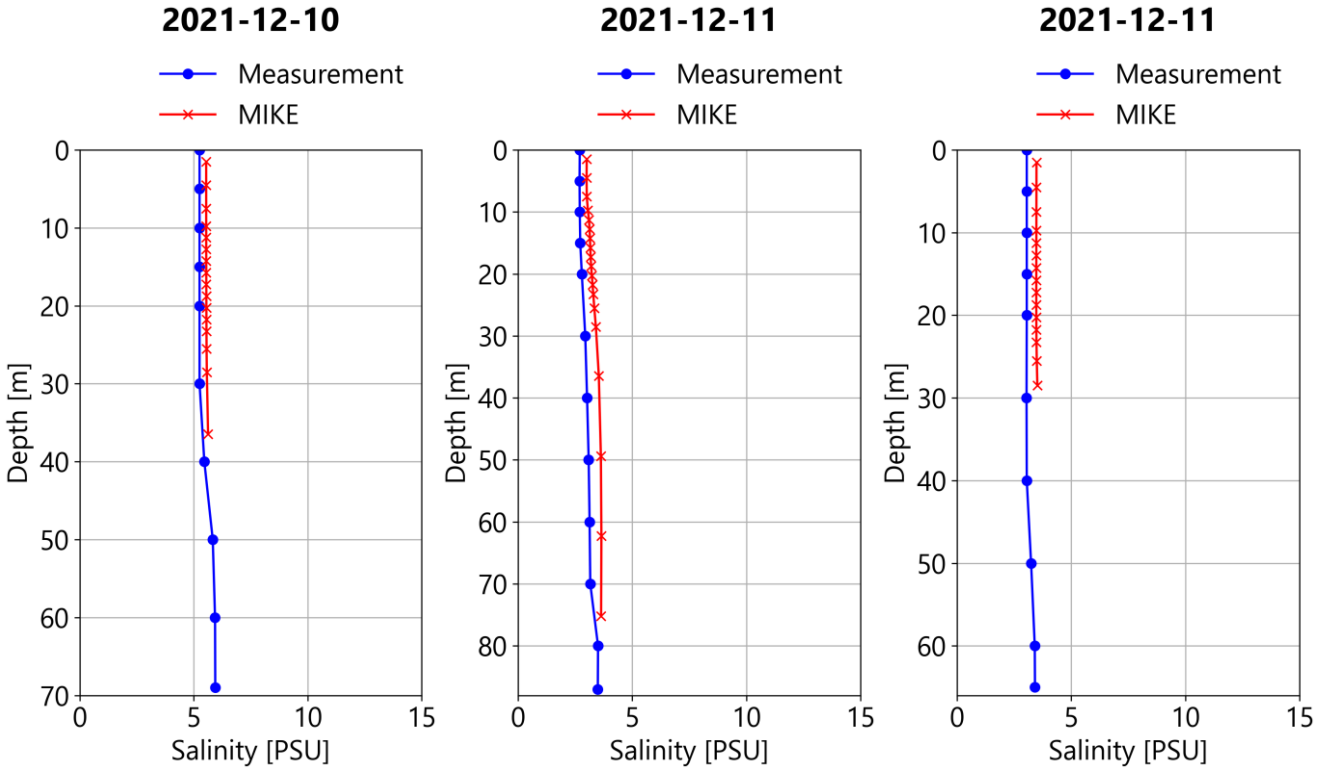
## Profiles from SMHI



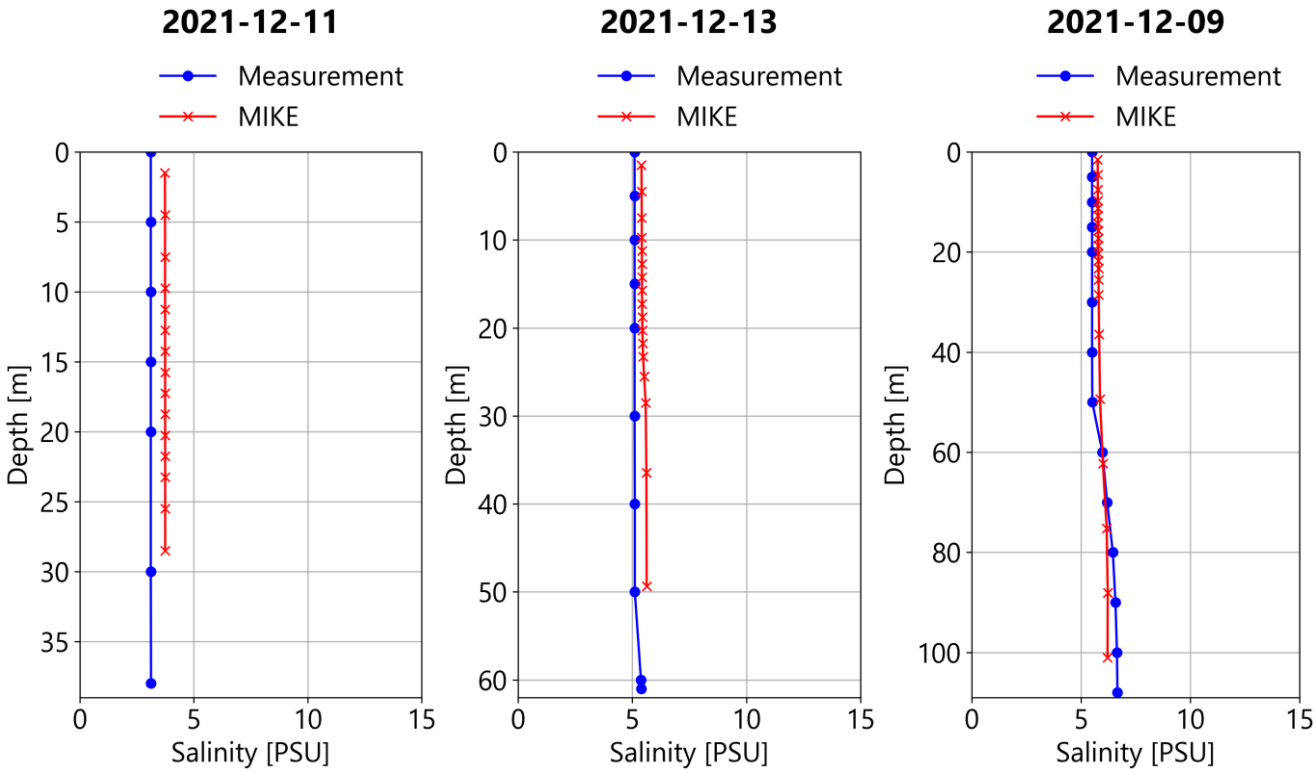

*Comparison between modelled and measured salinity profiles at location A5, F13, and F16 (from left to right, source: SMHI)*



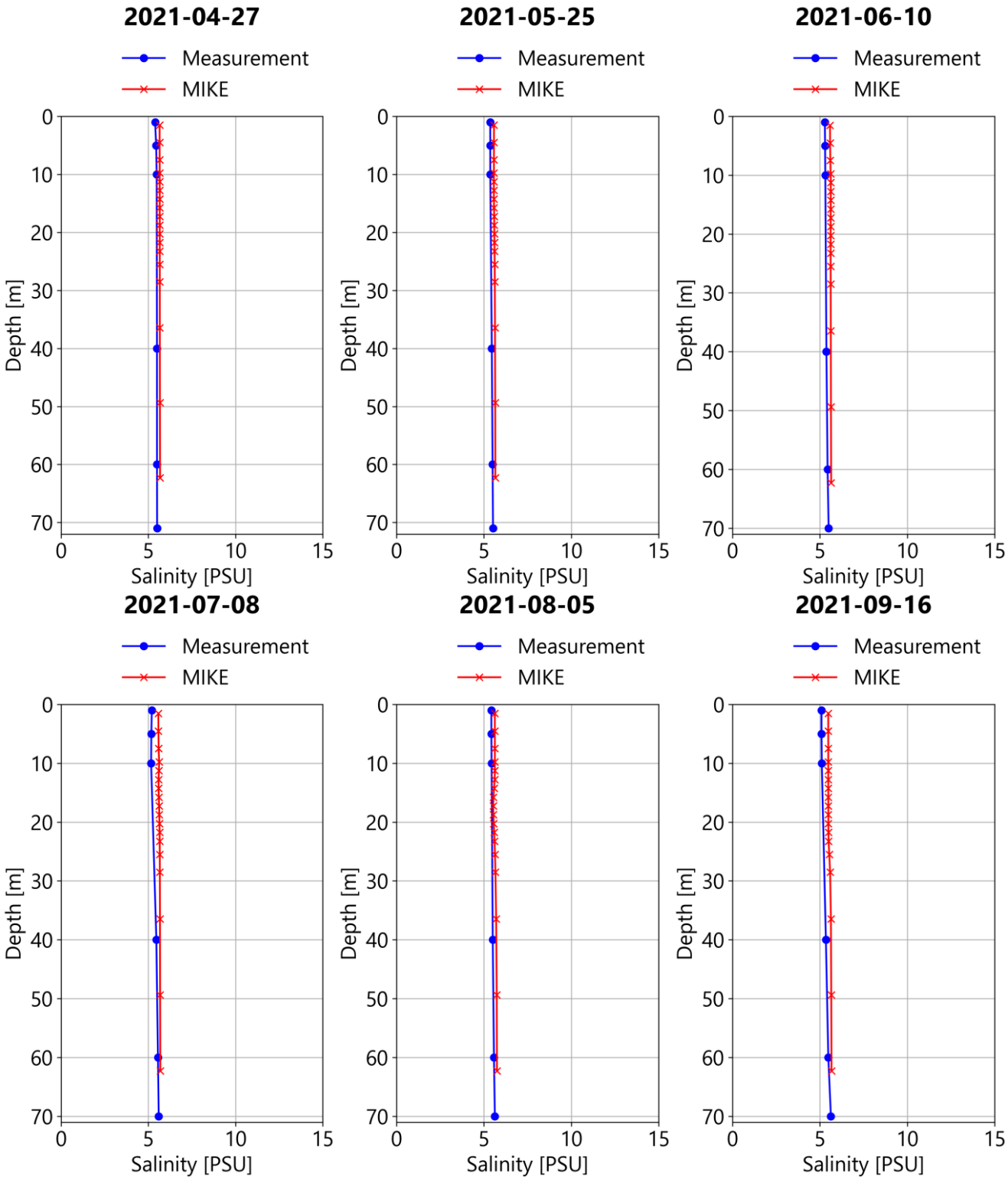

*Comparison between modelled and measured salinity profiles at location F18 SYDOSTBROTTEN, F33 GRUNDKALLEN, and MS2 (from left to right, source: SMHI)*



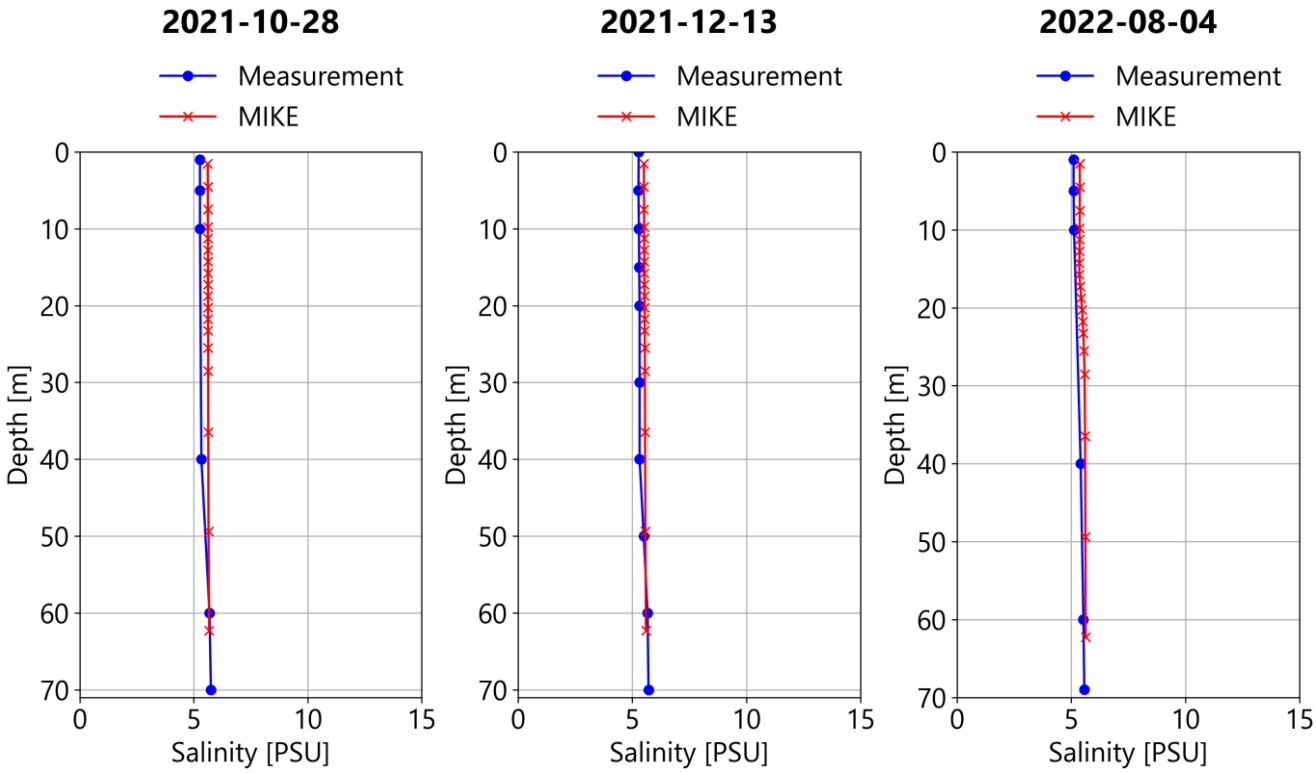

*Comparison between modelled and measured salinity profiles at location MS6, RR1, and RR5 (from left to right, source: SMHI)*




*Comparison between modelled and measured salinity profiles at location RR7, SR1A, and SS29 (from left to right, source: SMHI)*

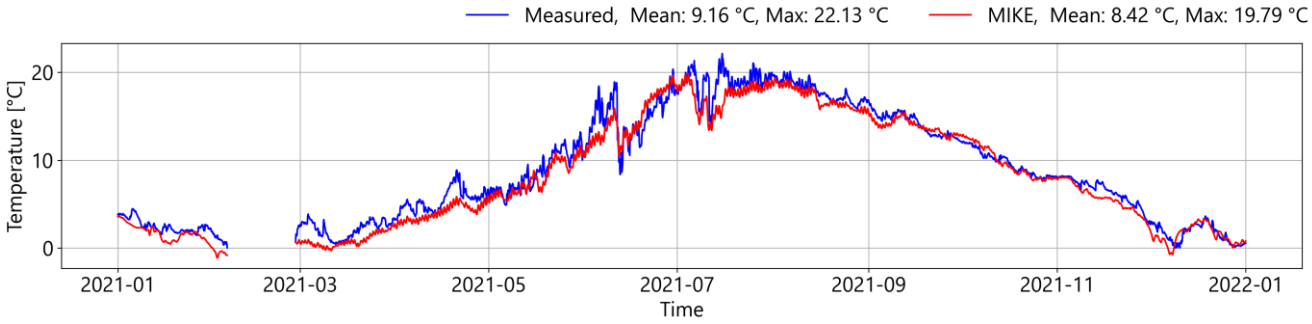



*Comparison between modelled and measured salinity profiles at location SR3 (from left to right, source: SMHI)*

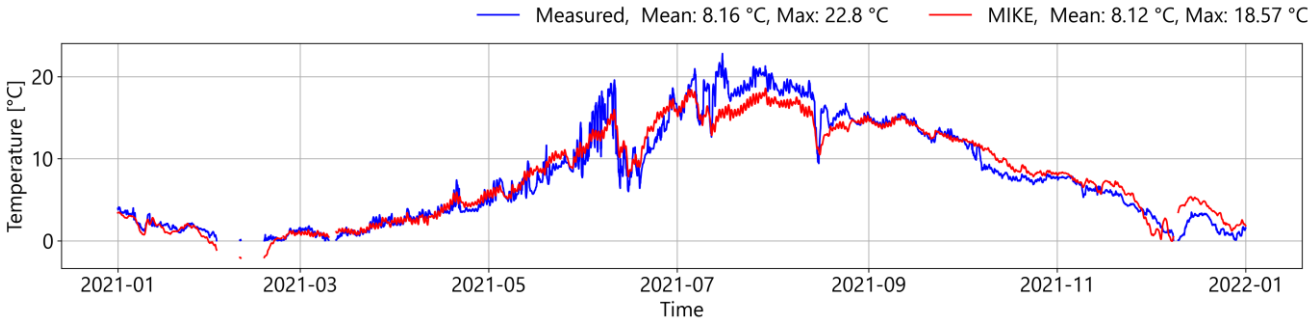



*Comparison between modelled and measured salinity profiles at location SR3 (from left to right, source: SMHI)*

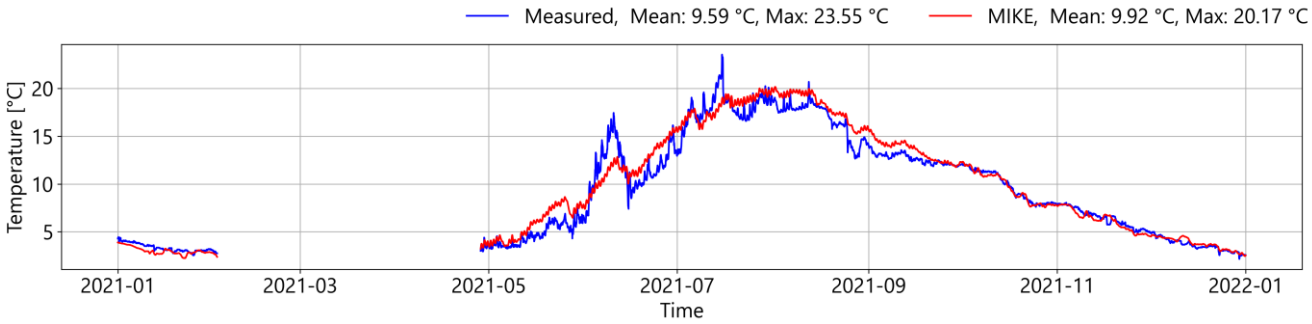
# Appendix 15 Model verification: Timeseries of surface temperature



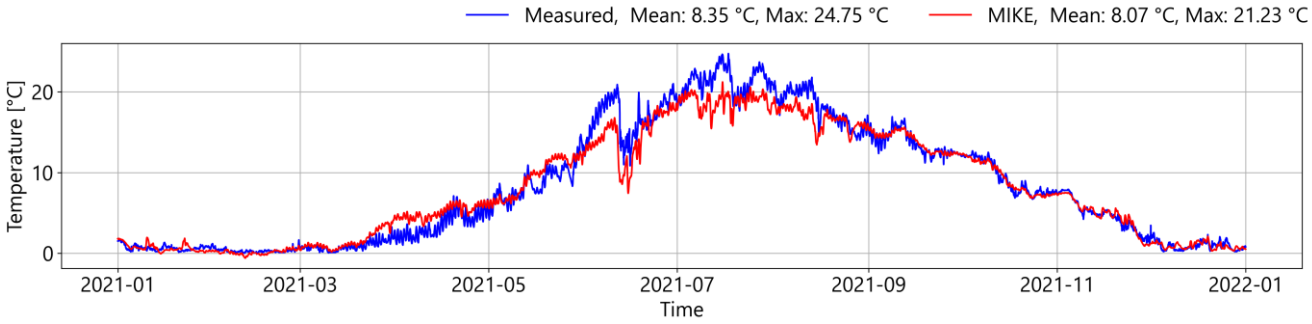

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for FORSMARK (SMHI-Station).*



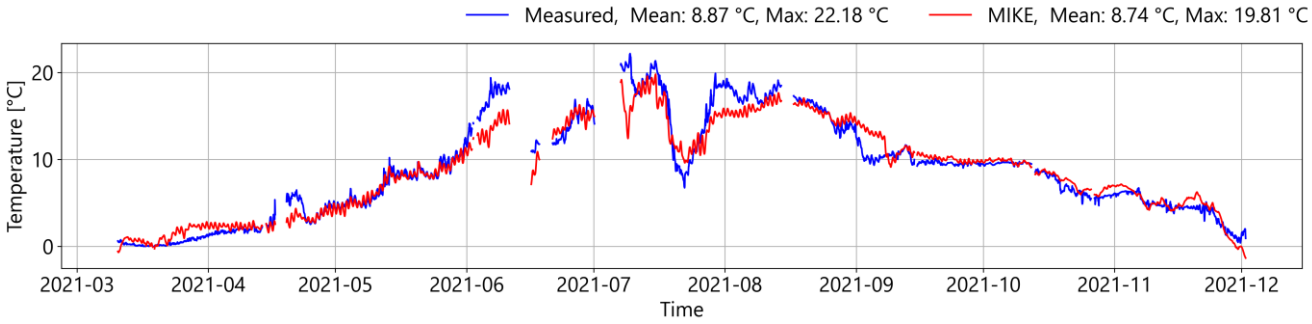

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for BÖNAN SJÖV (SMHI-Station).*



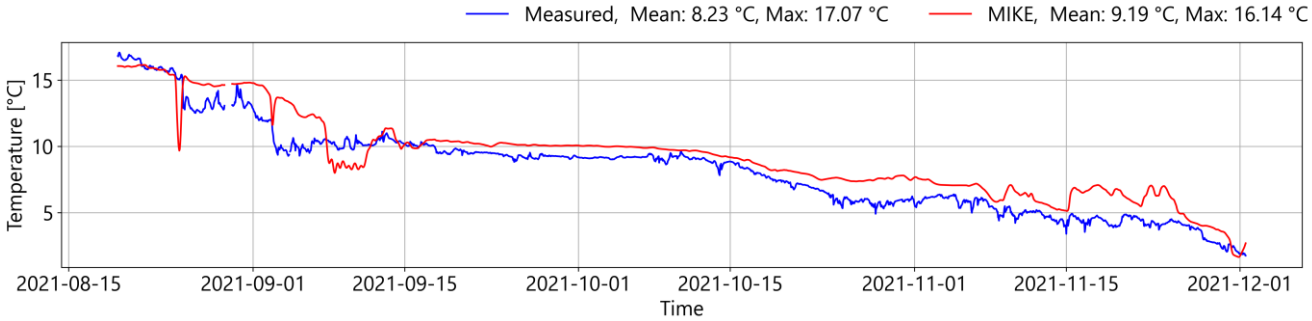

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for FINNGRUNDET WR BOJ (SMHI-Station).*



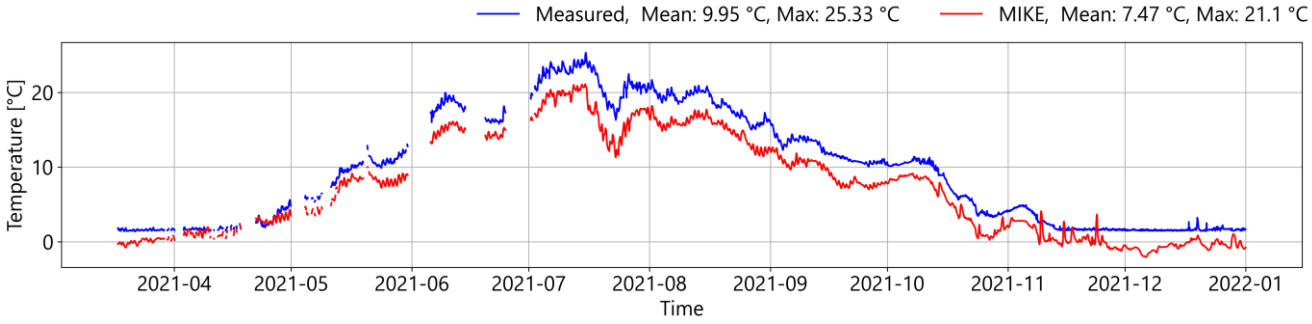

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for LJUSNE SJÖV (SMHI-Station).*



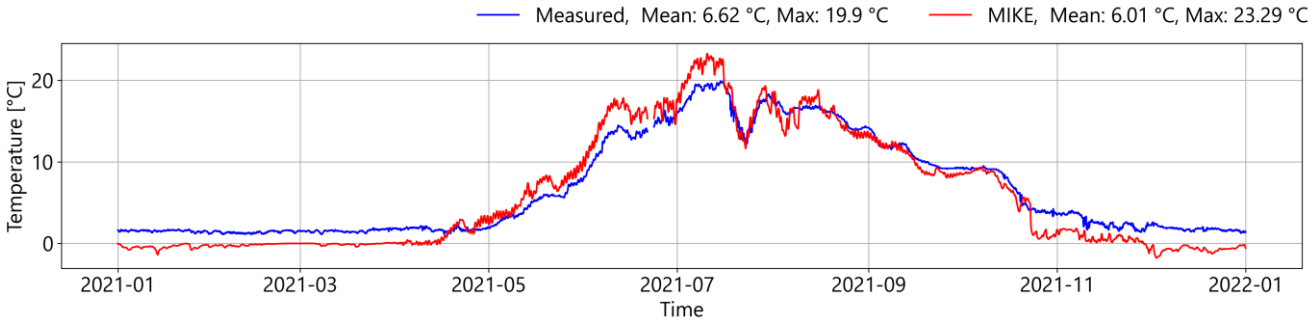

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for NORRBYN SST (SMHI-Station).*



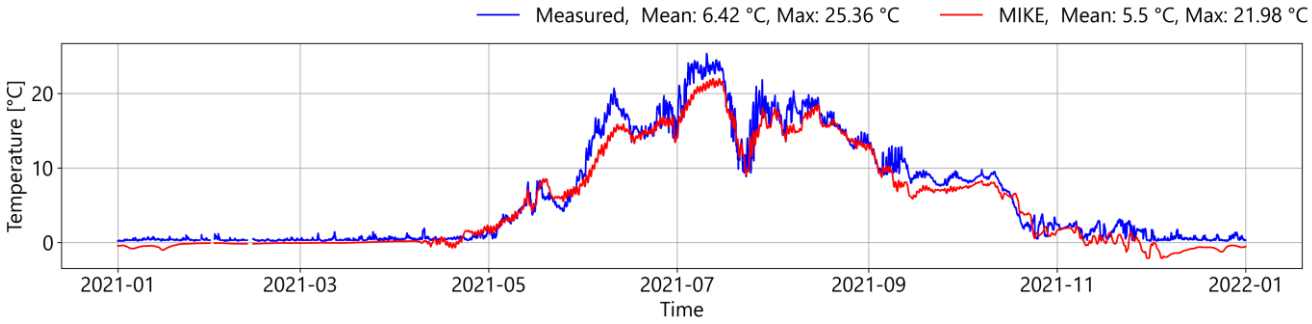

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for NORRBYN BOJ (SMHI-Station).*



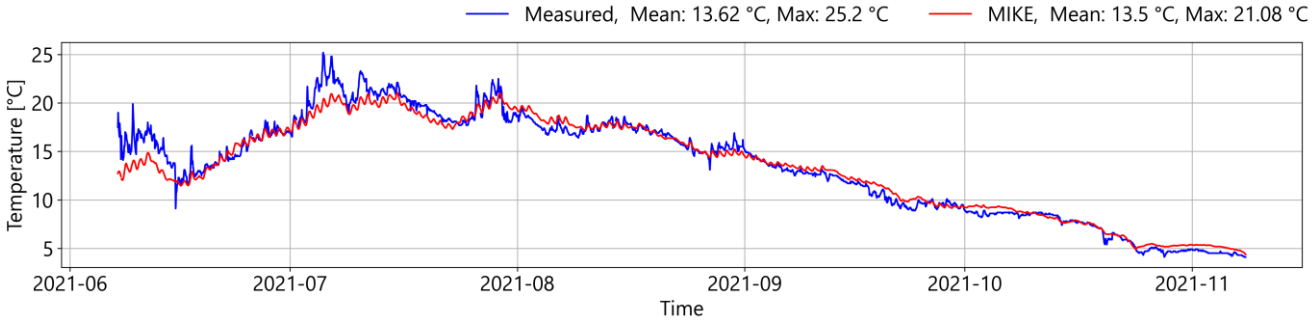

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Holmsund (SMHI-Station).*



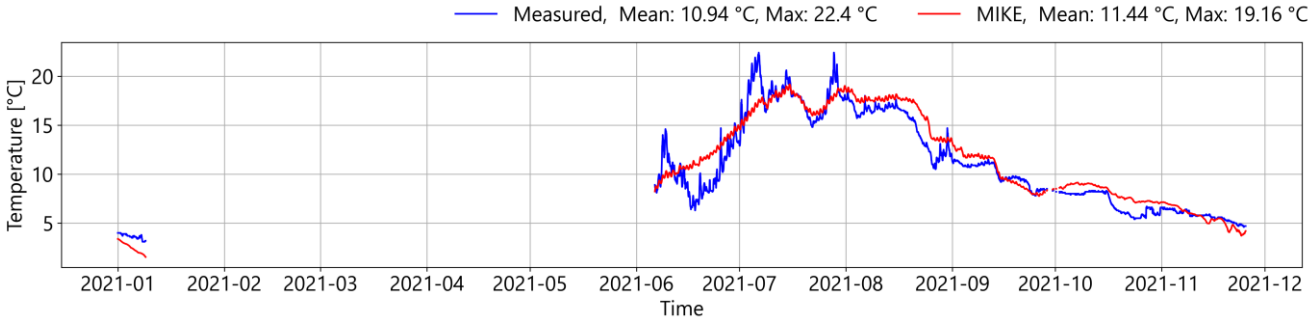

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for STRÖMÖREN SJÖV (SMHI-Station).*



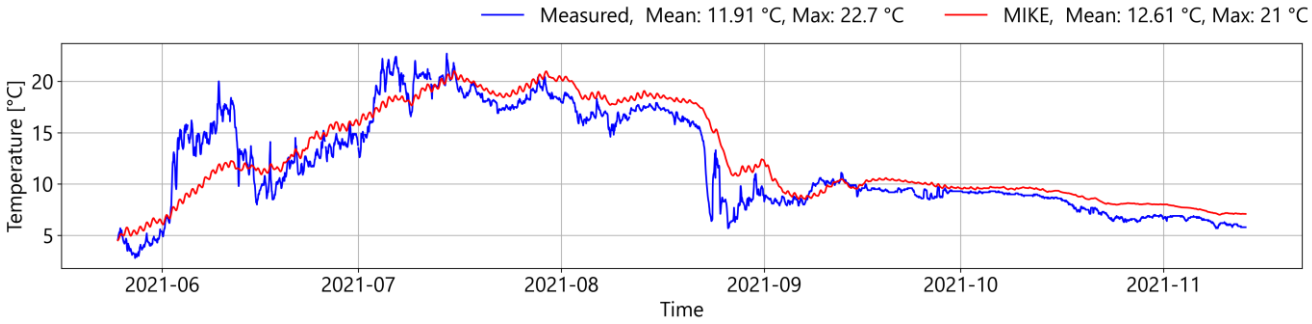

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for KALIX-KARLSBORG SJÖV (SMHI-Station).*



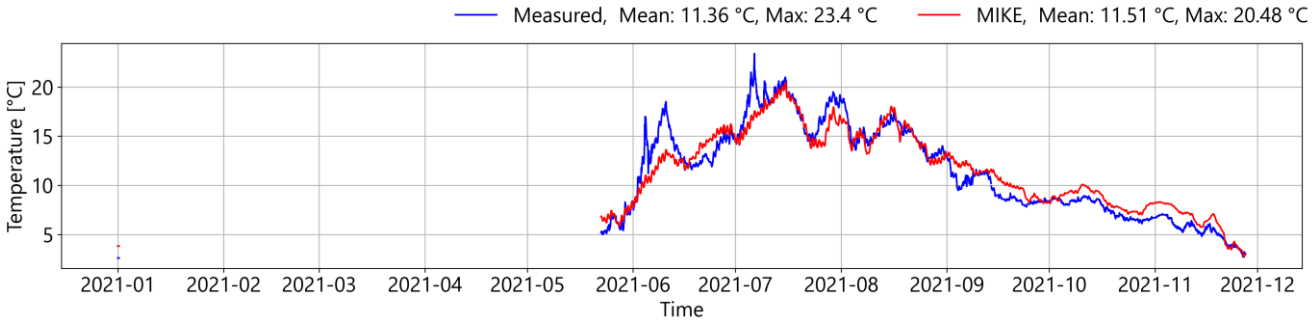

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Oulu Santapankki (FMI-Station).*



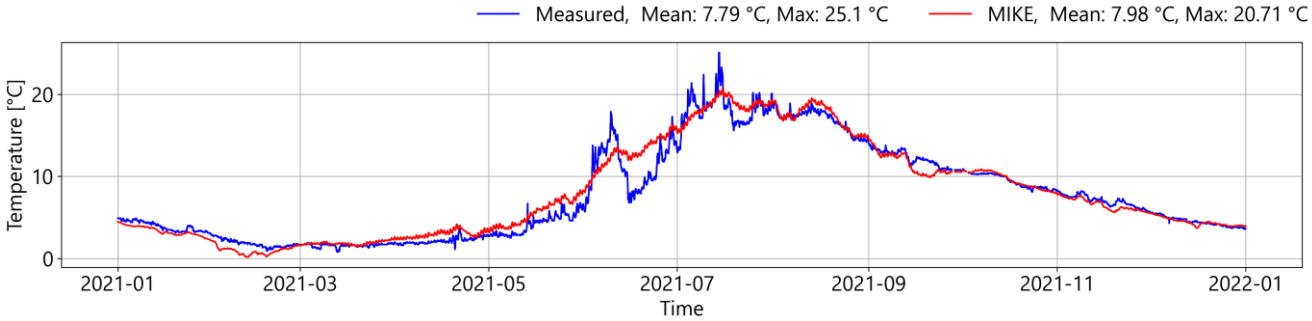

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Perämeri aaltopoiju (FMI-Station).*



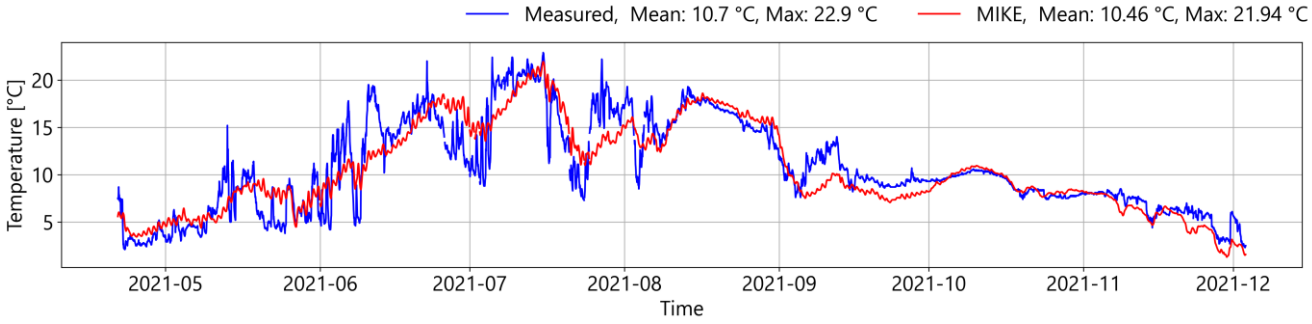

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Kalajoki Maakalla (FMI-Station).*



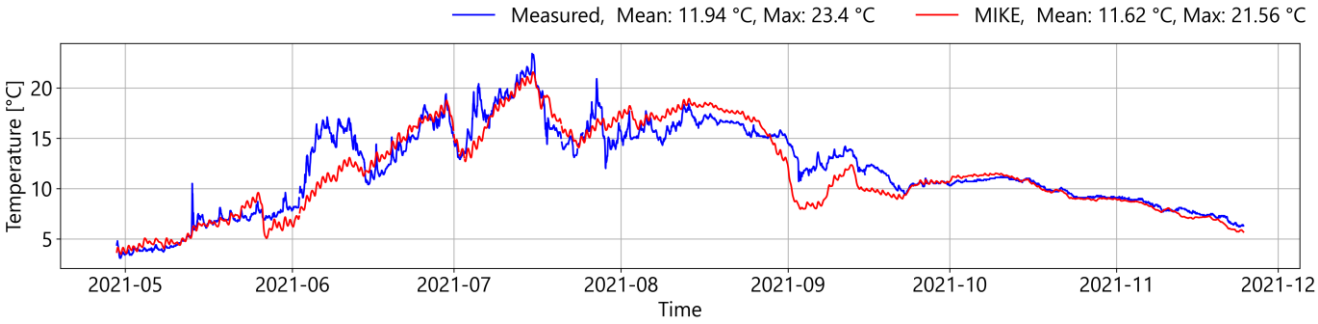

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Maalahti Storskäret (FMI-Station).*




*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Selkämeri aaltopoiju (FMI-Station).*



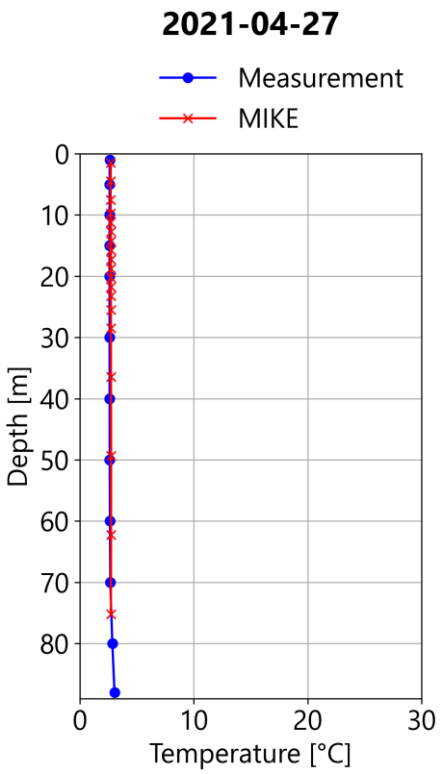

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Pori Kaijakari (FMI-Station).*



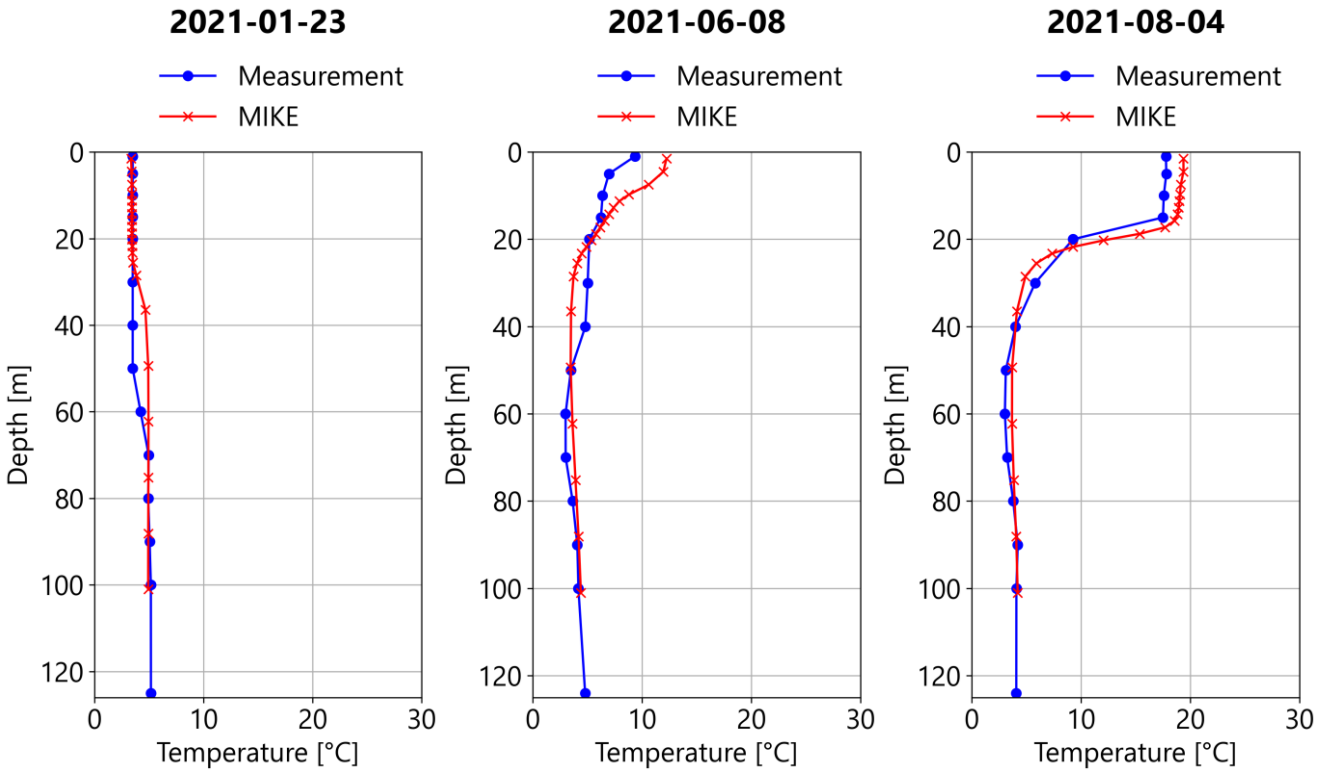

*Comparison between observed surface water temperature (blue line) and modelled surface water temperature (red line) for Uusikaupunki Vekara (FMI-Station).*

# Appendix 16 Model verification: Temperature profiles

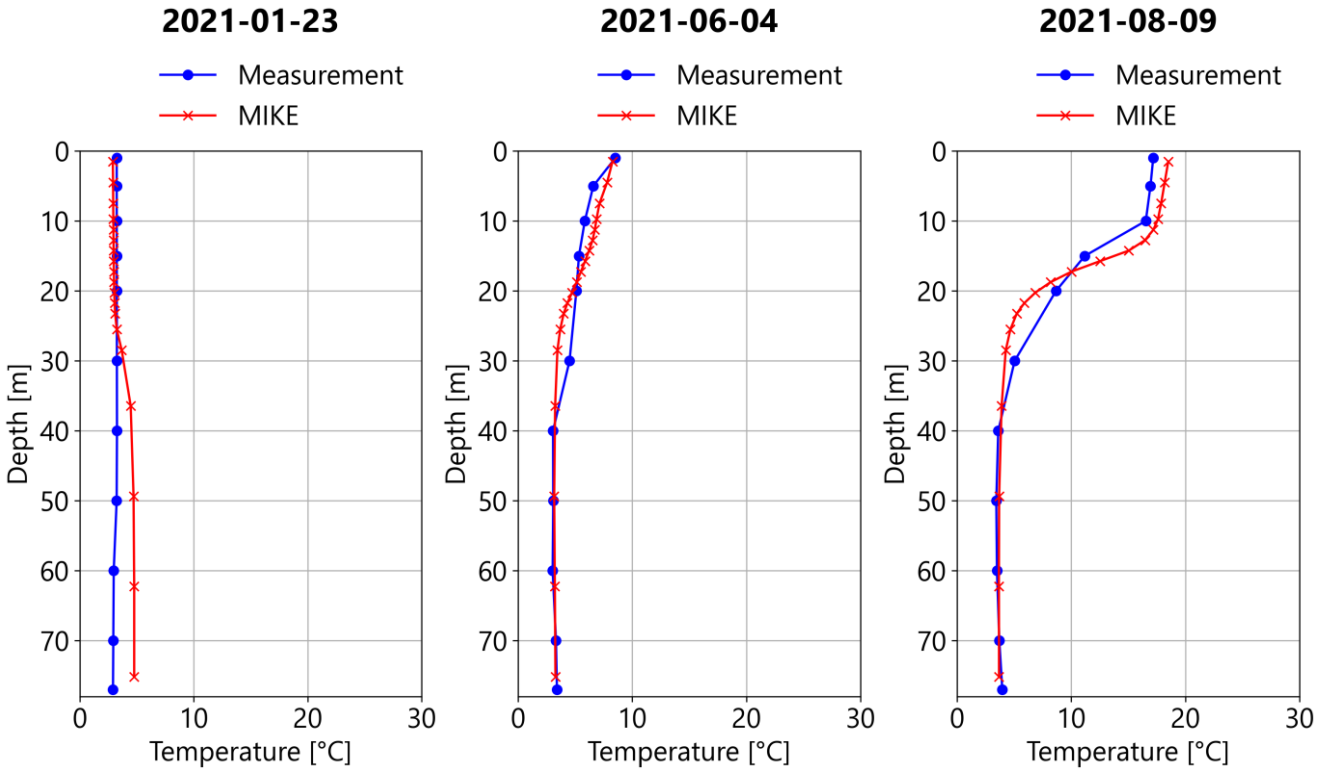
## Profiles from merihavainnot.fi



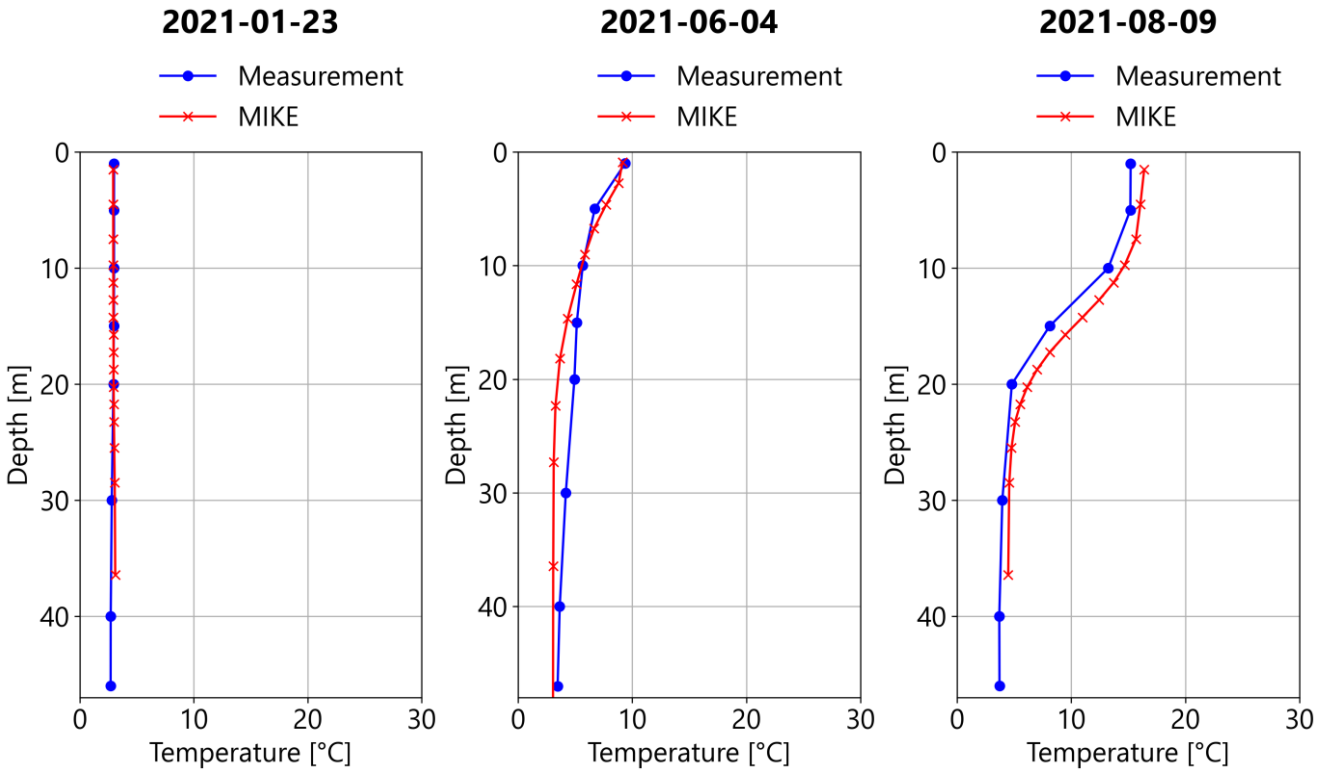

*Comparison between modelled and measured temperature profiles at location MAME61 (source: merihavainnot.fi)*



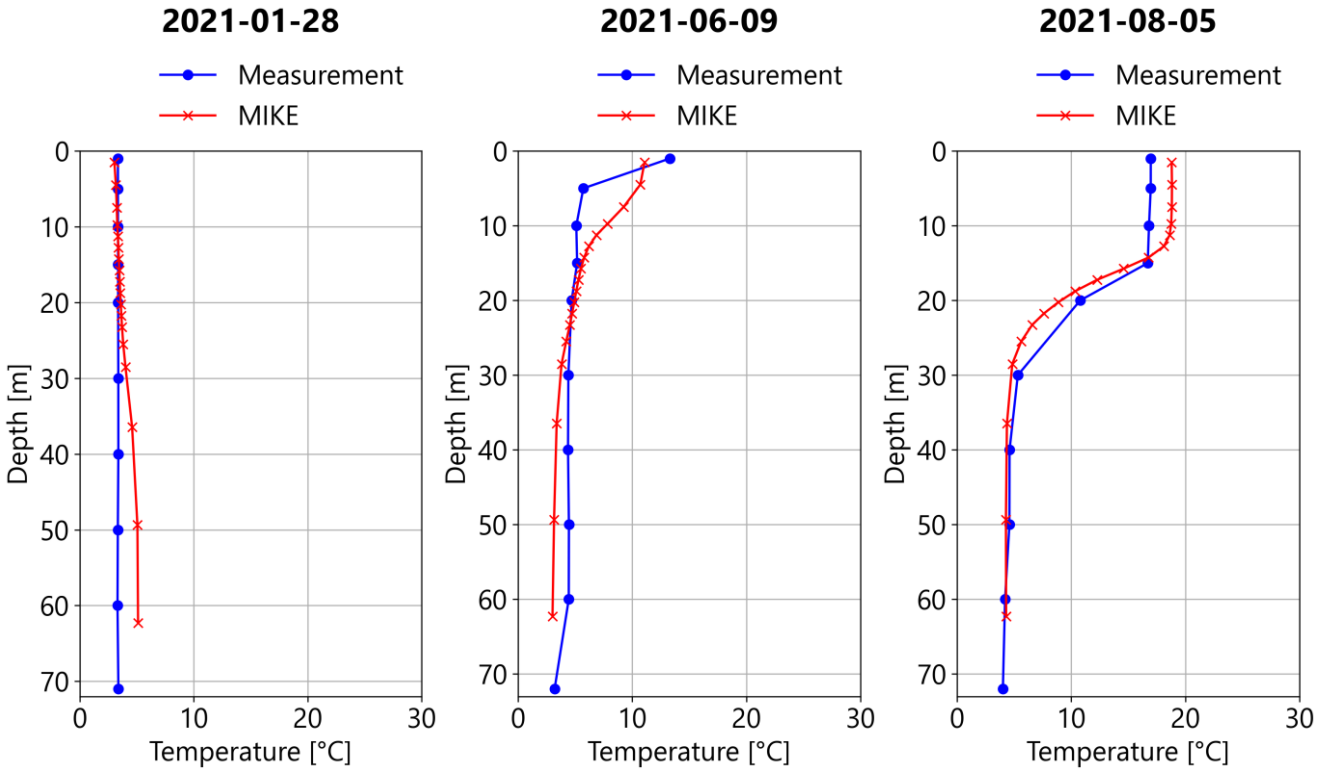

*Comparison between modelled and measured temperature profiles at location SR5 (source: merihavainnot.fi)*



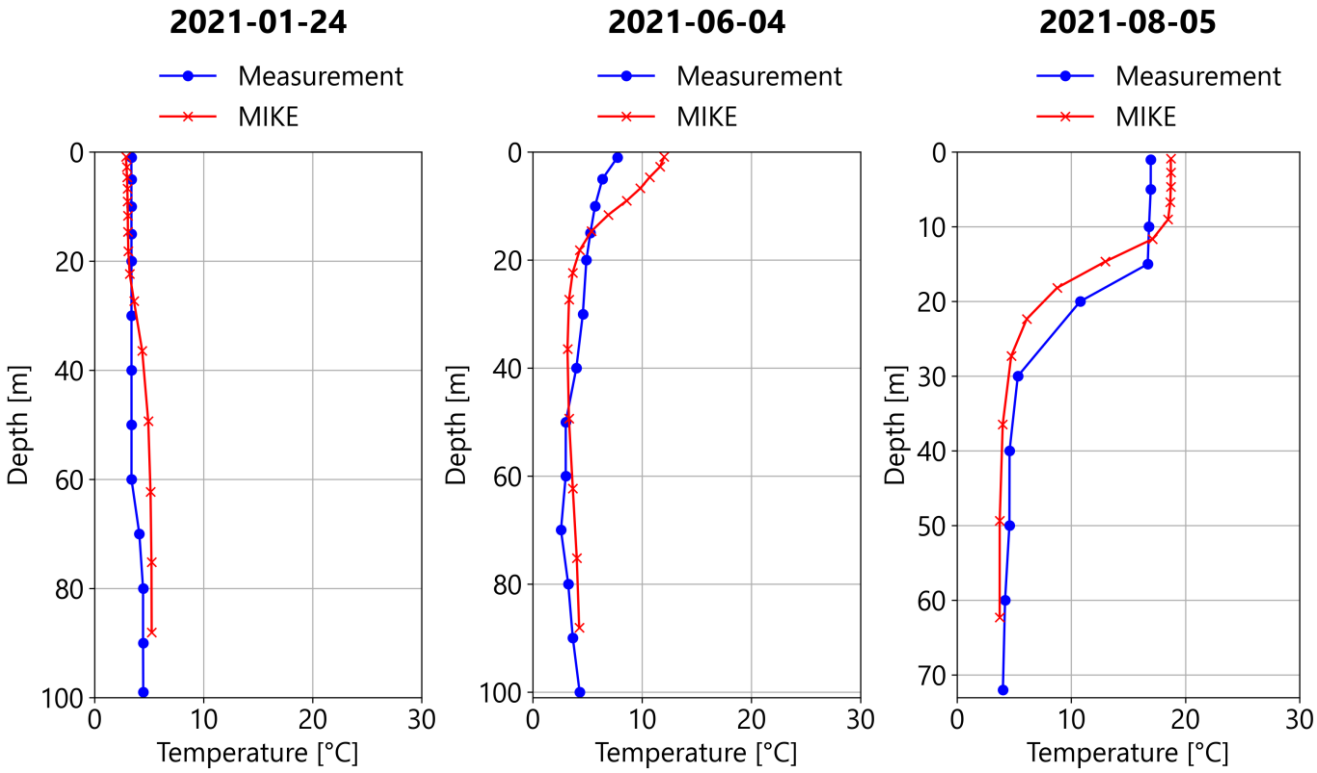

*Comparison between modelled and measured temperature profiles at location SR7 (source: merihavainnot.fi)*



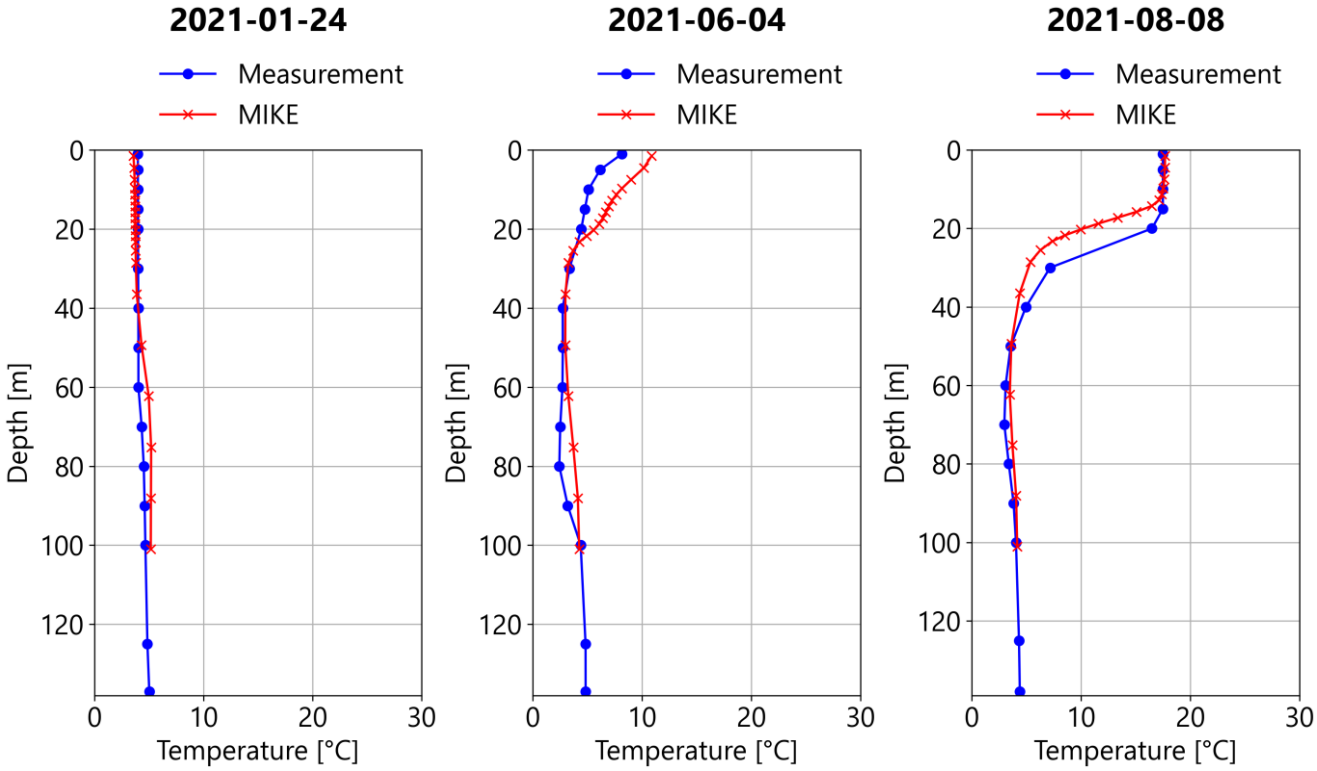

*Comparison between modelled and measured temperature profiles at location SR8 (source: merihavainnot.fi)*



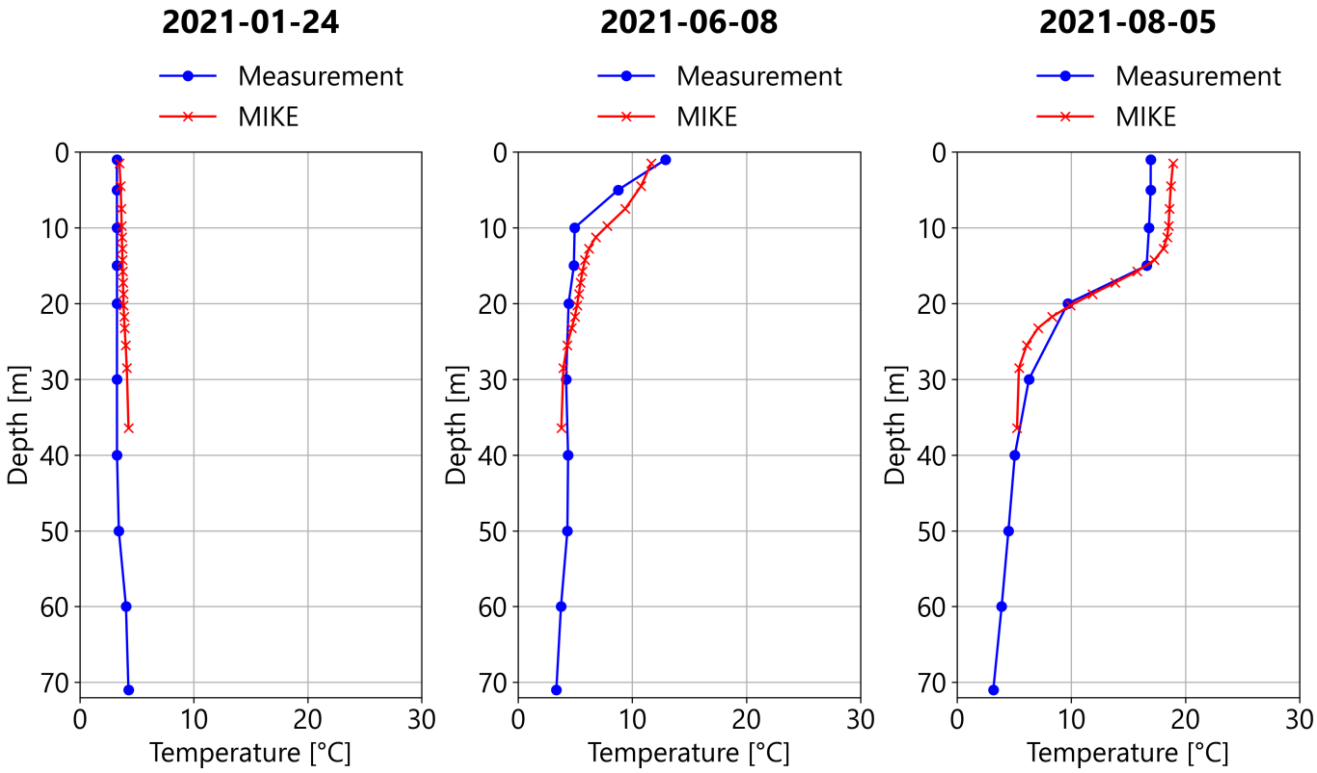

*Comparison between modelled and measured temperature profiles at location SR3 (source: merihavainnot.fi)*



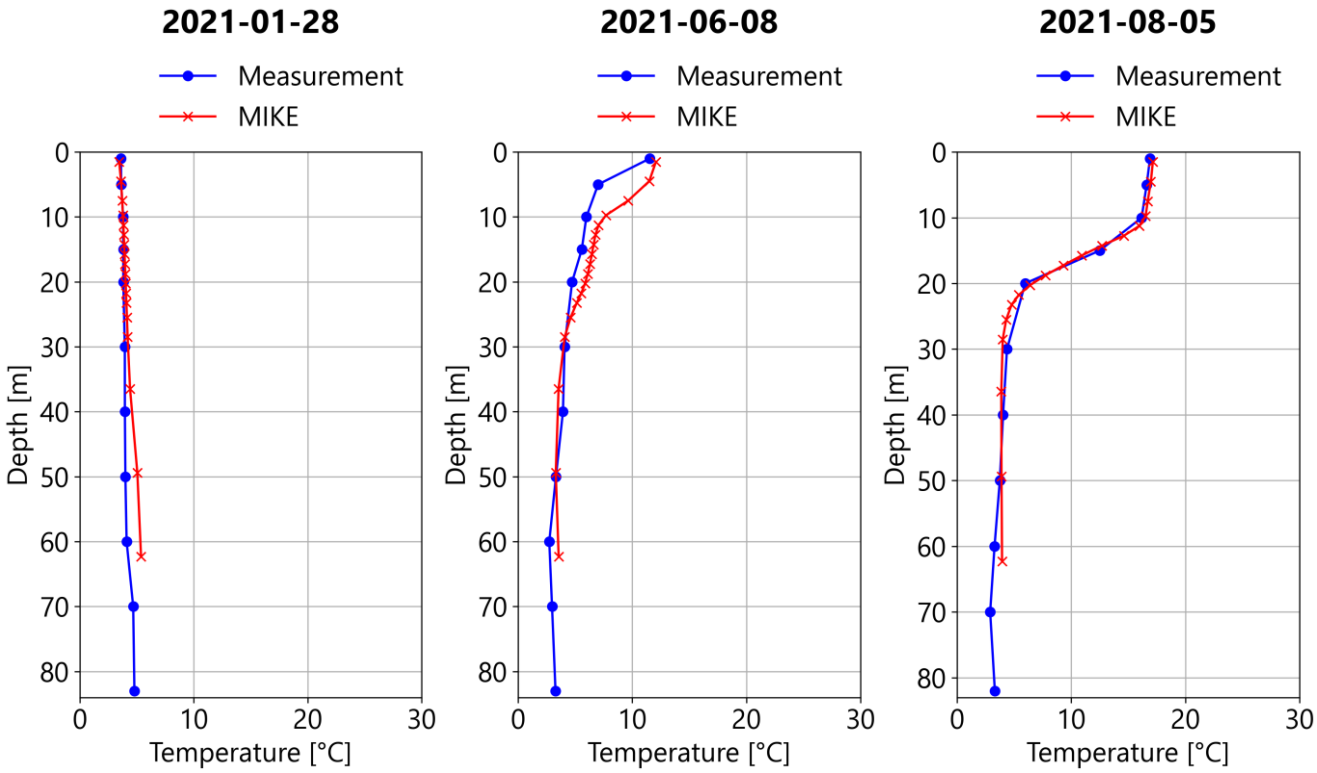

*Comparison between modelled and measured temperature profiles at location MS9 (source: merihavainnot.fi)*



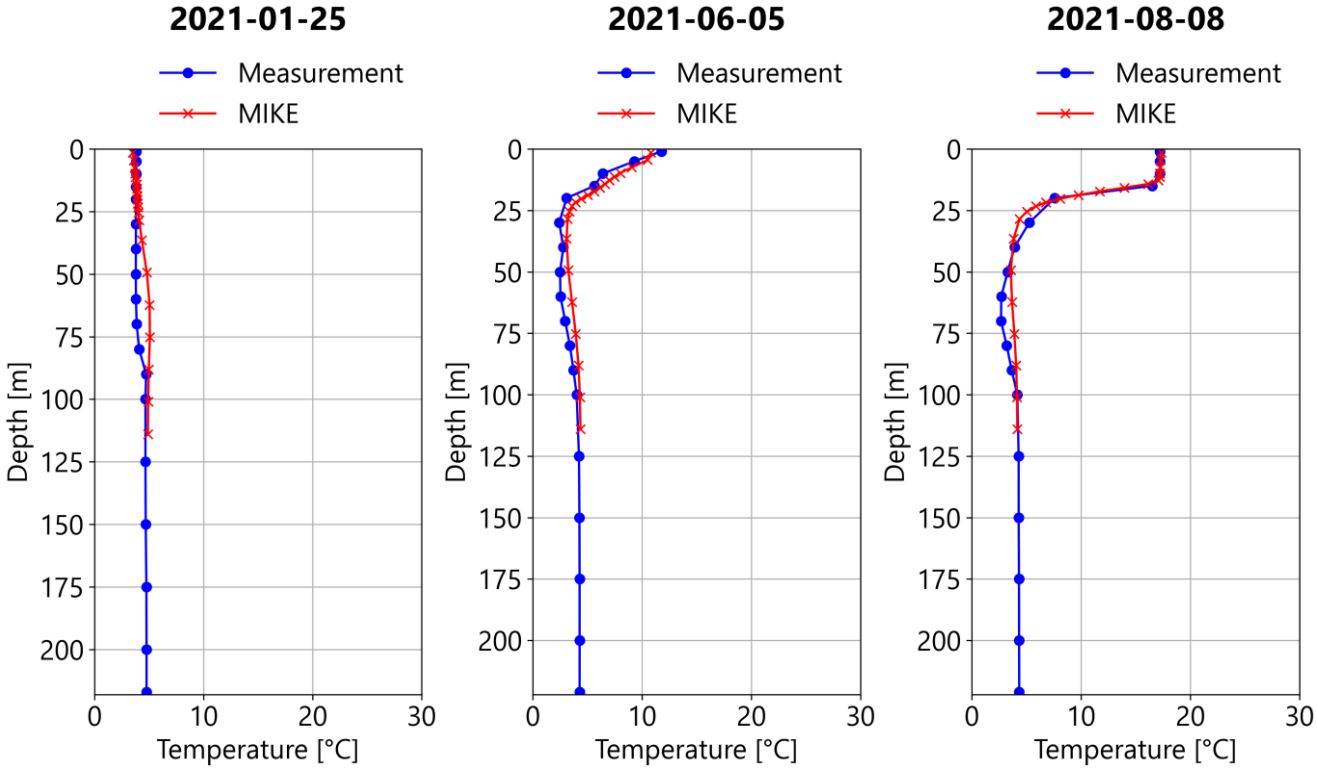

*Comparison between modelled and measured temperature profiles at location F26 (source: merihavainnot.fi, location)*



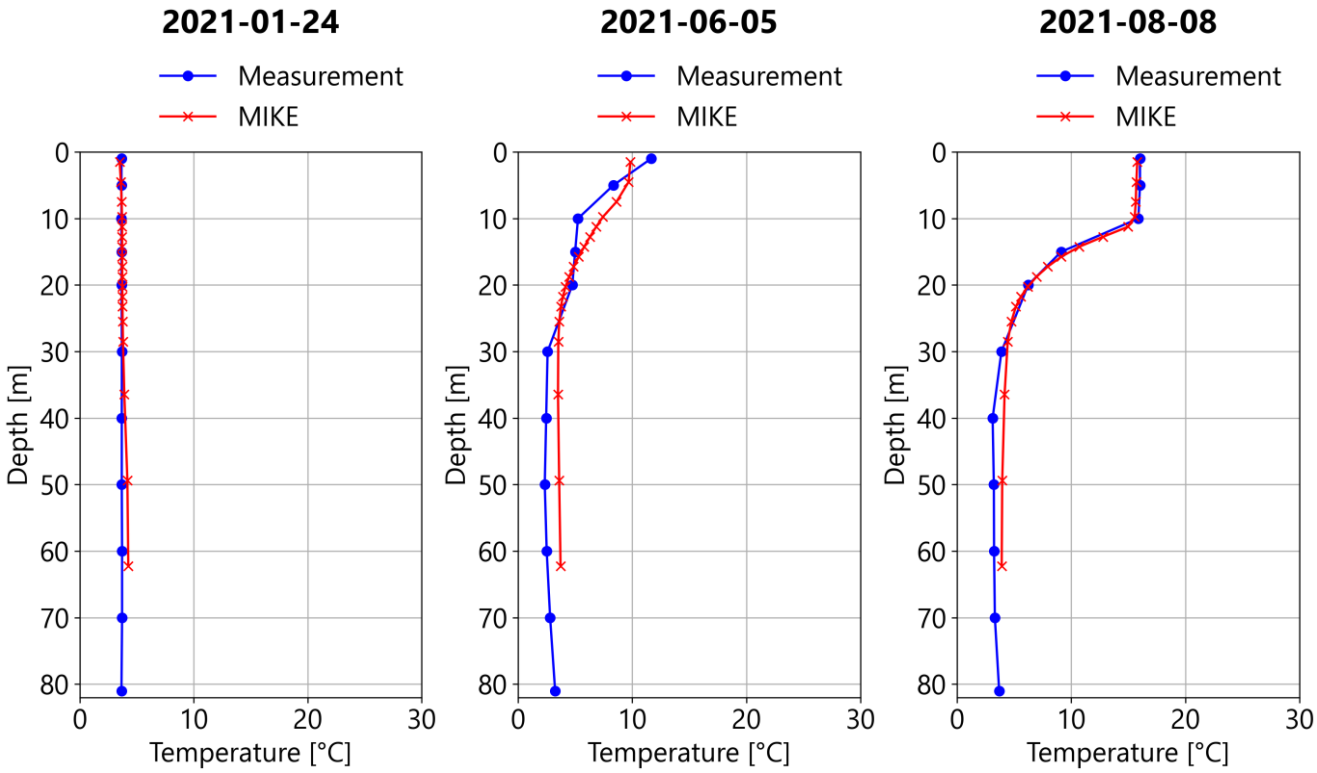

*Comparison between modelled and measured temperature profiles at location MS6 (source: merihavainnot.fi)*



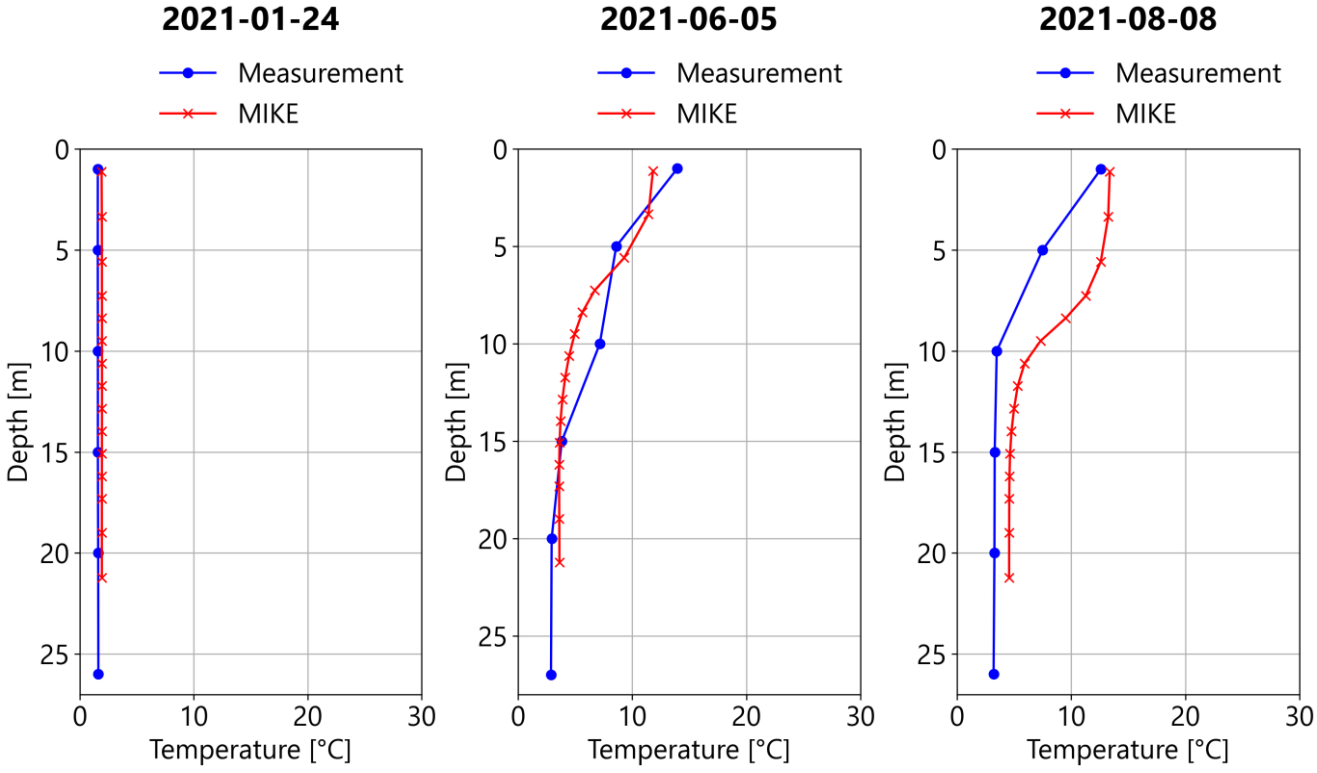

*Comparison between modelled and measured temperature profiles at location MS3 (source: merihavainnot.fi)*



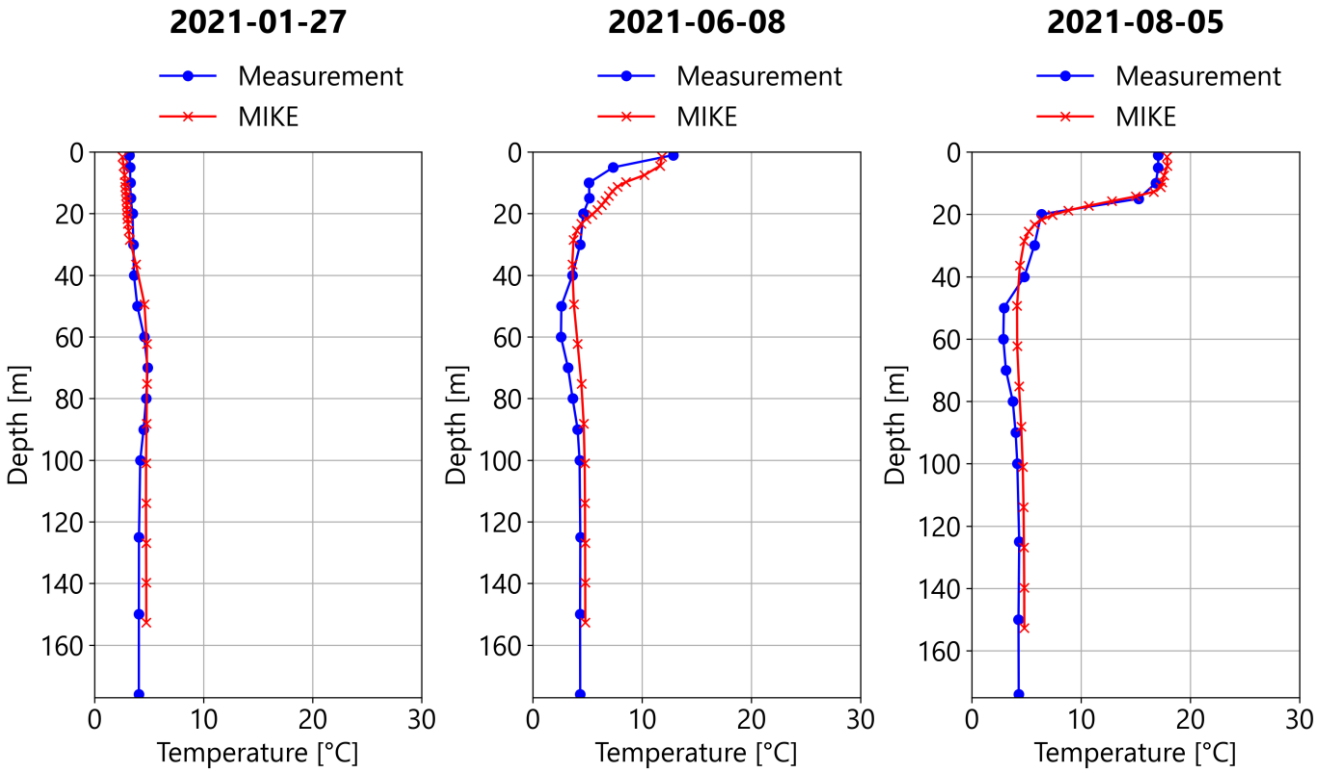

*Comparison between modelled and measured temperature profiles at location US5B (source: merihavainnot.fi)*



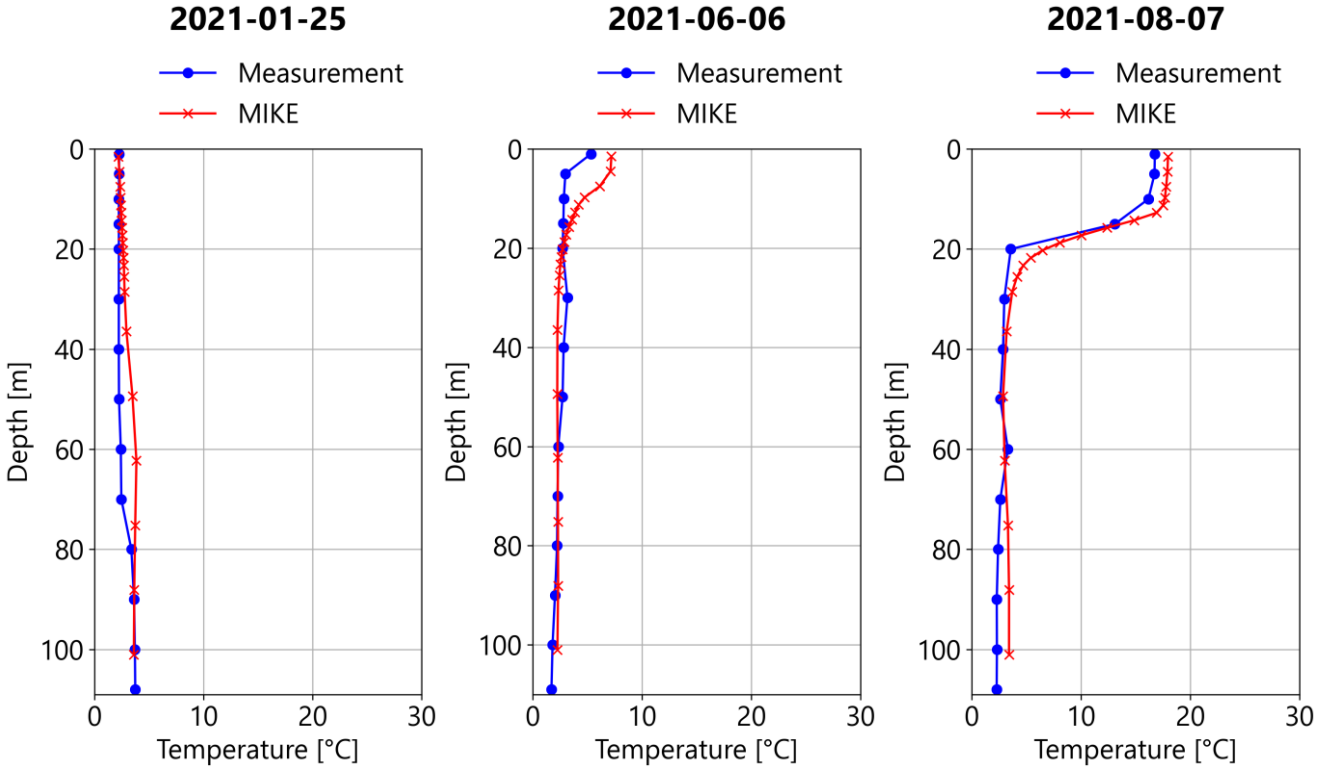

*Comparison between modelled and measured temperature profiles at location US6B (source: merihavainnot.fi)*



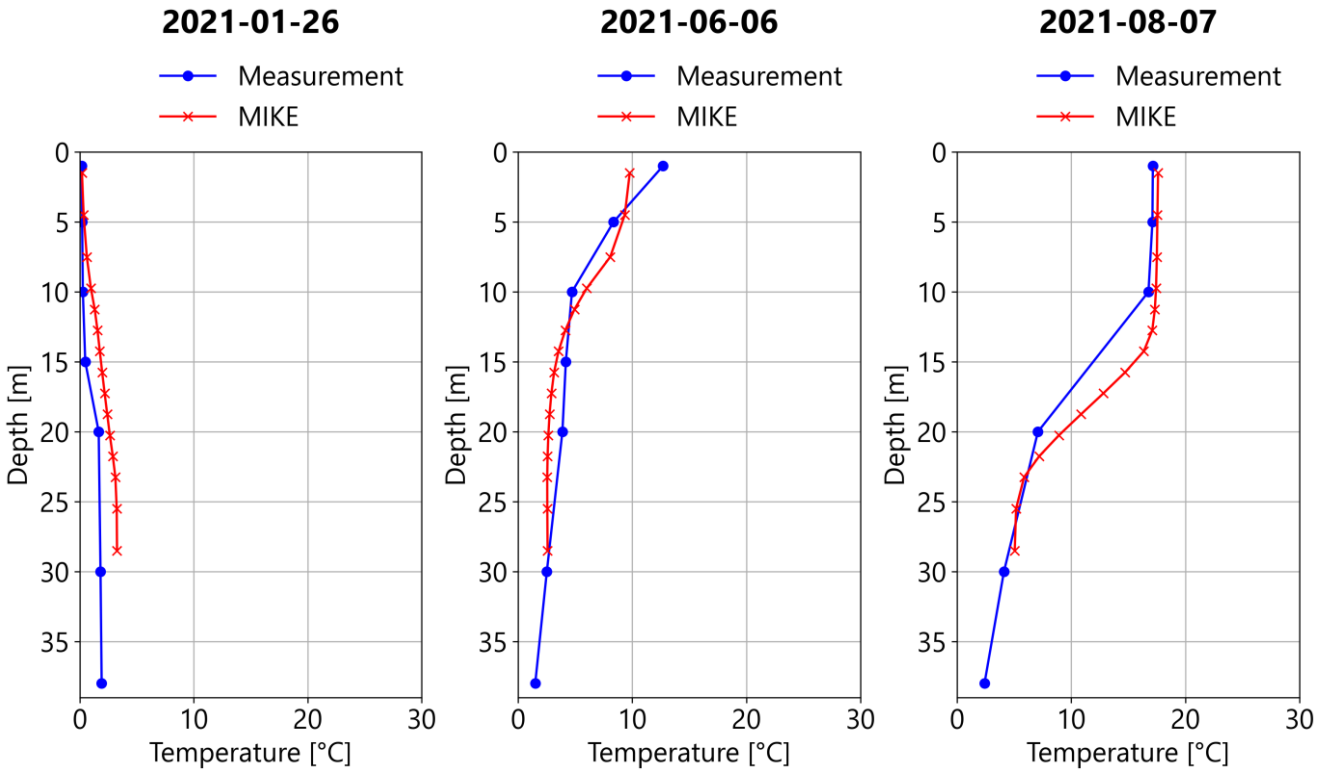

*Comparison between modelled and measured temperature profiles at location US7 (source: merihavainnot.fi)*



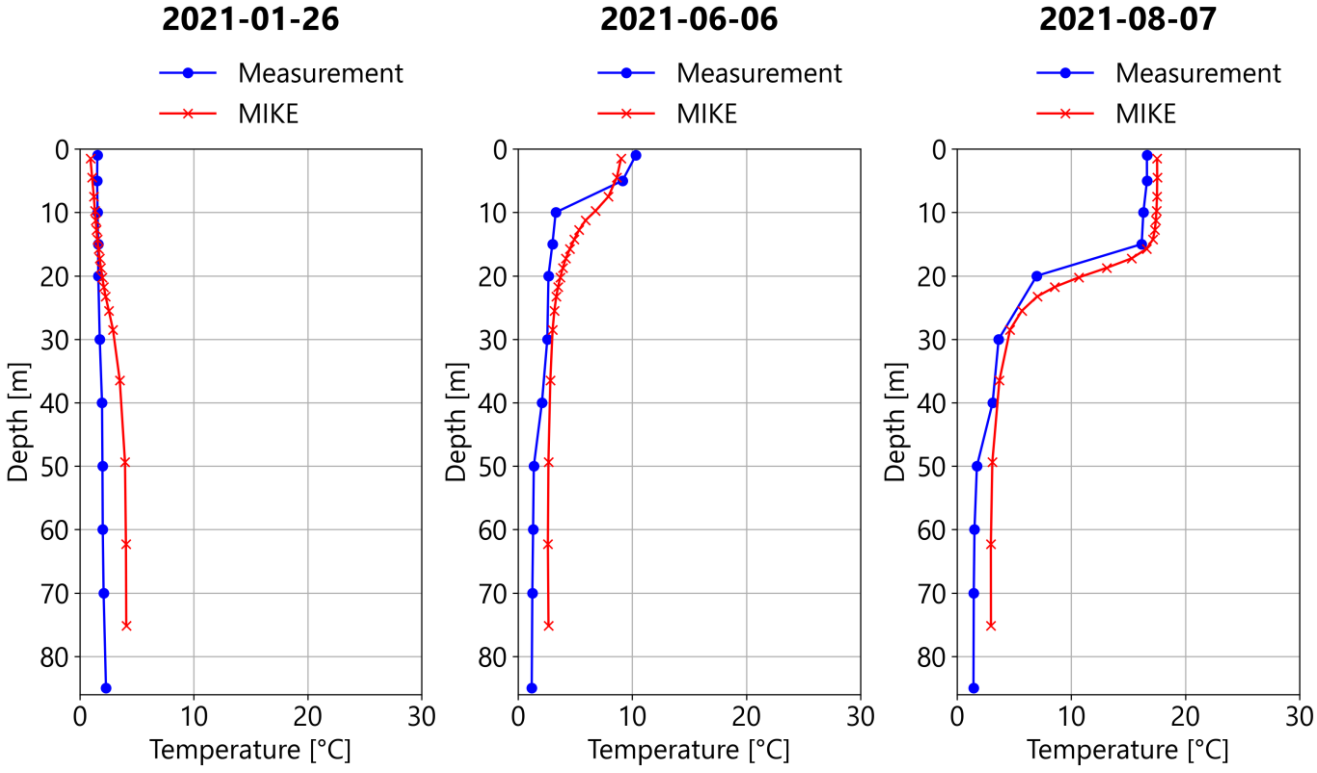

*Comparison between modelled and measured temperature profiles at location US3 (source: merihavainnot.fi)*



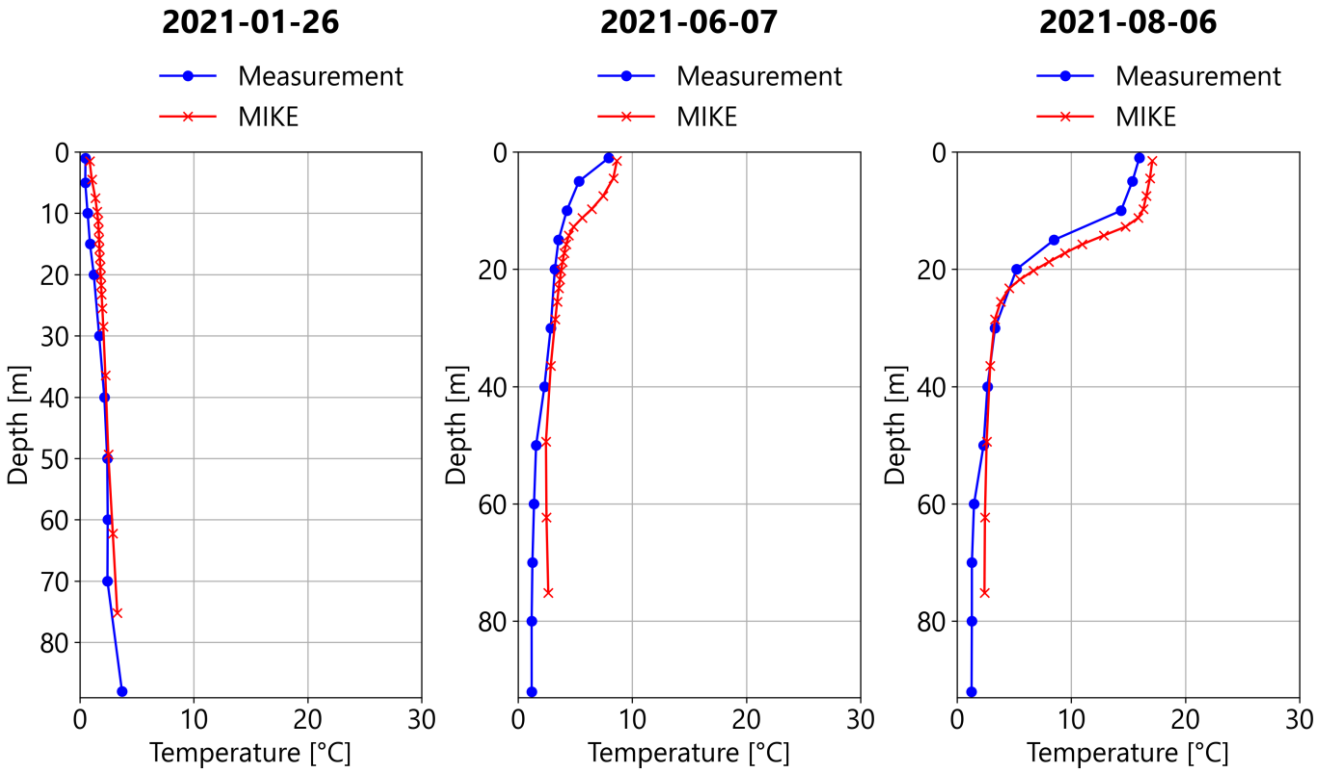

*Comparison between modelled and measured temperature profiles at location BO3 (source: merihavainnot.fi)*



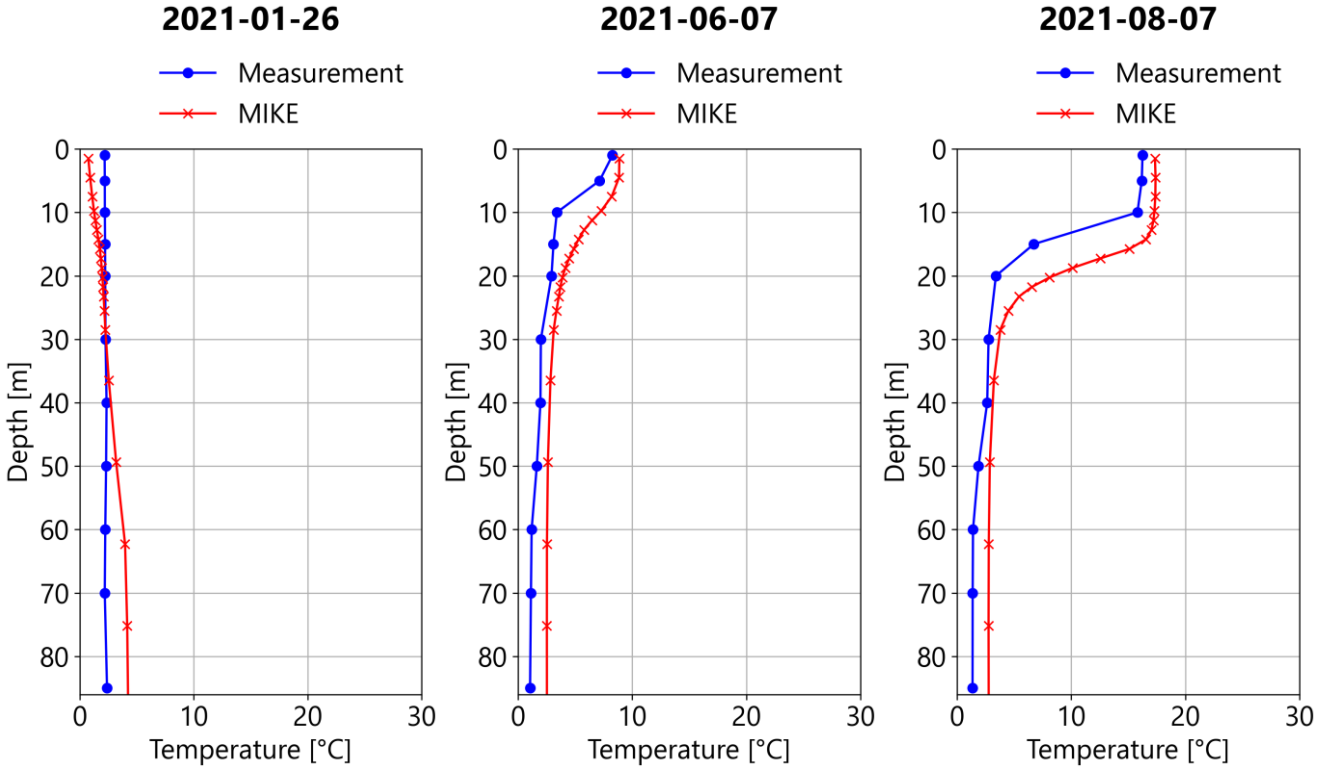

*Comparison between modelled and measured temperature profiles at location RR7 (source: merihavainnot.fi)*



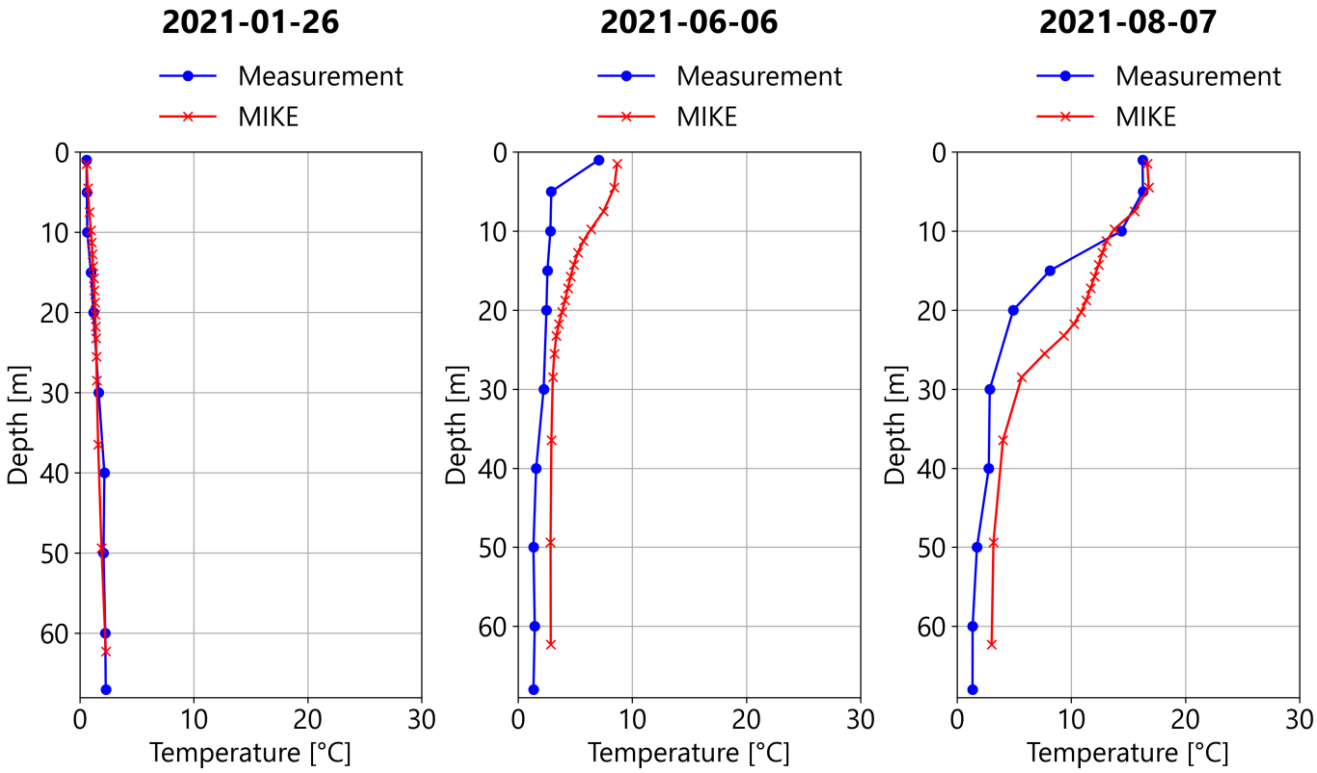

*Comparison between modelled and measured temperature profiles at location RR6 (source: merihavainnot.fi)*



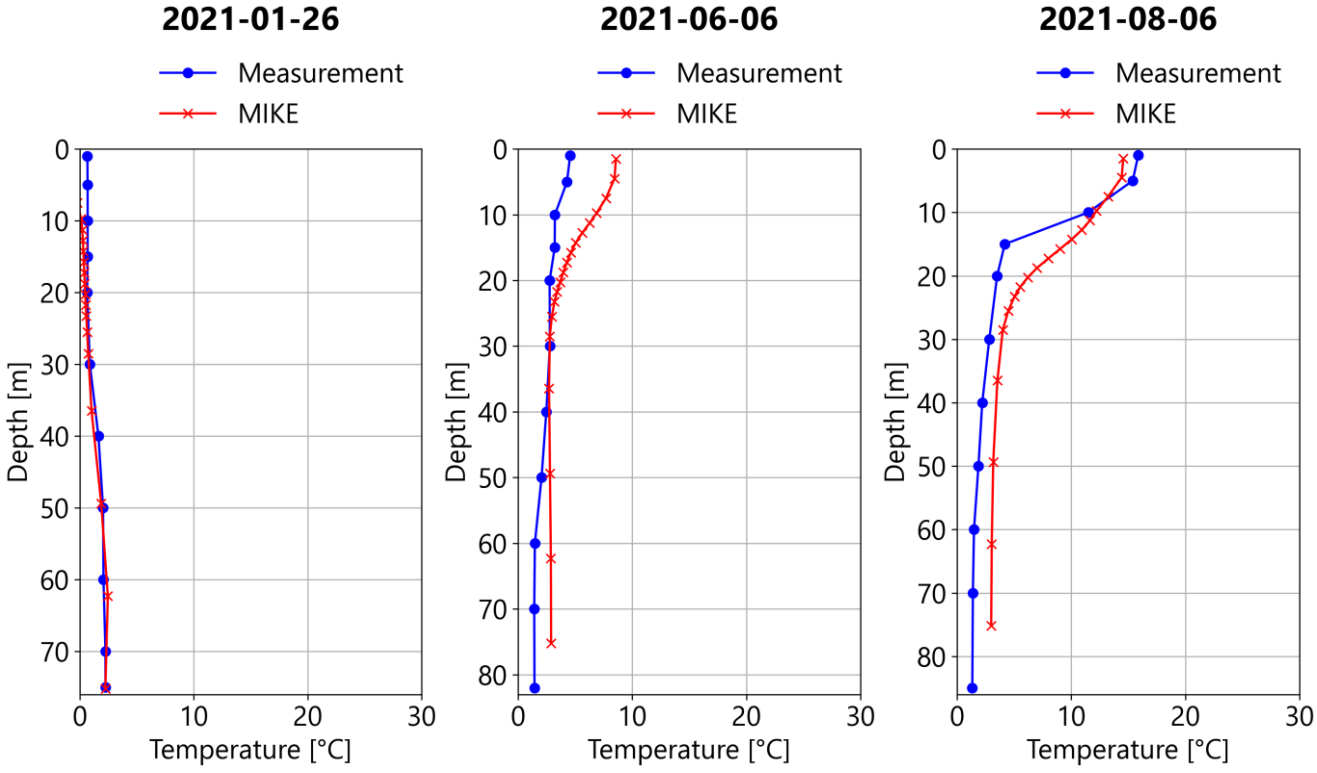

*Comparison between modelled and measured temperature profiles at location RR3 (source: merihavainnot.fi)*




*Comparison between modelled and measured temperature profiles at location CV (source: merihavainnot.fi)*

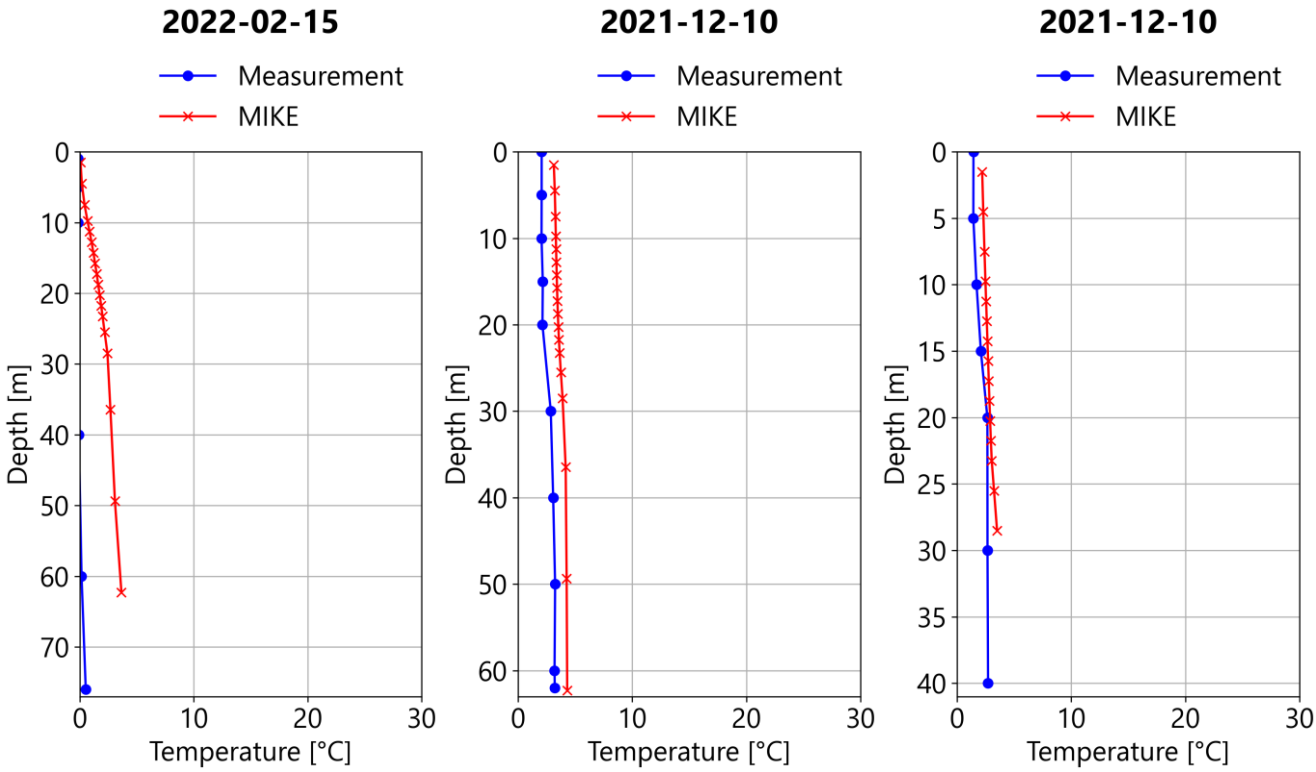



*Comparison between modelled and measured temperature profiles at location CVI (source: merihavainnot.fi)*

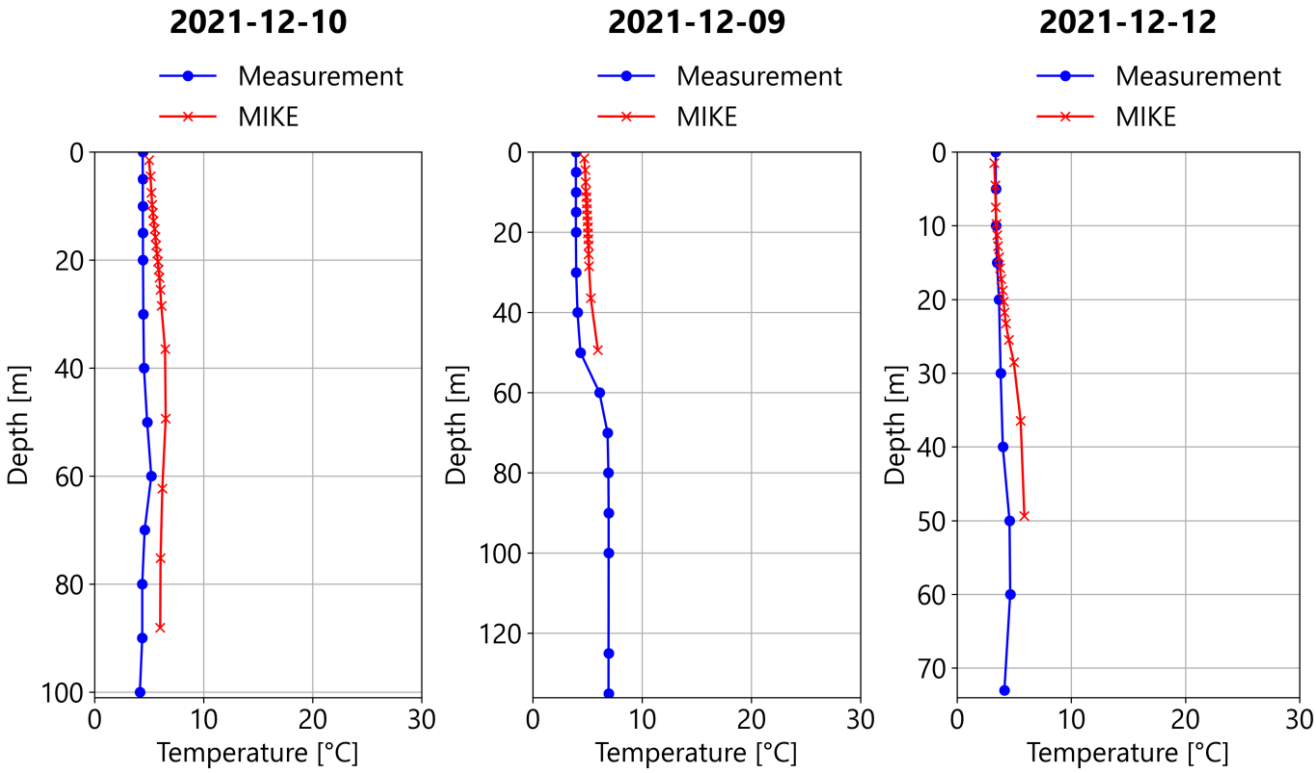



*Comparison between modelled and measured temperature profiles at location F2 (source: merihavainnot.fi)*

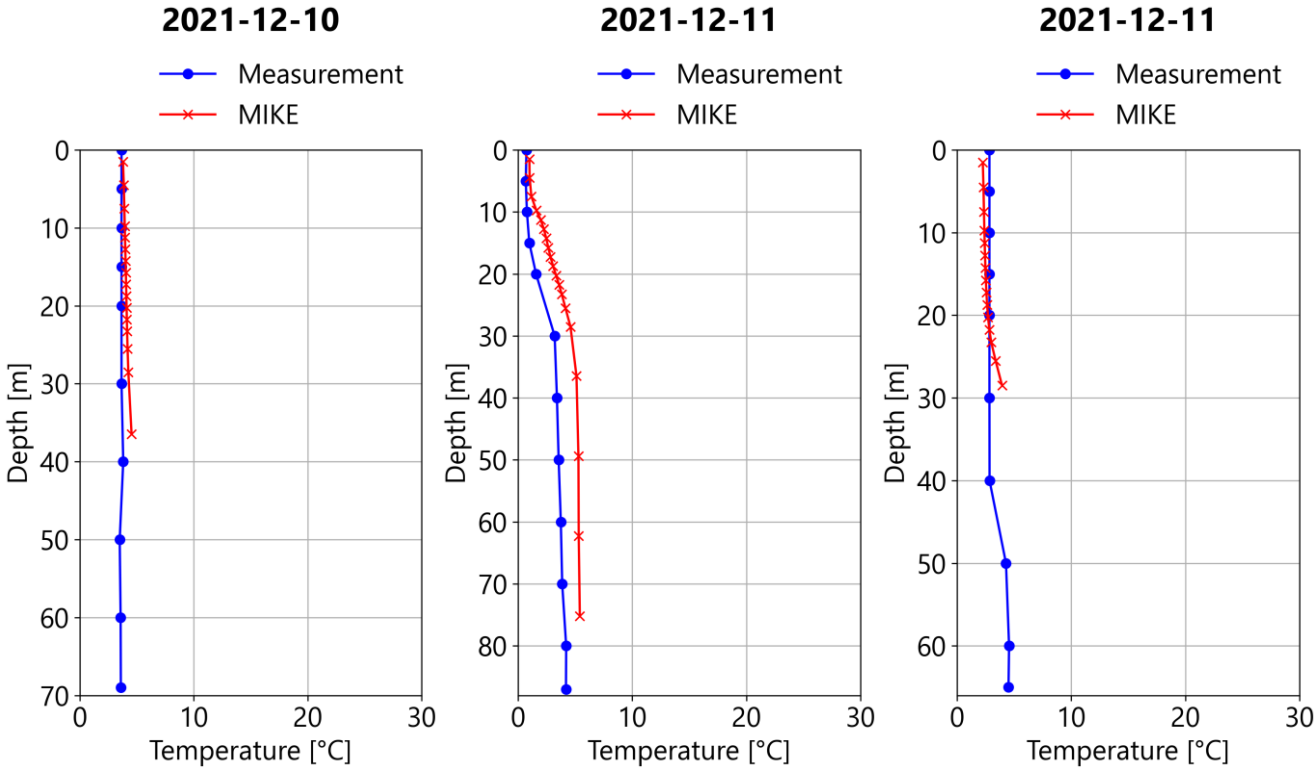
## Profiles from SMHI



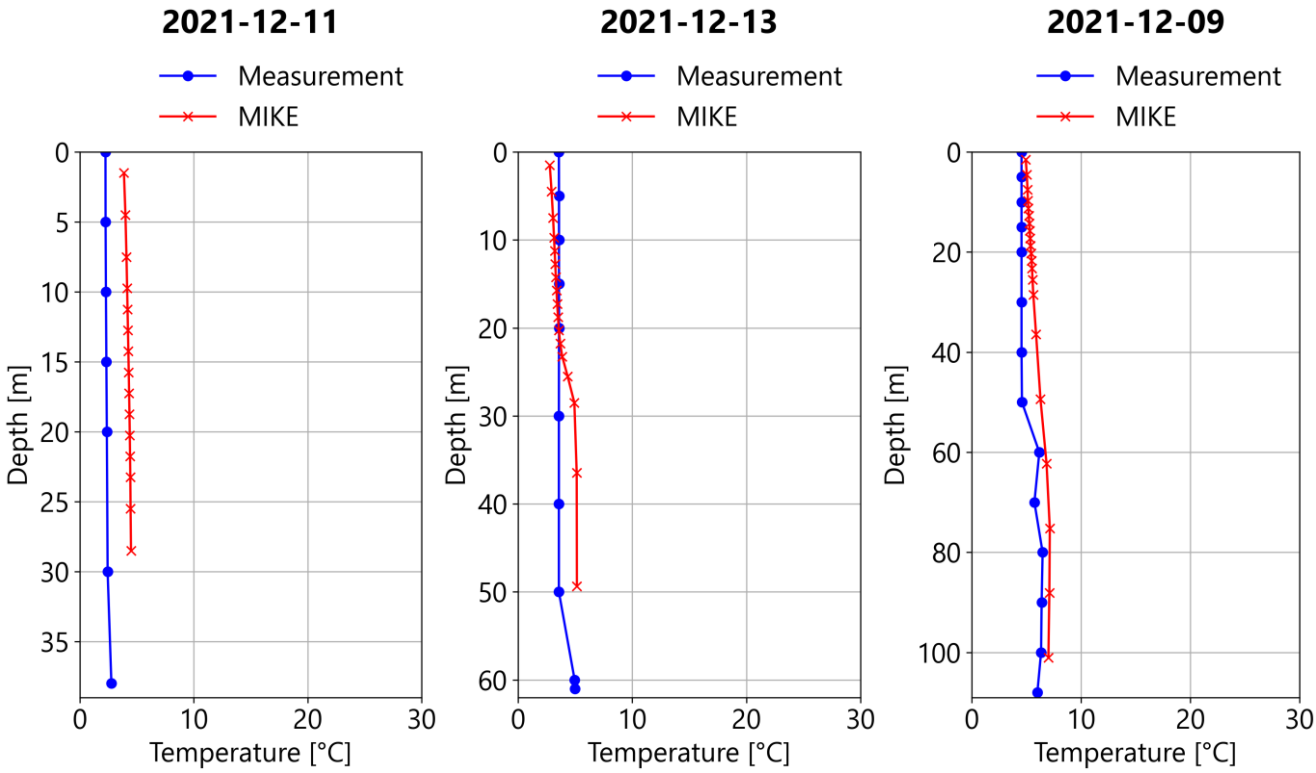

*Comparison between modelled and measured temperature profiles at location A5, F13, and F16 (from left to right, source: SMHI)*



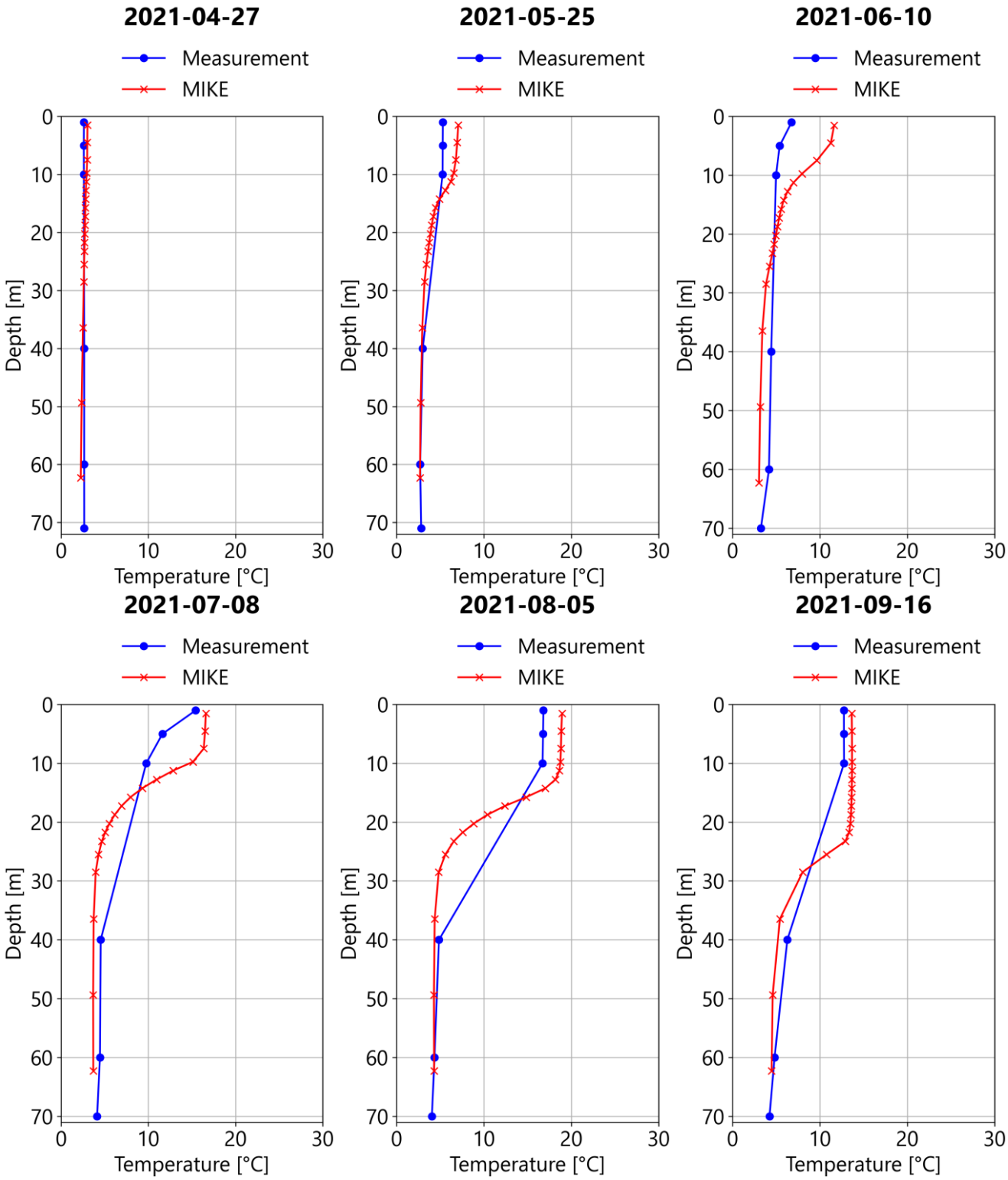

*Comparison between modelled and measured temperature profiles at location F18 SYDOSTBROTTEN, F33 GRUNDKALLEN, and MS2 (from left to right, source: SMHI)*



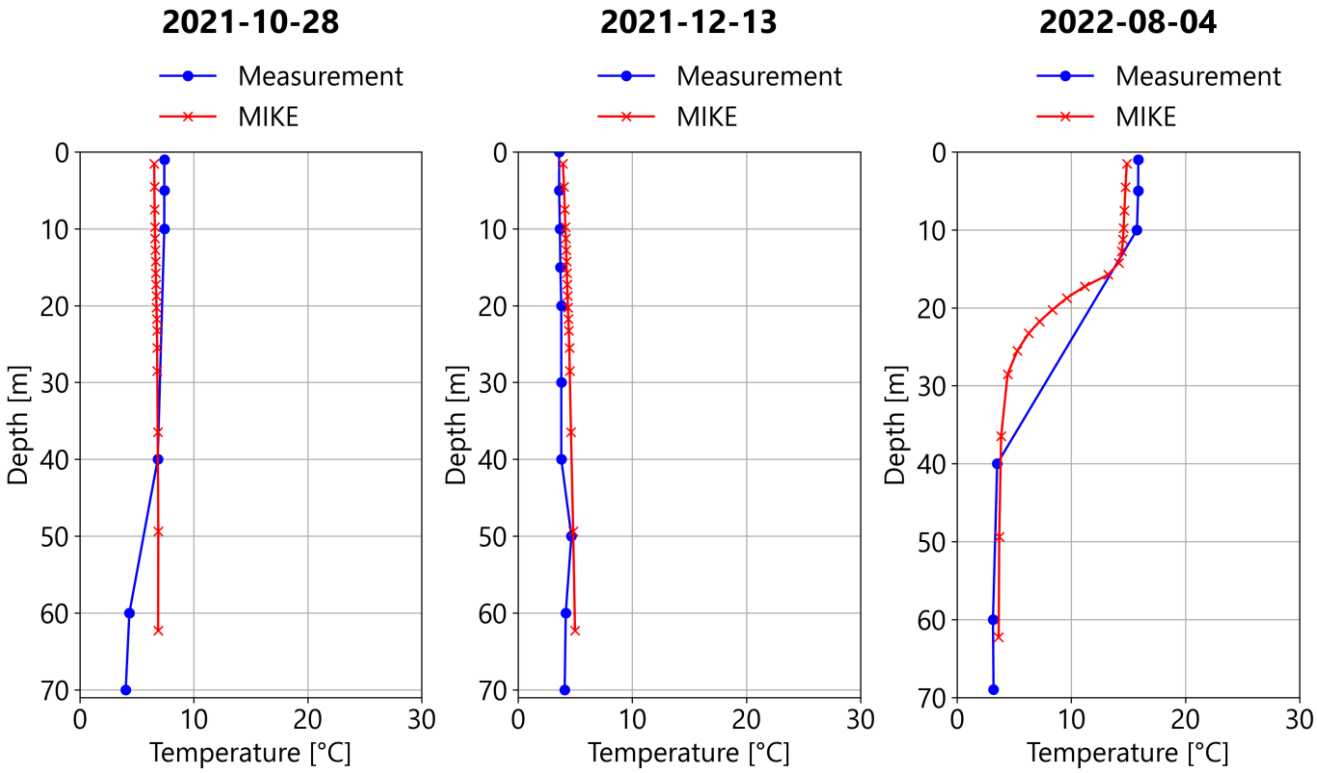

*Comparison between modelled and measured temperature profiles at location MS6, RR1, and RR5 (from left to right, source: SMHI)*




*Comparison between modelled and measured temperature profiles at location SR1A, and SS29 (from left to right, source: SMHI)*

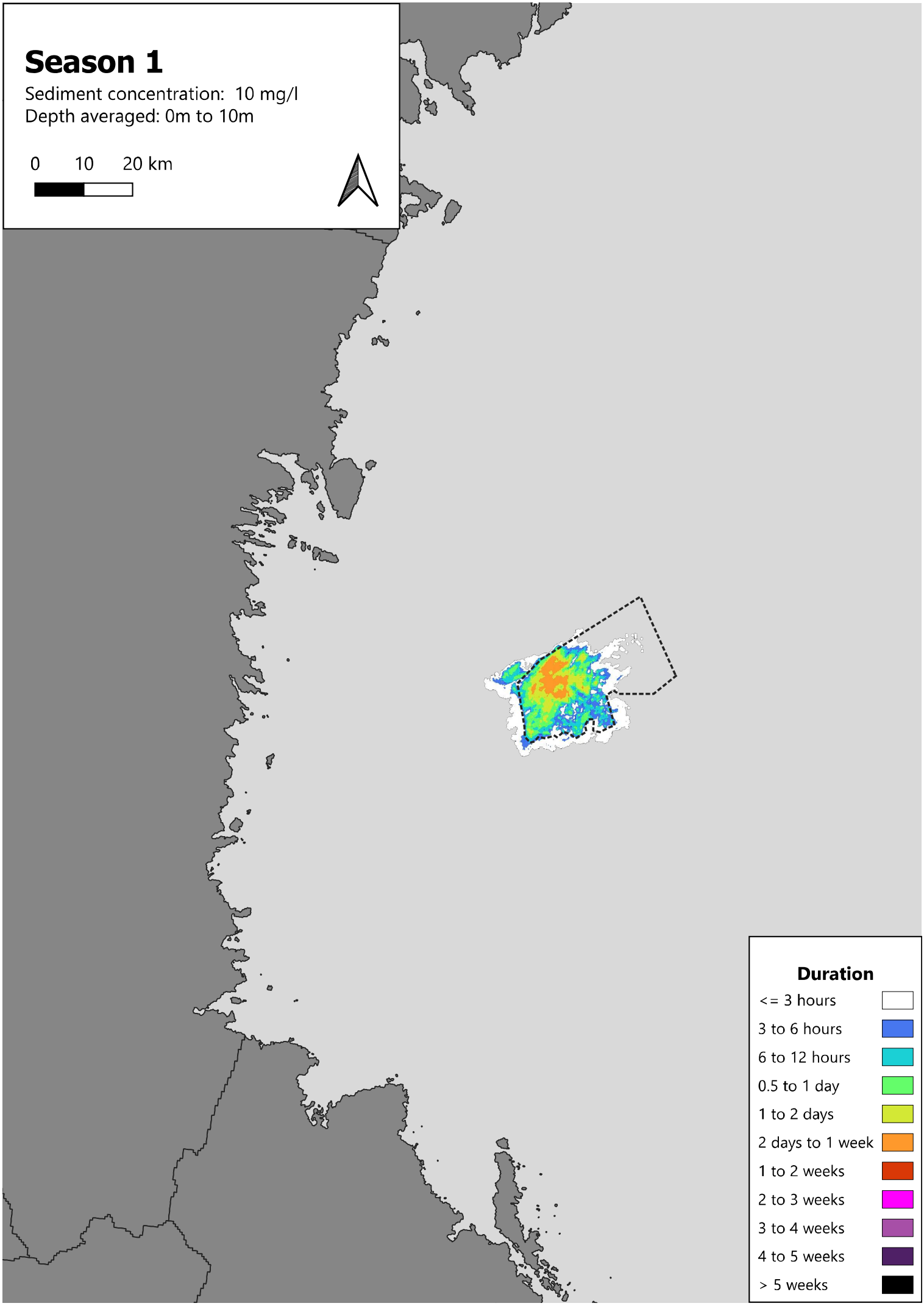


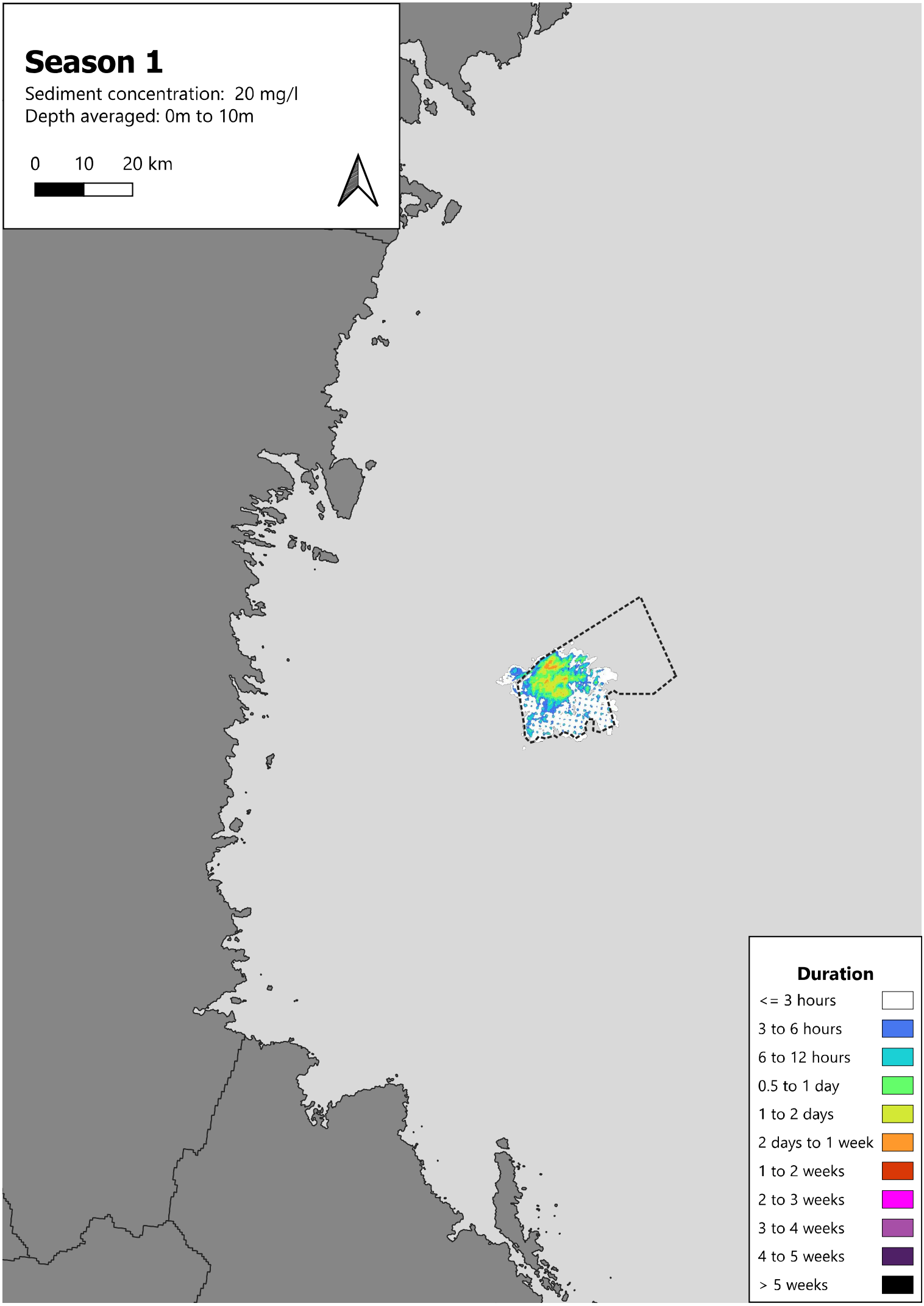

*Comparison between modelled and measured temperature profiles at location SR3 (from left to right, source: SMHI)*

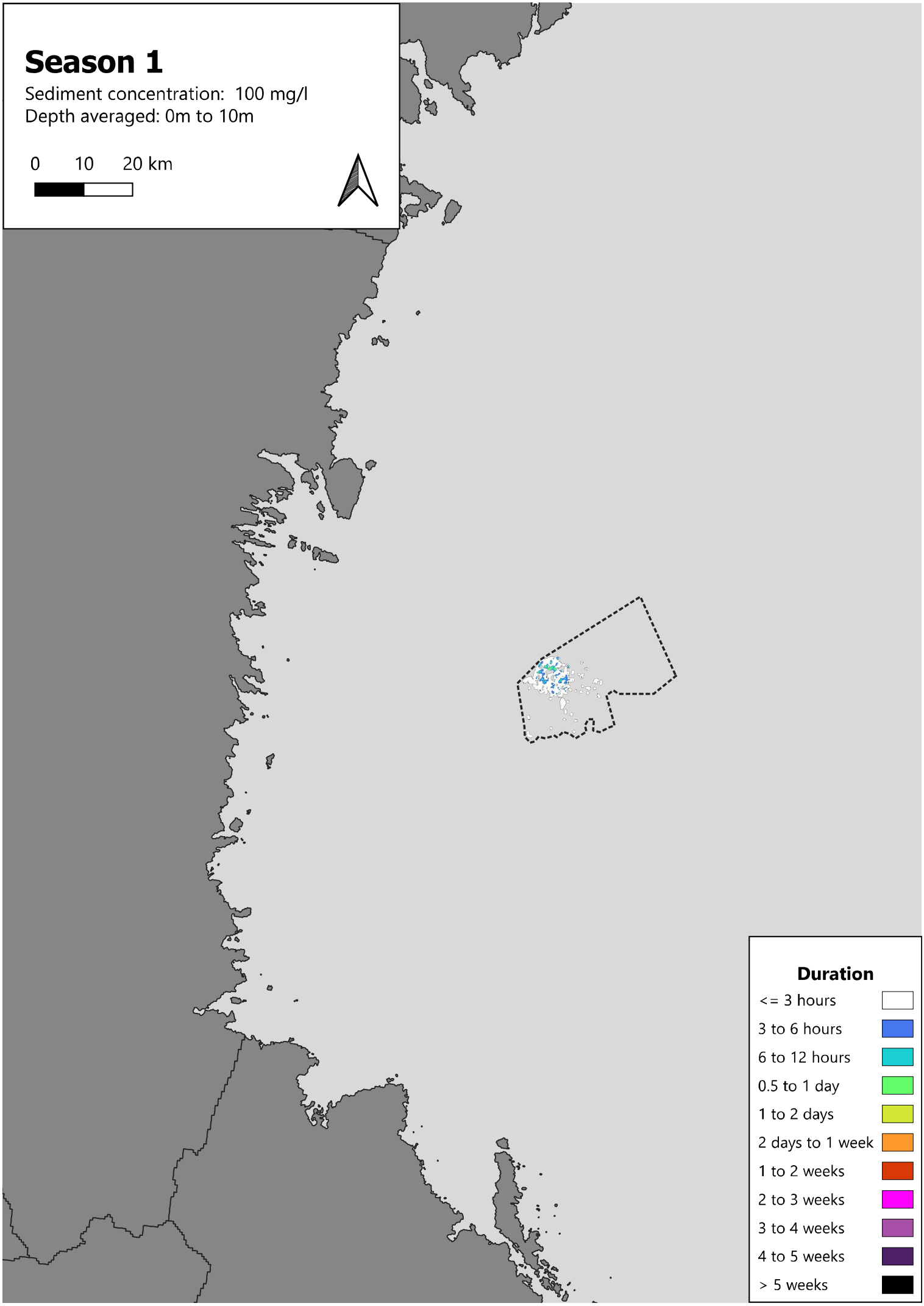


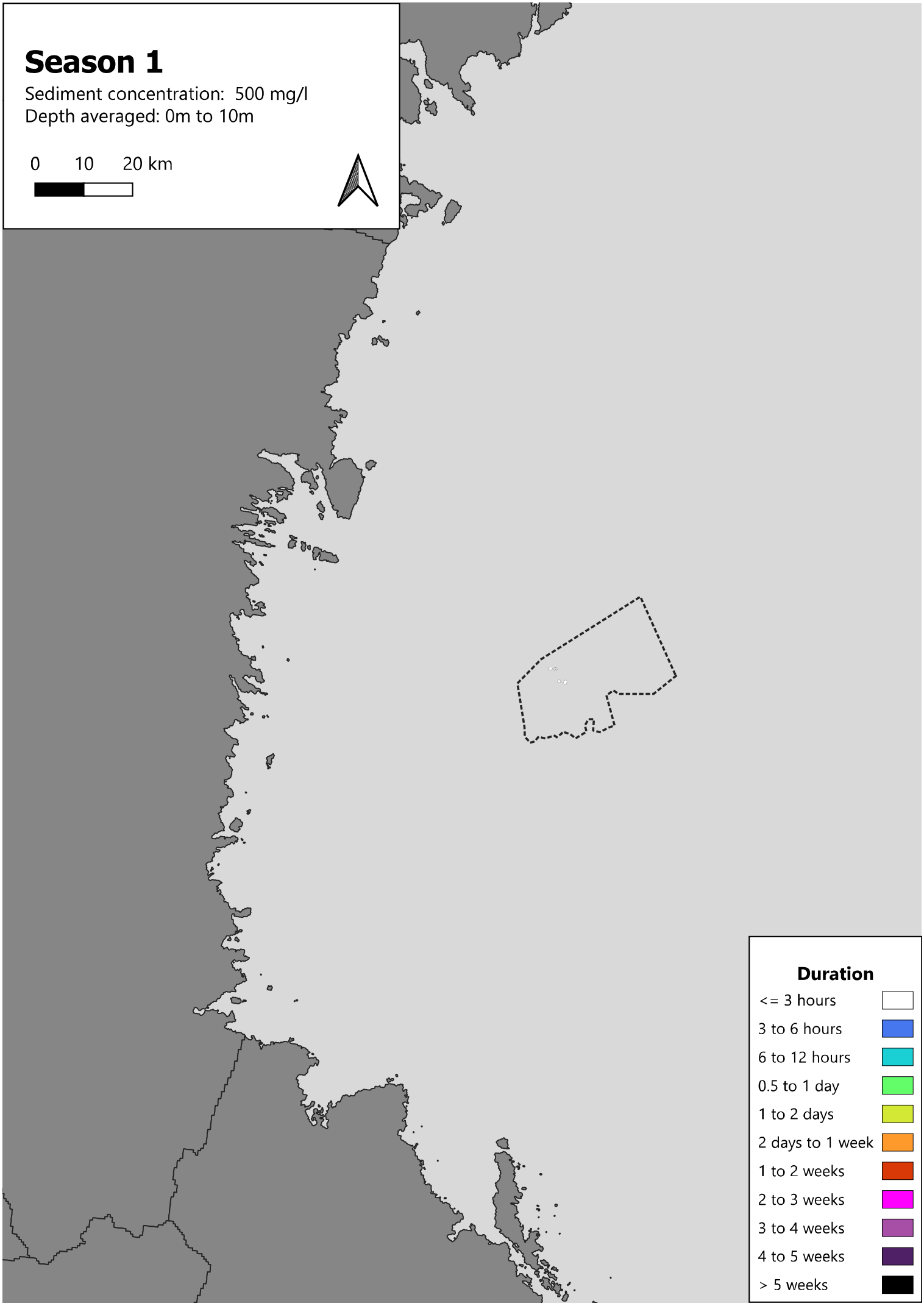

*Comparison between modelled and measured temperature profiles at location SR3 (from left to right, source: SMHI)*

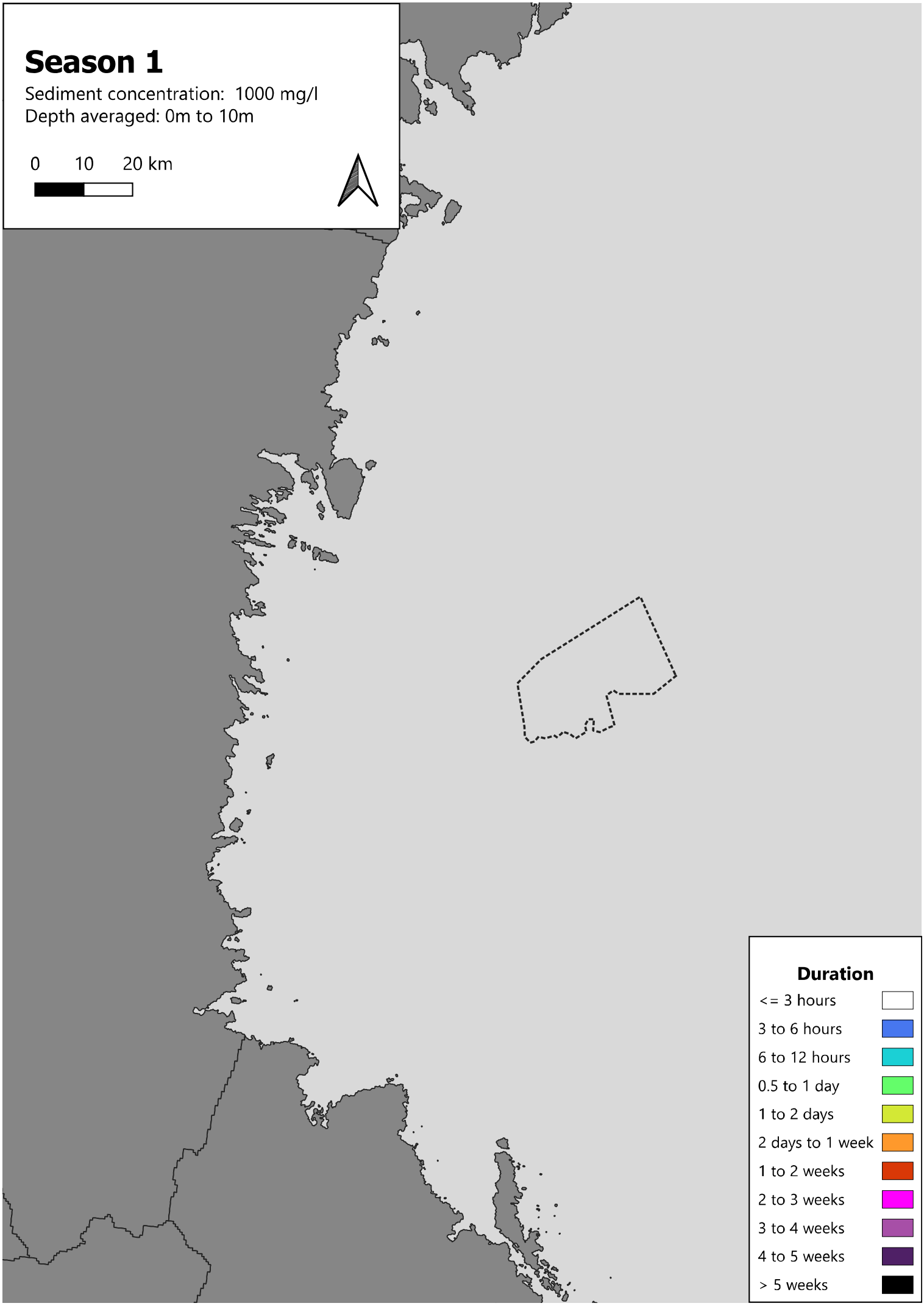
# Appendix 17 Sediment dispersal: Concentration – Season 1

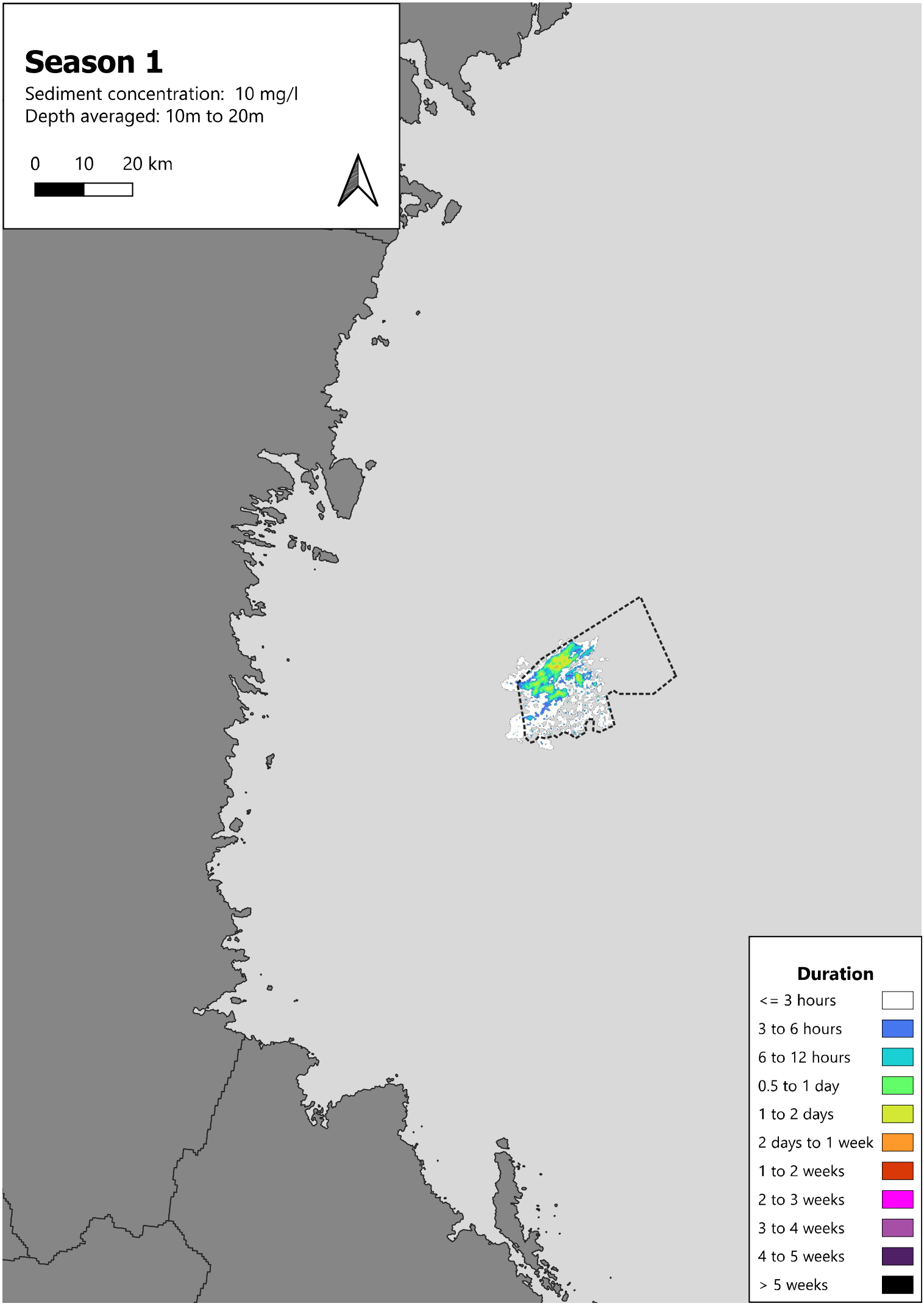

Season 1
Sediment concentration: 10 mg/l
Depth averaged: 0m to 10m
0
10
20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

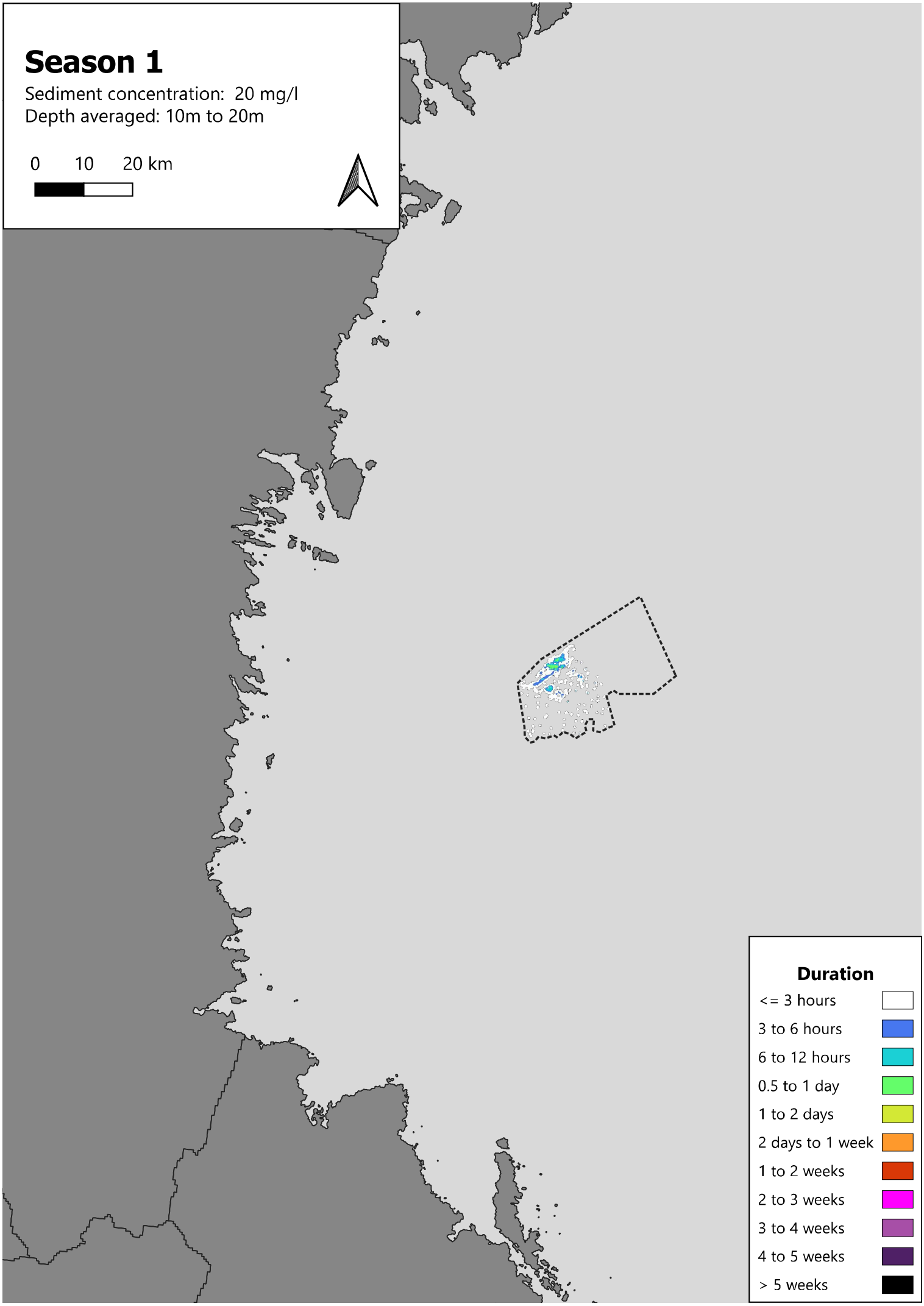

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

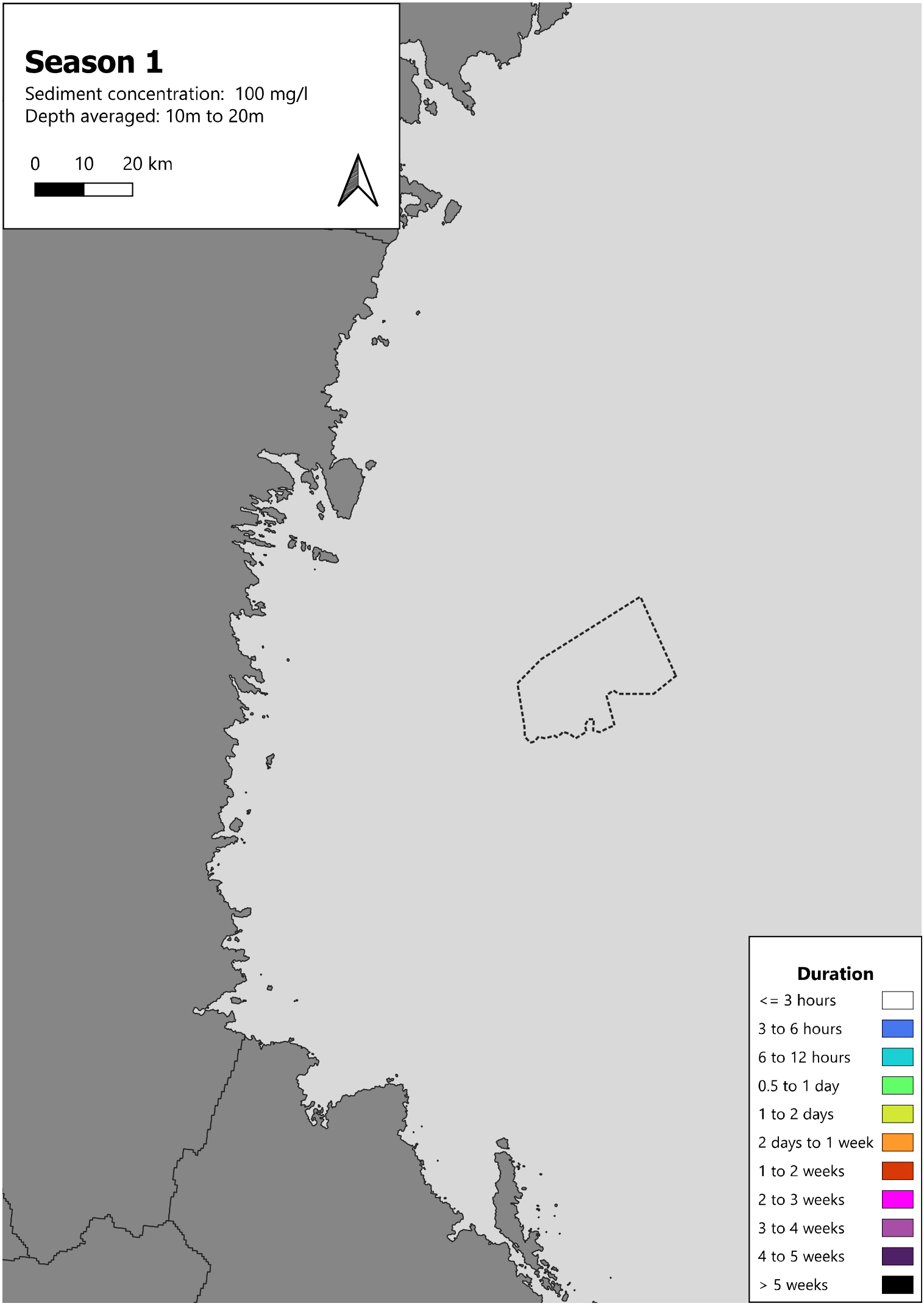

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

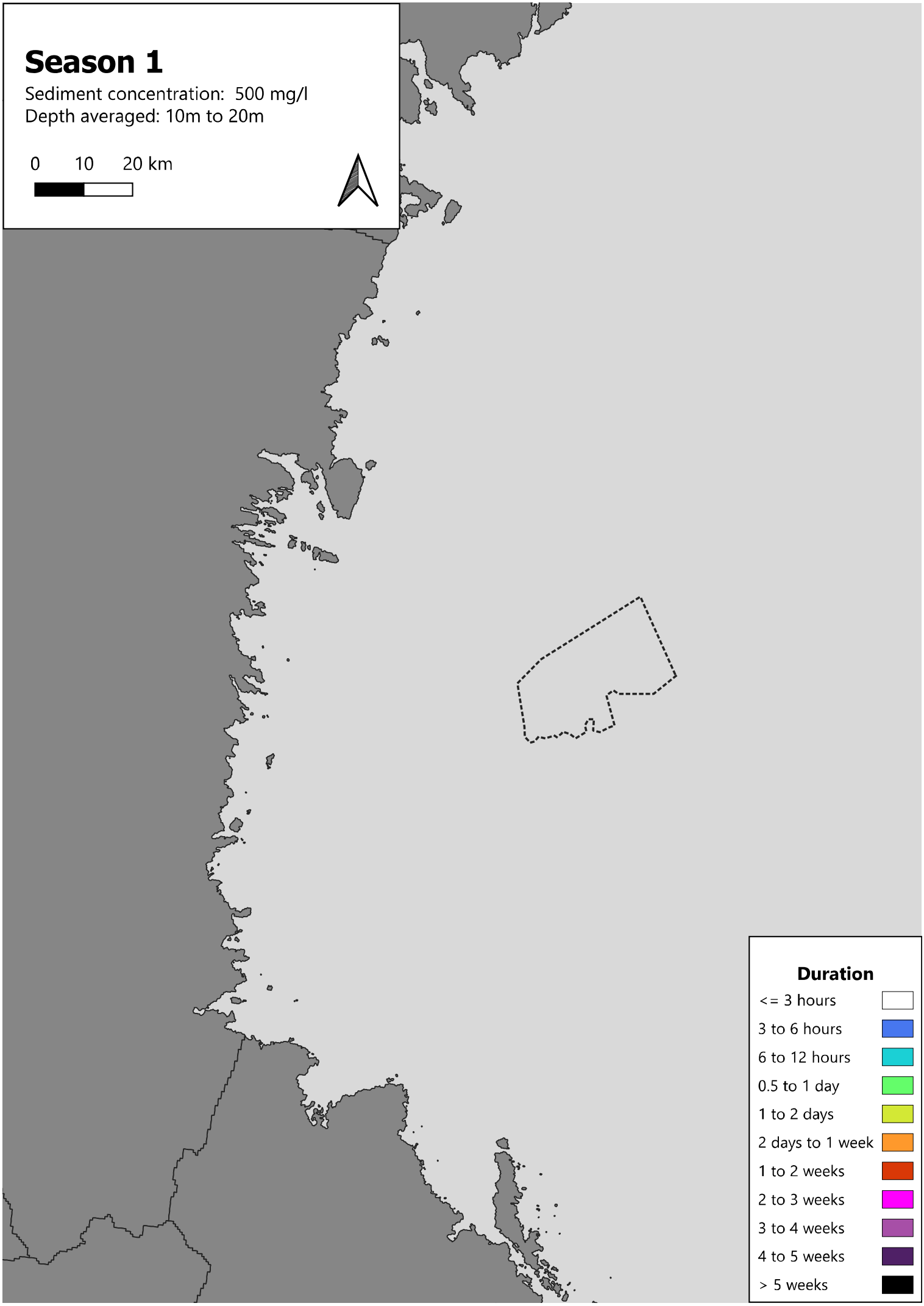

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

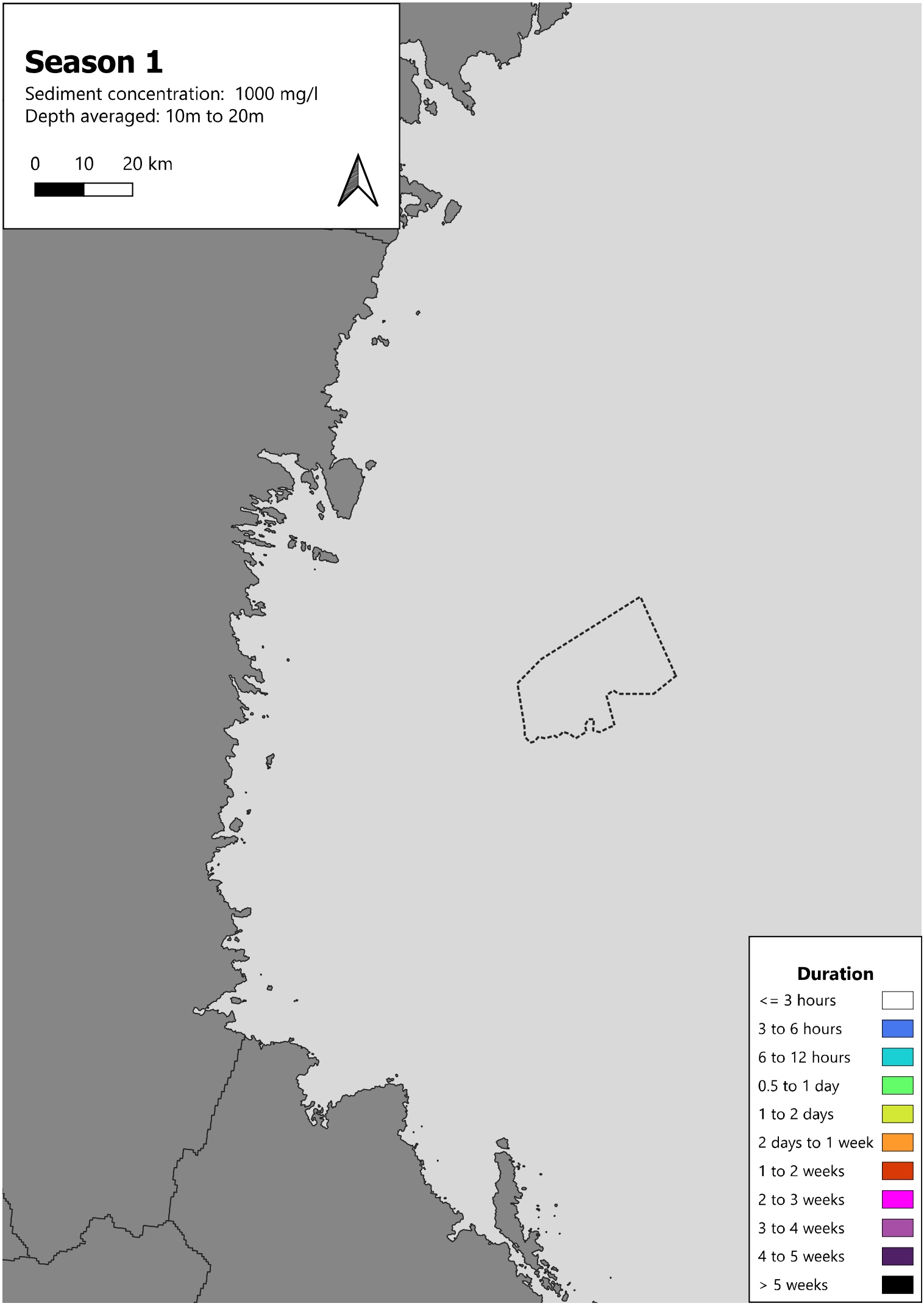

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

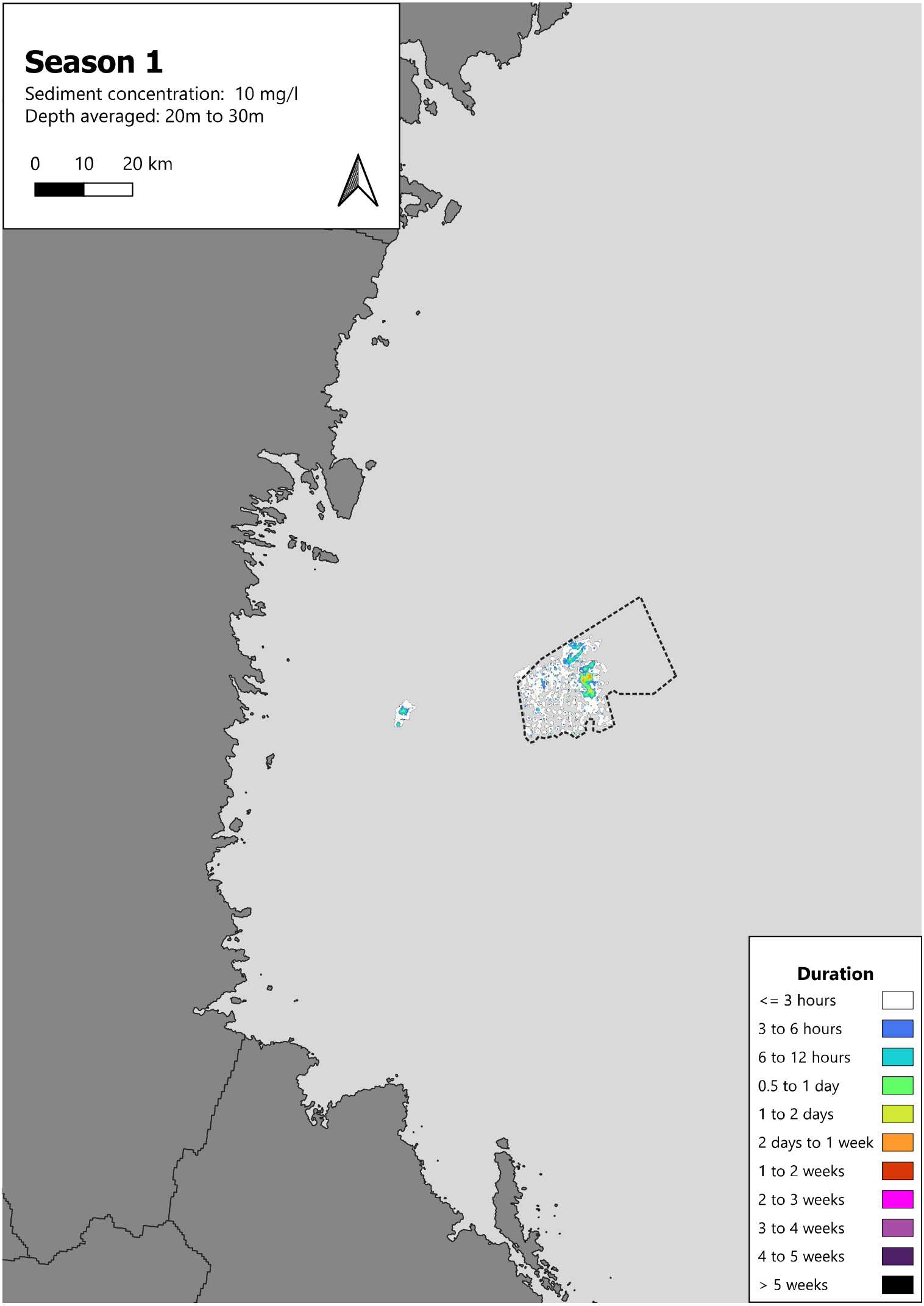

Season 1
Sediment concentration: 10 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

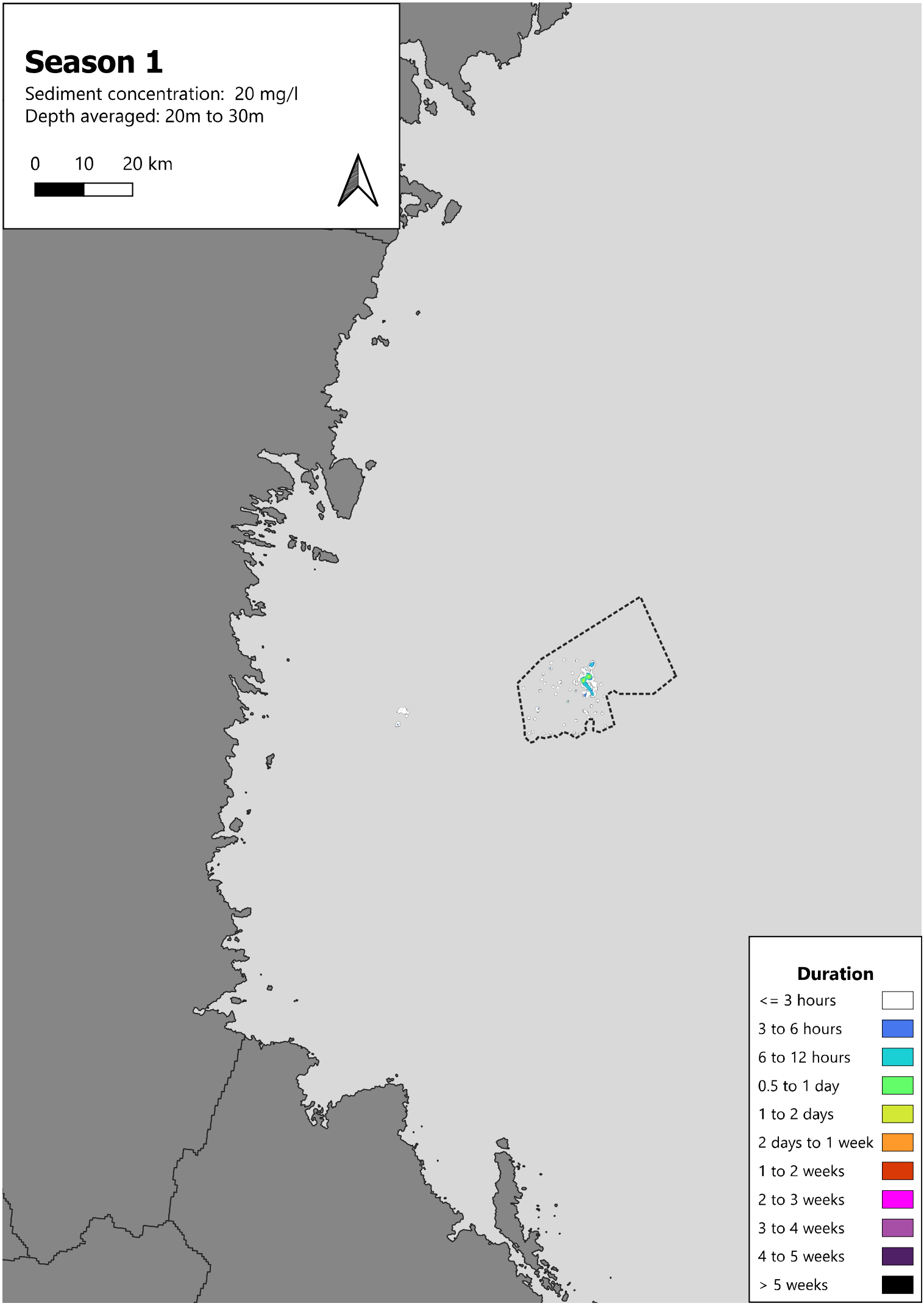

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

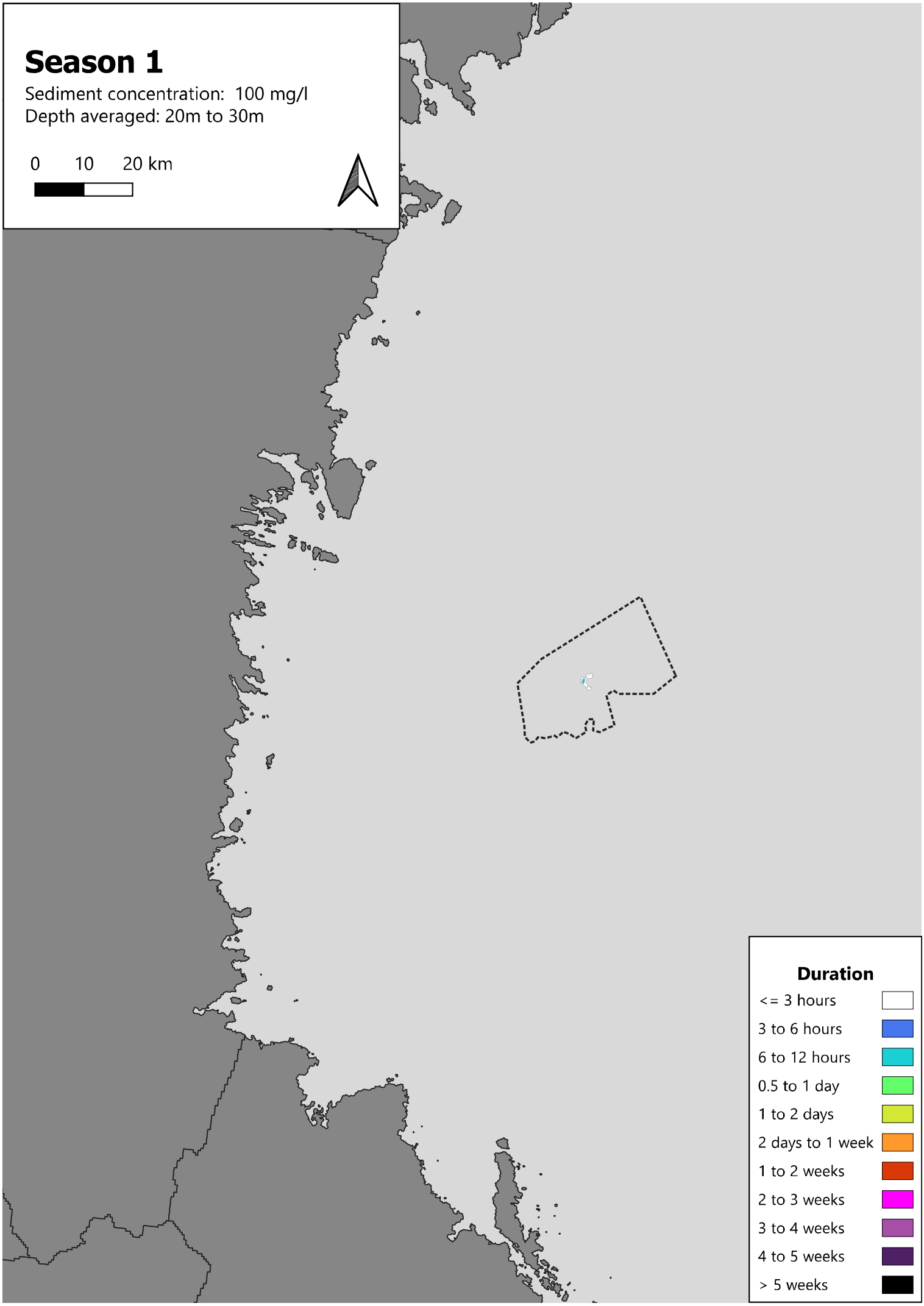

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

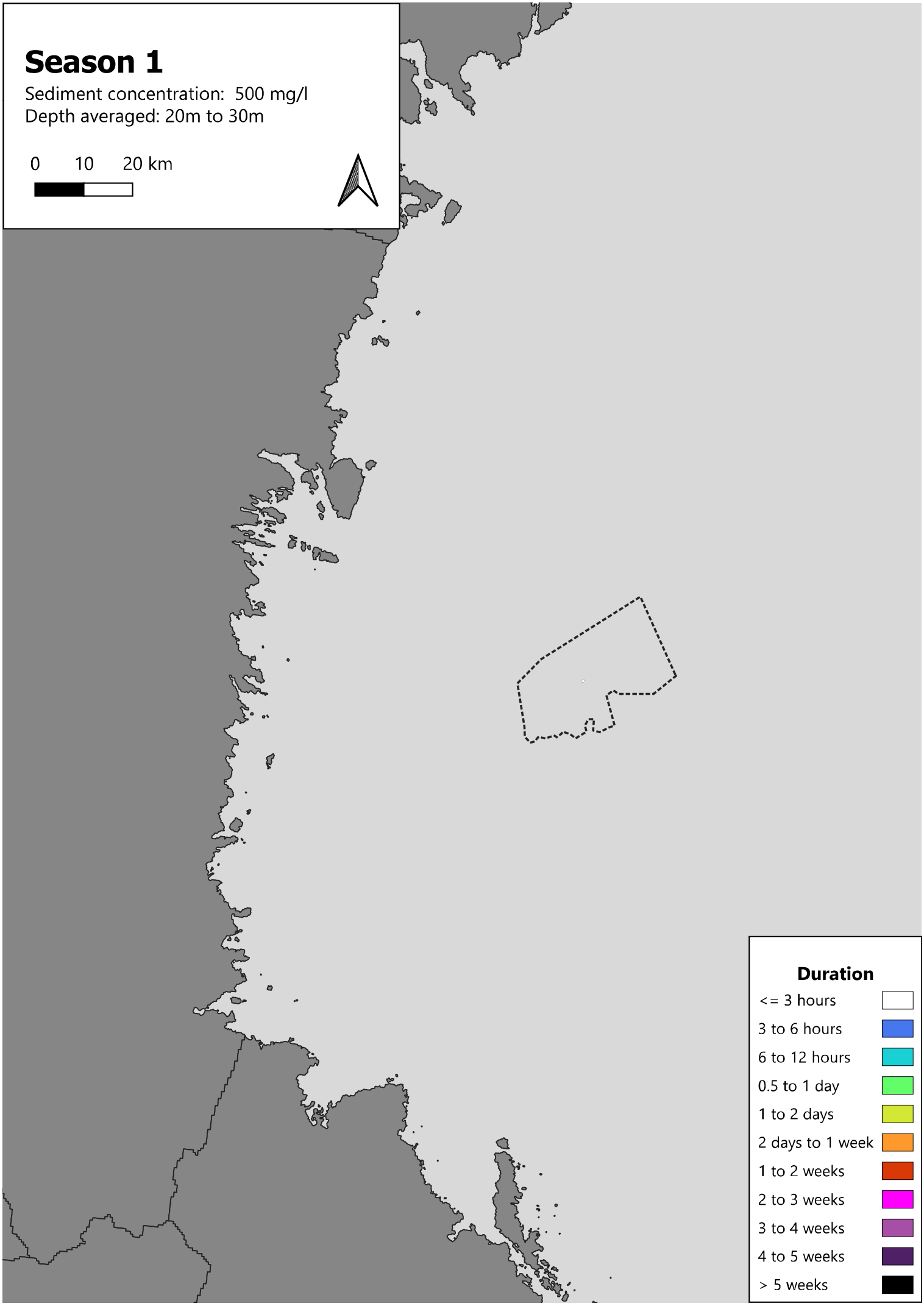

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

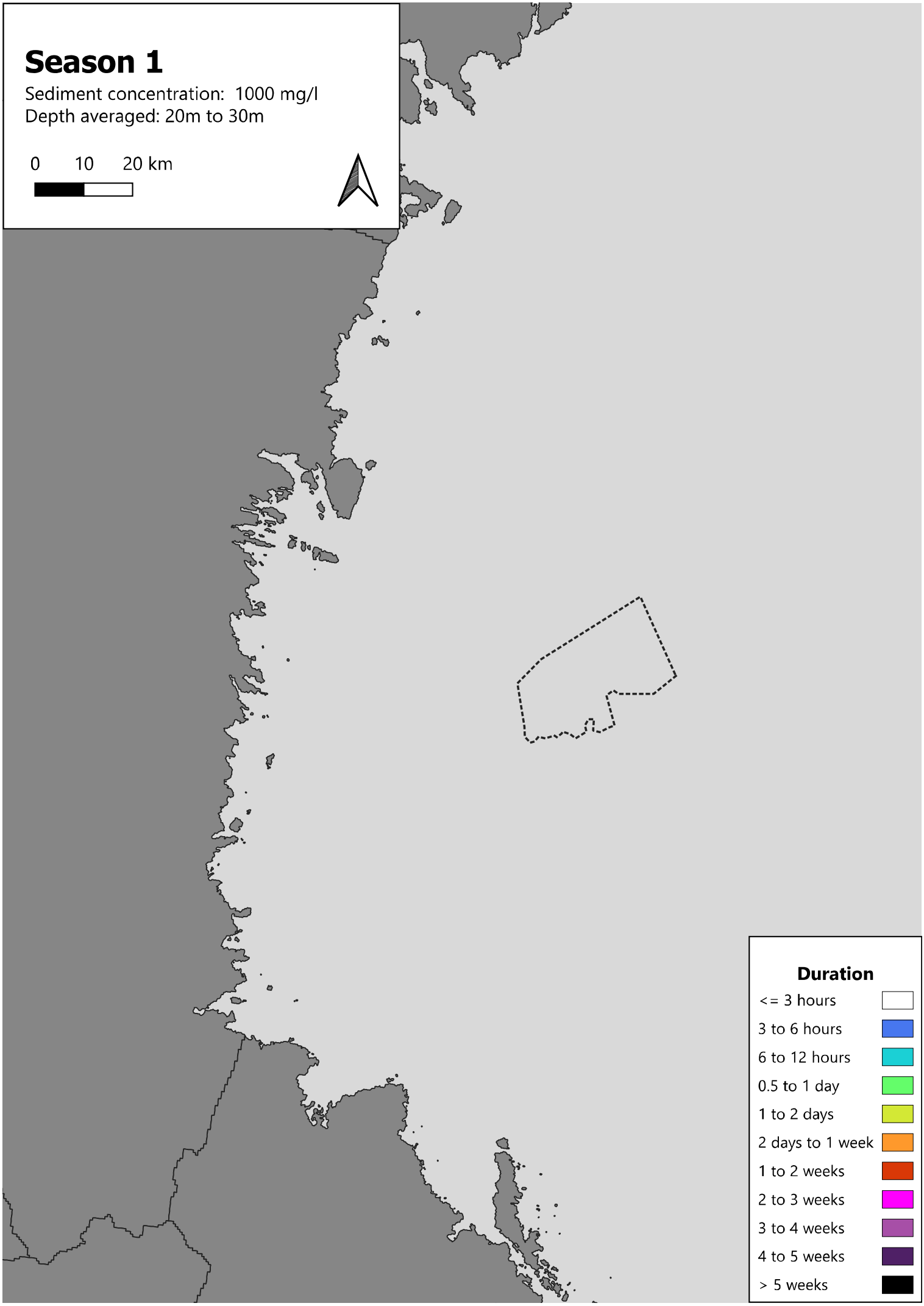

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

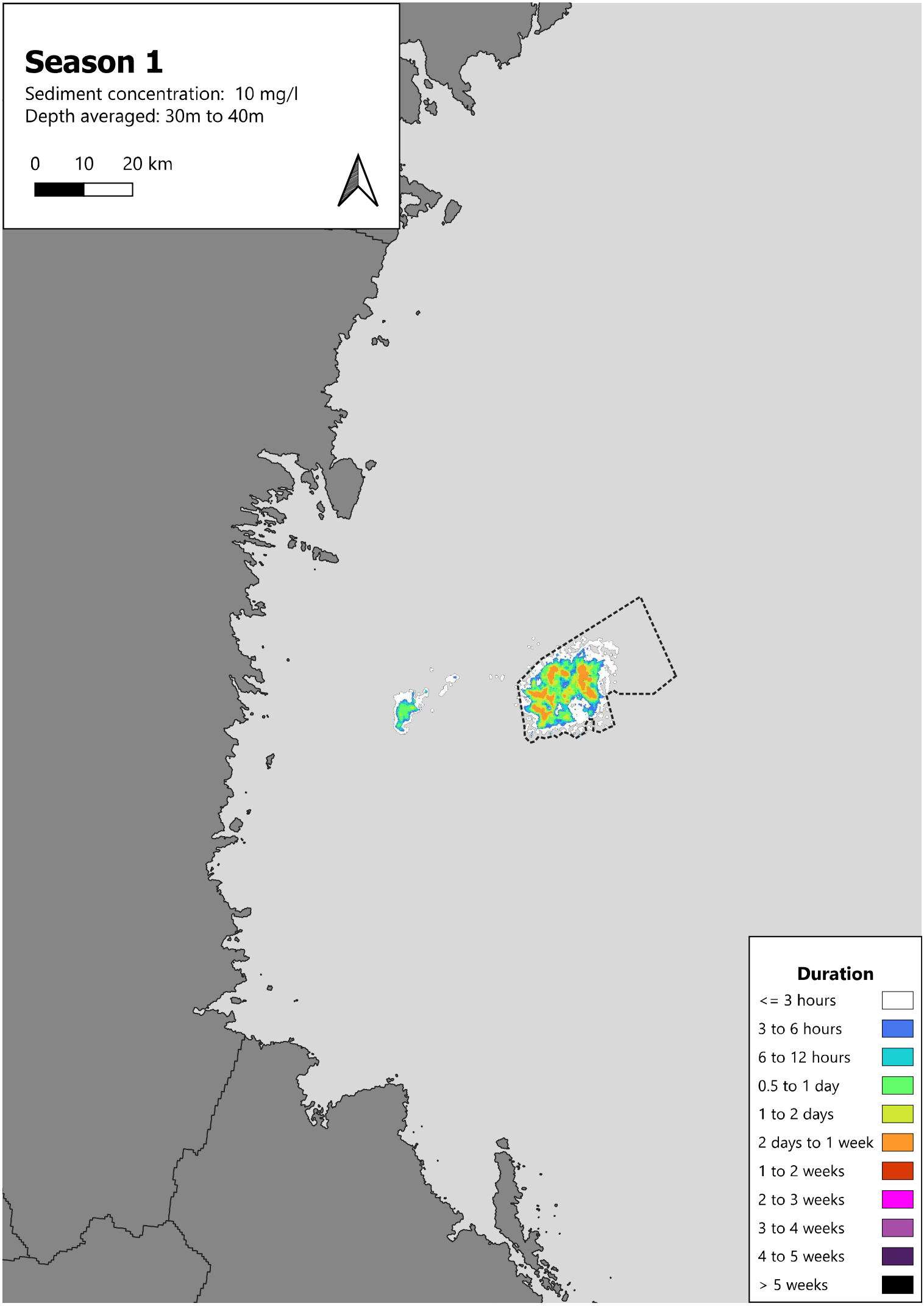

Season 1
Sediment concentration: 10 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

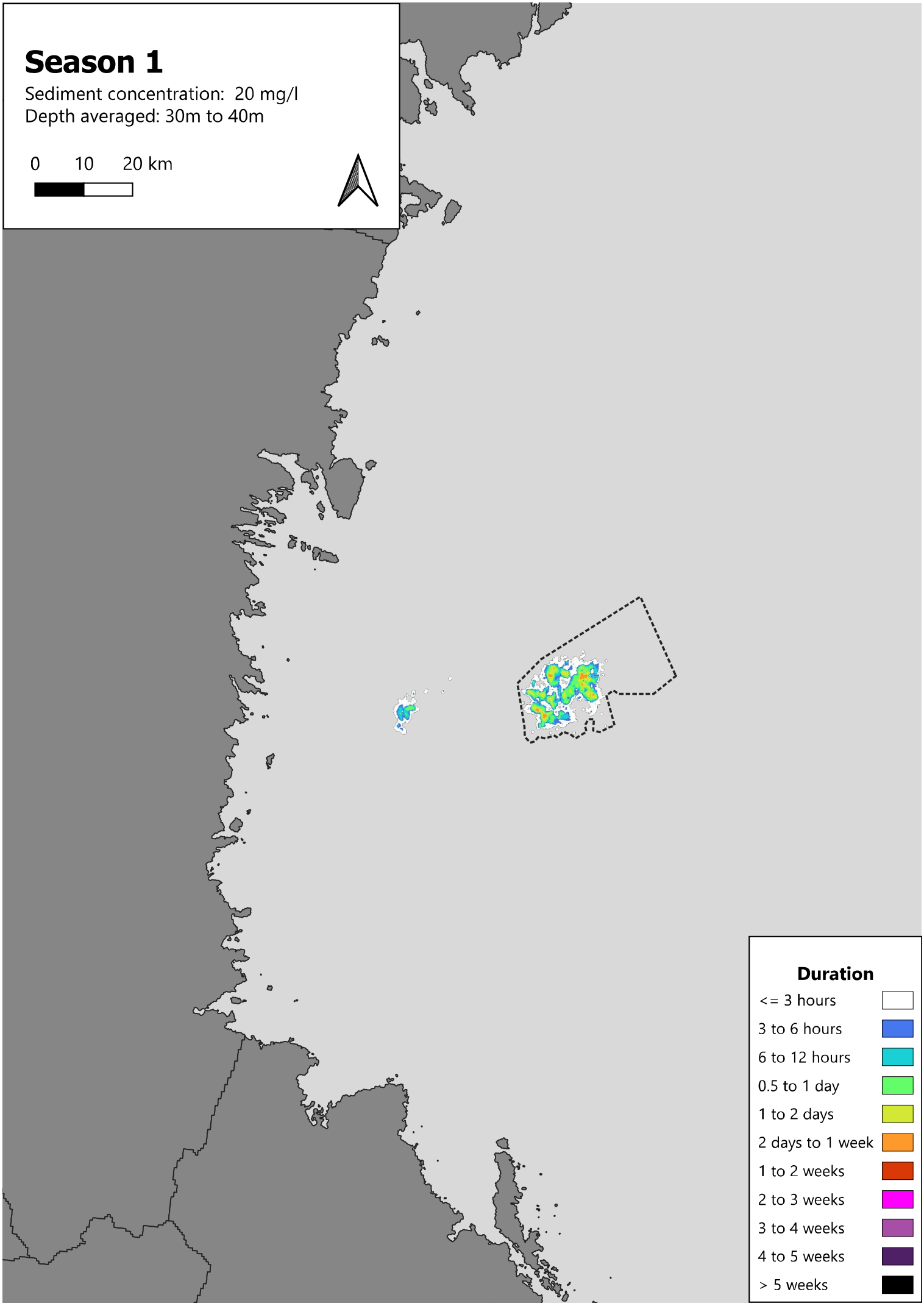

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

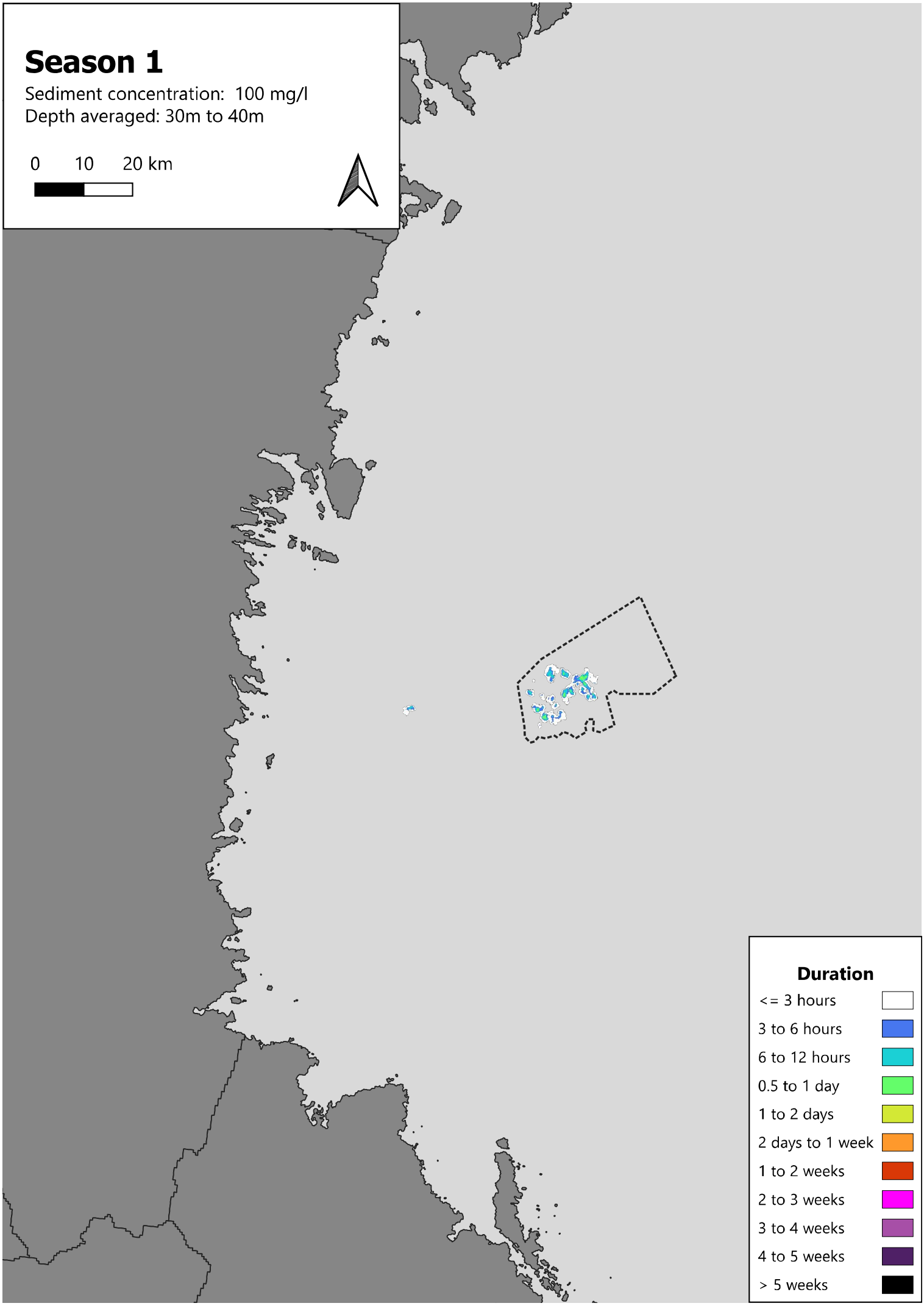

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

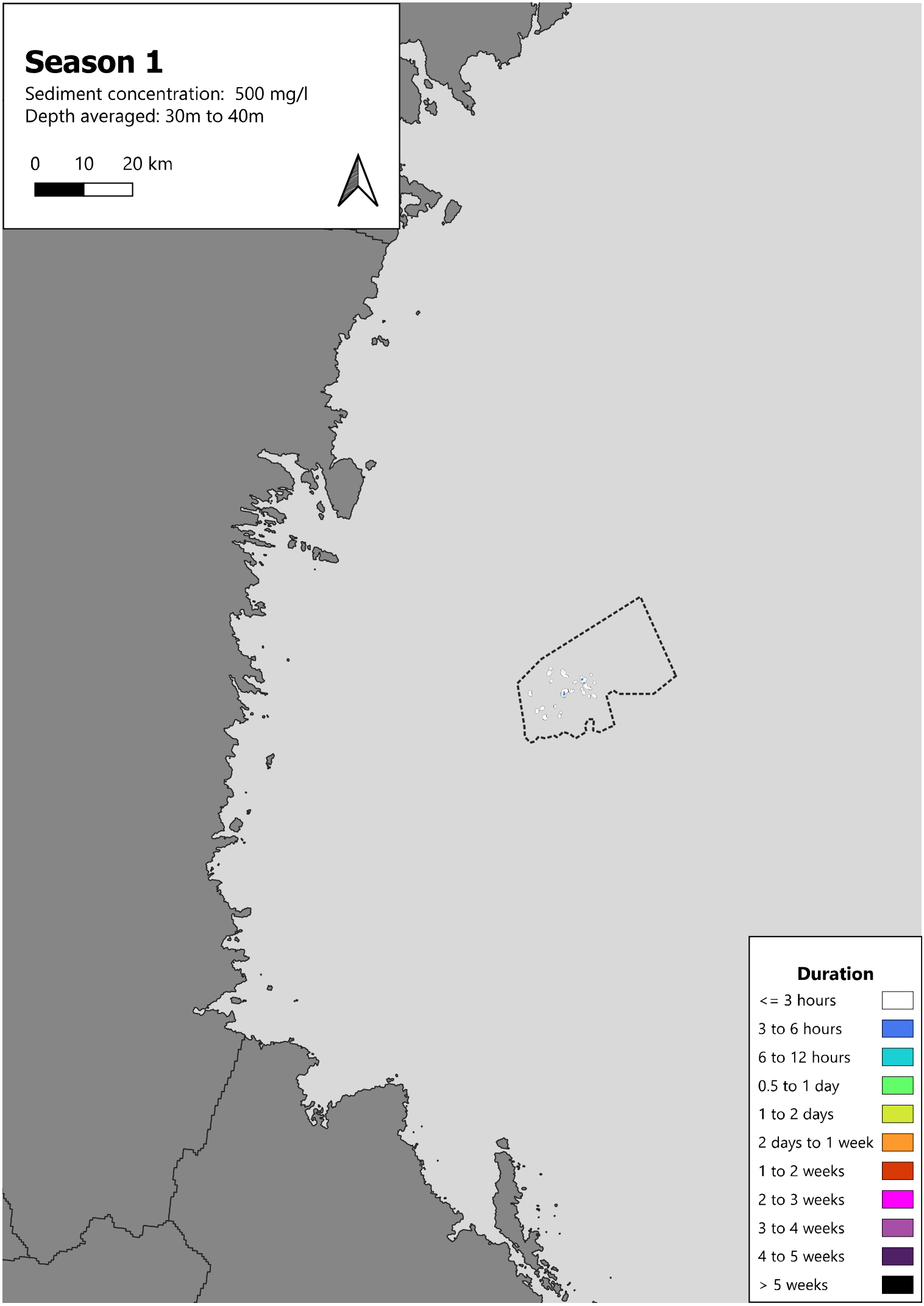

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

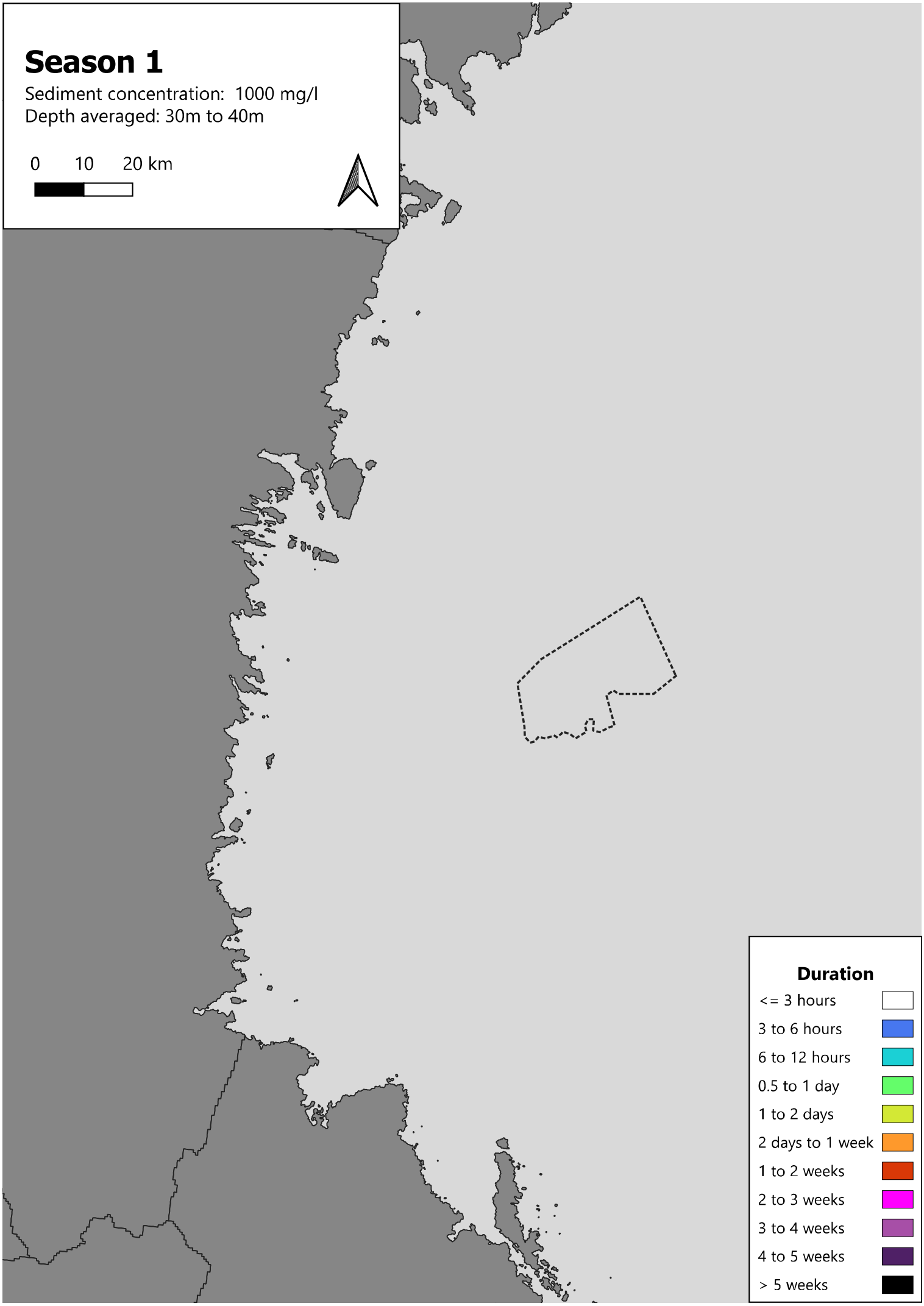

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

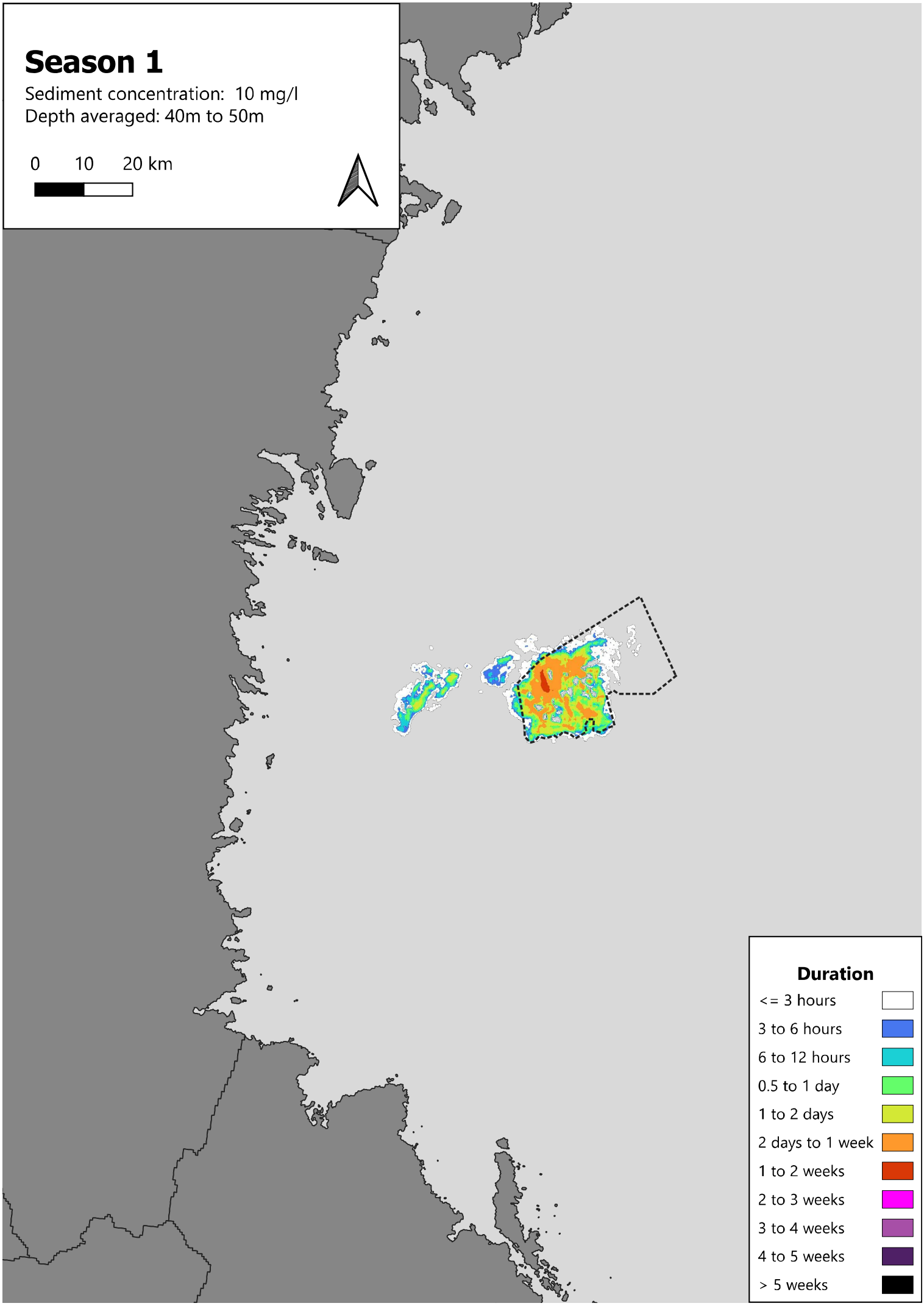

Season 1
Sediment concentration: 10 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

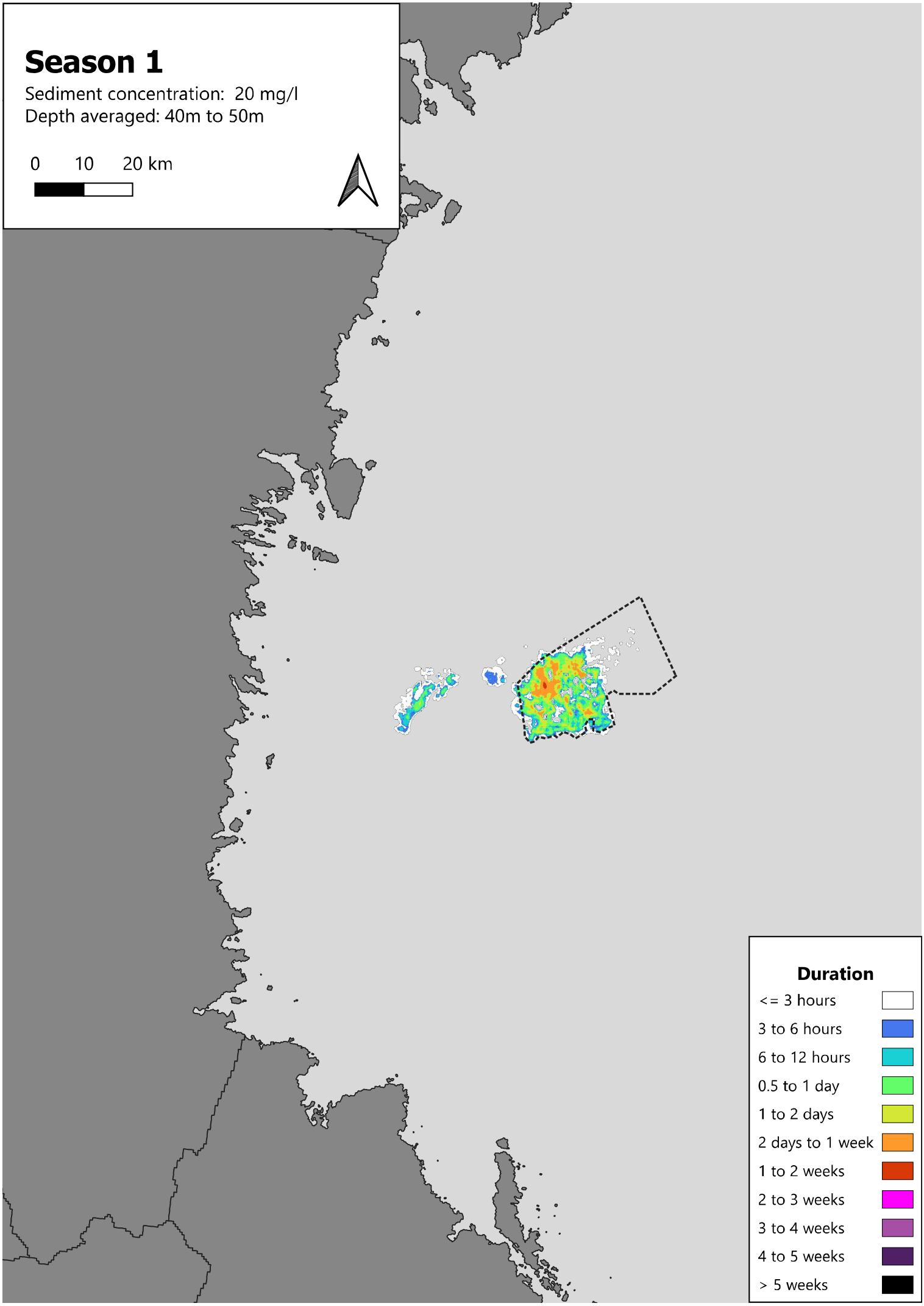

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

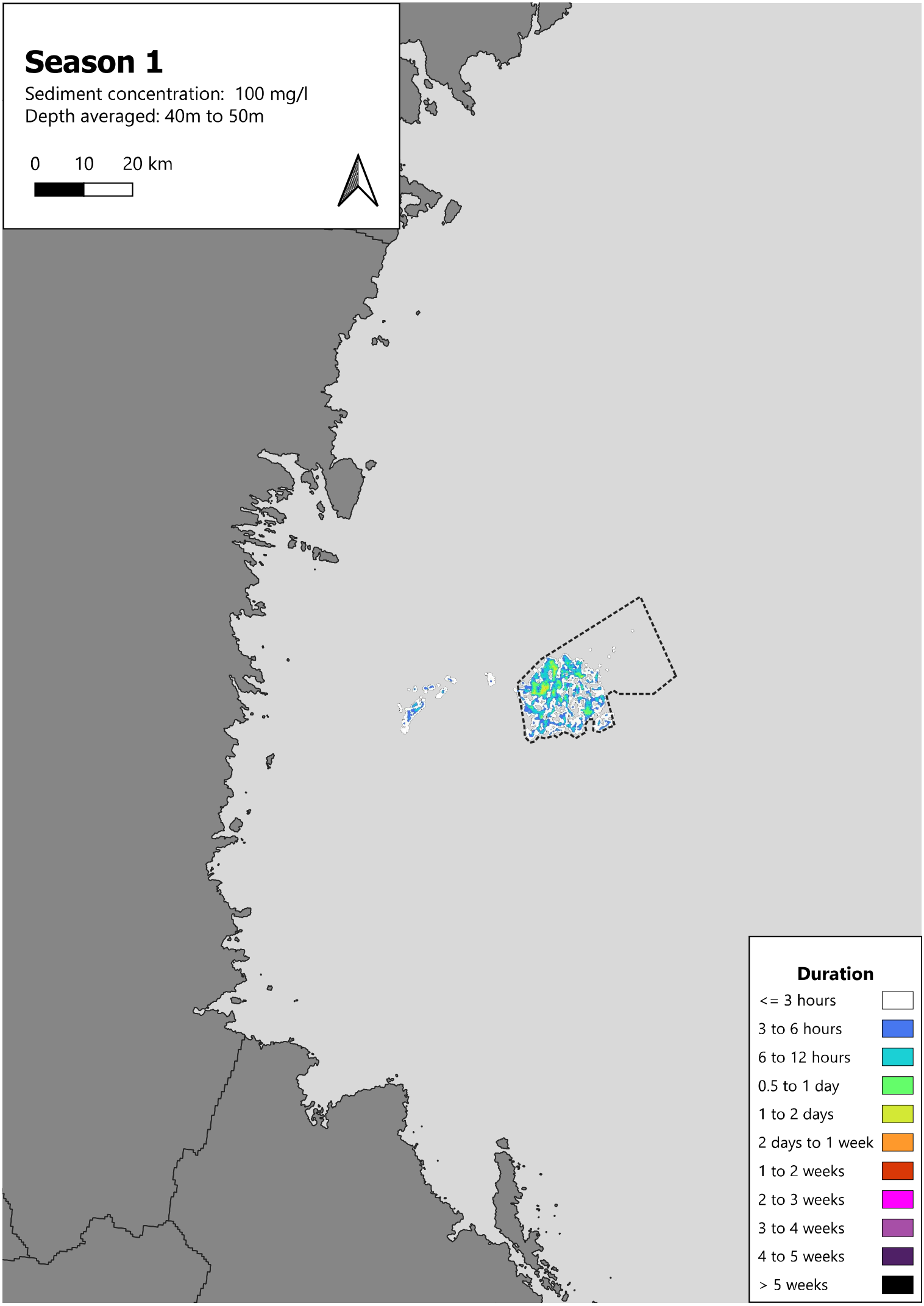

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

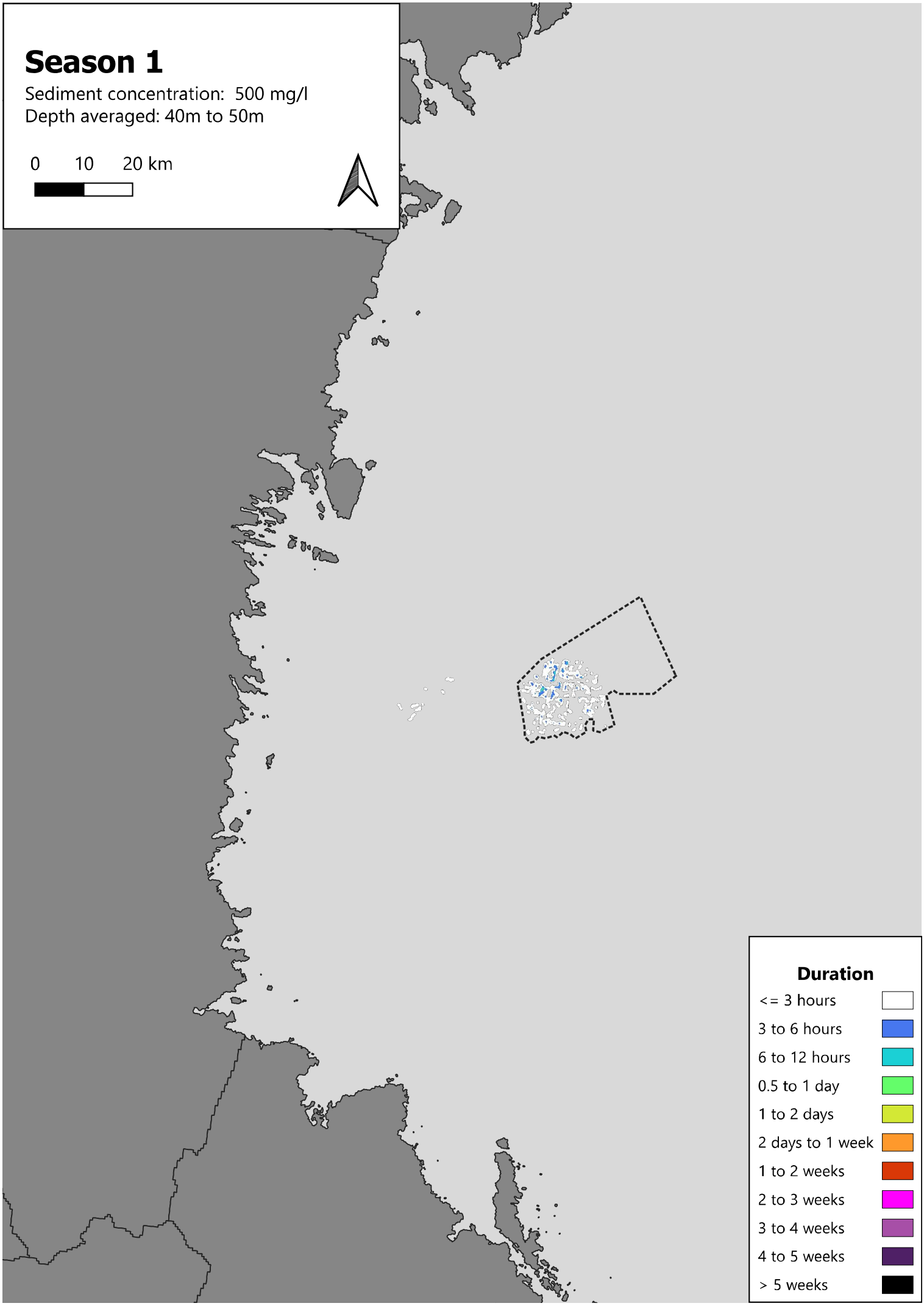

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

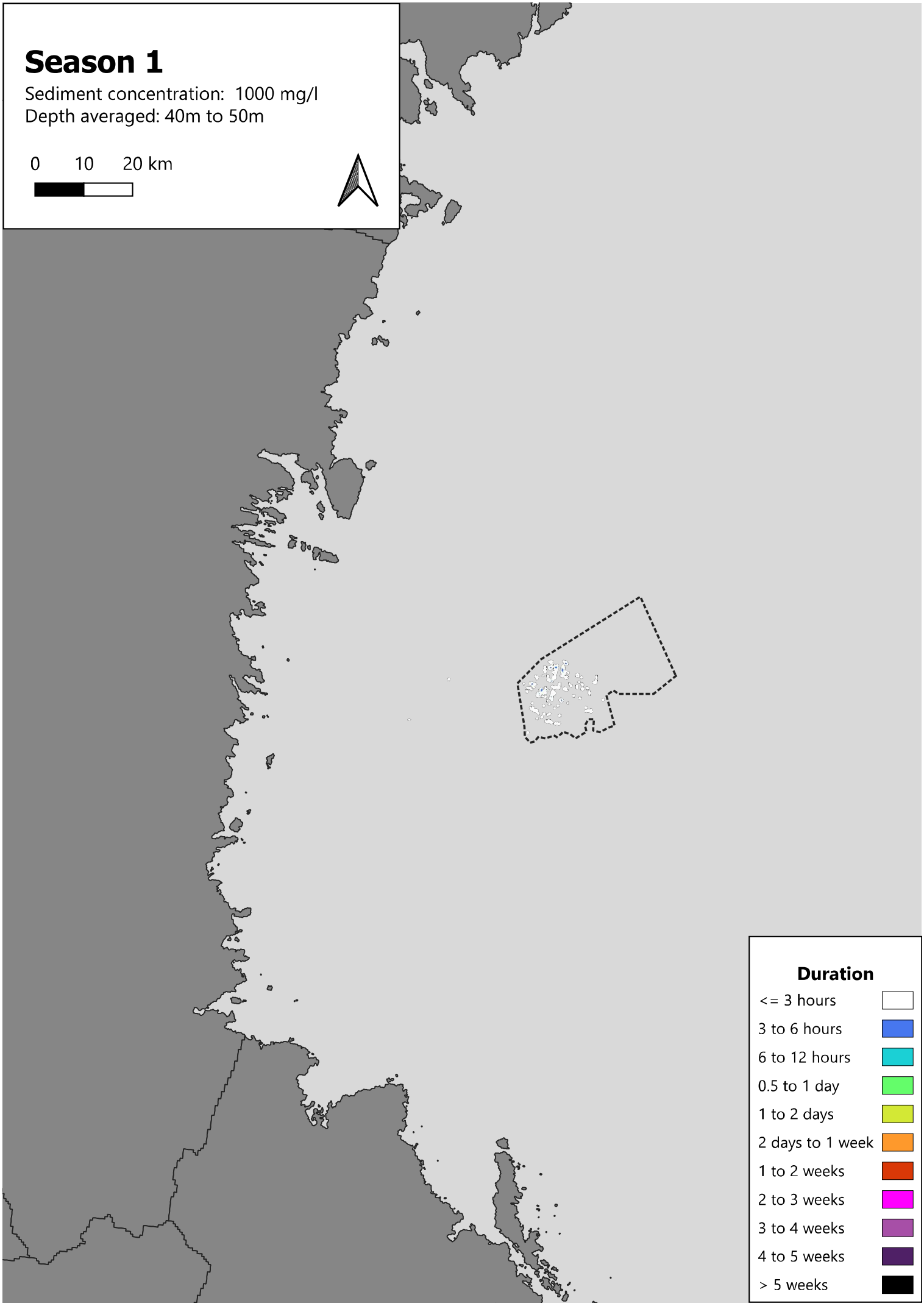

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

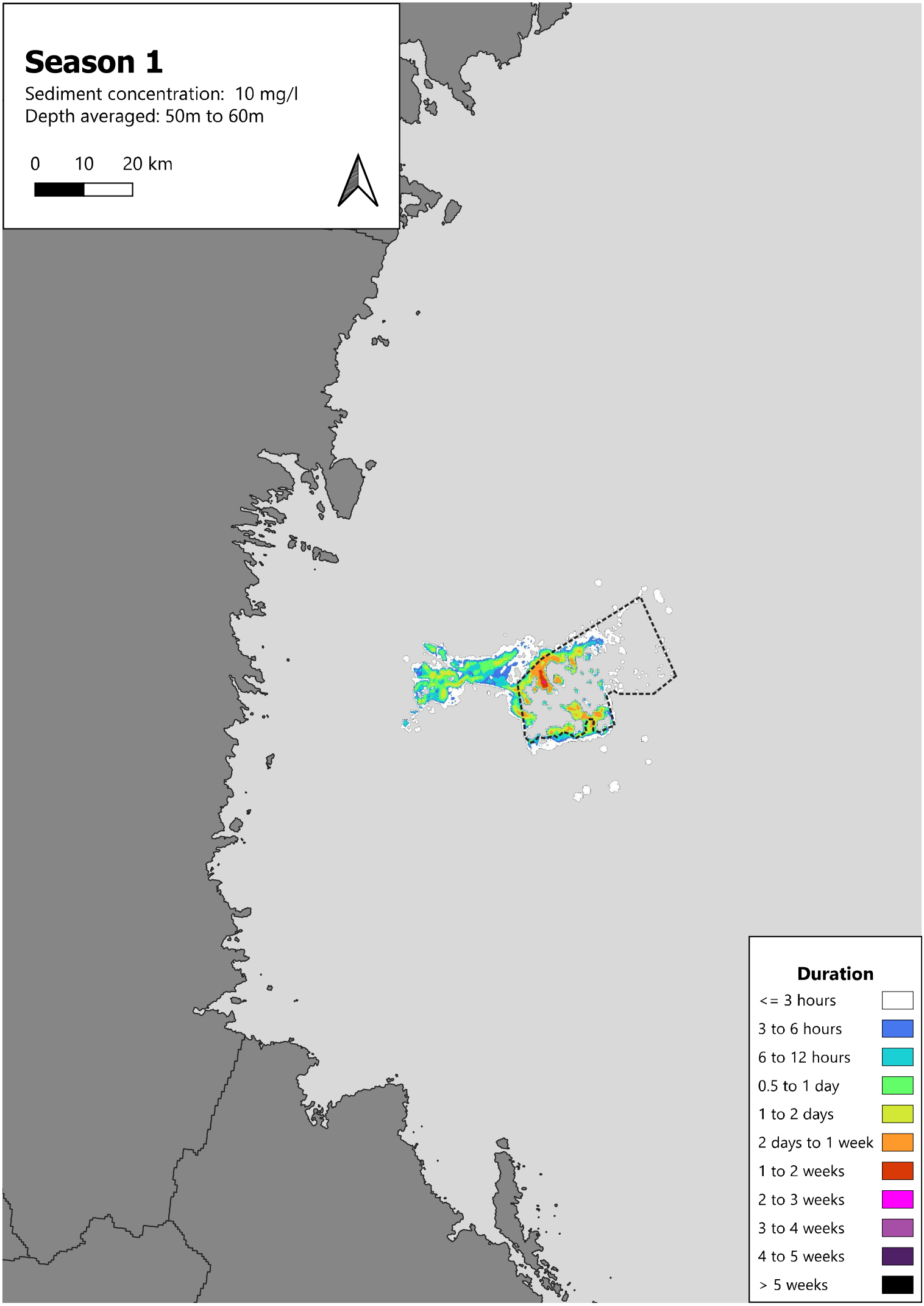

Season 1
Sediment concentration: 10 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

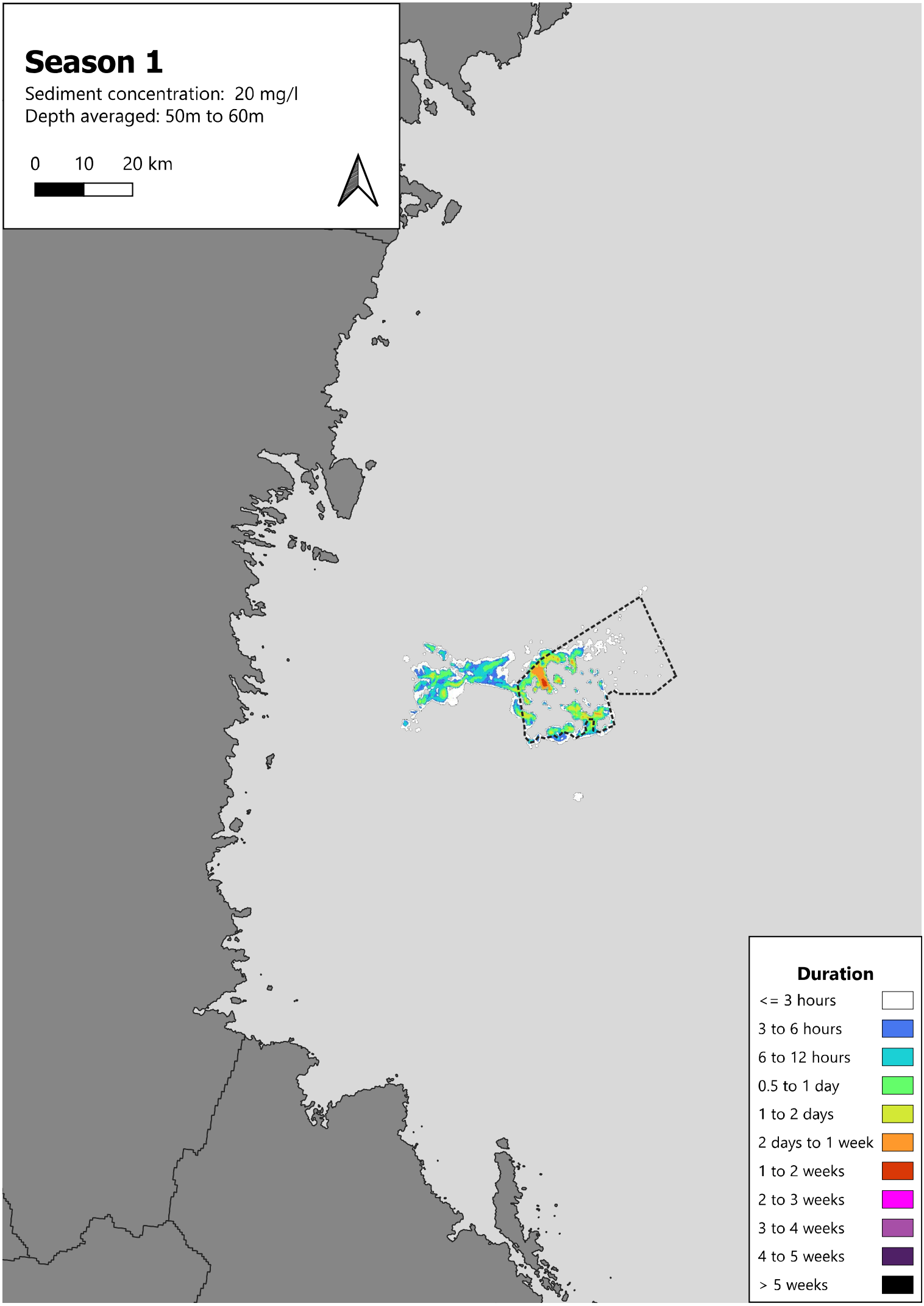

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

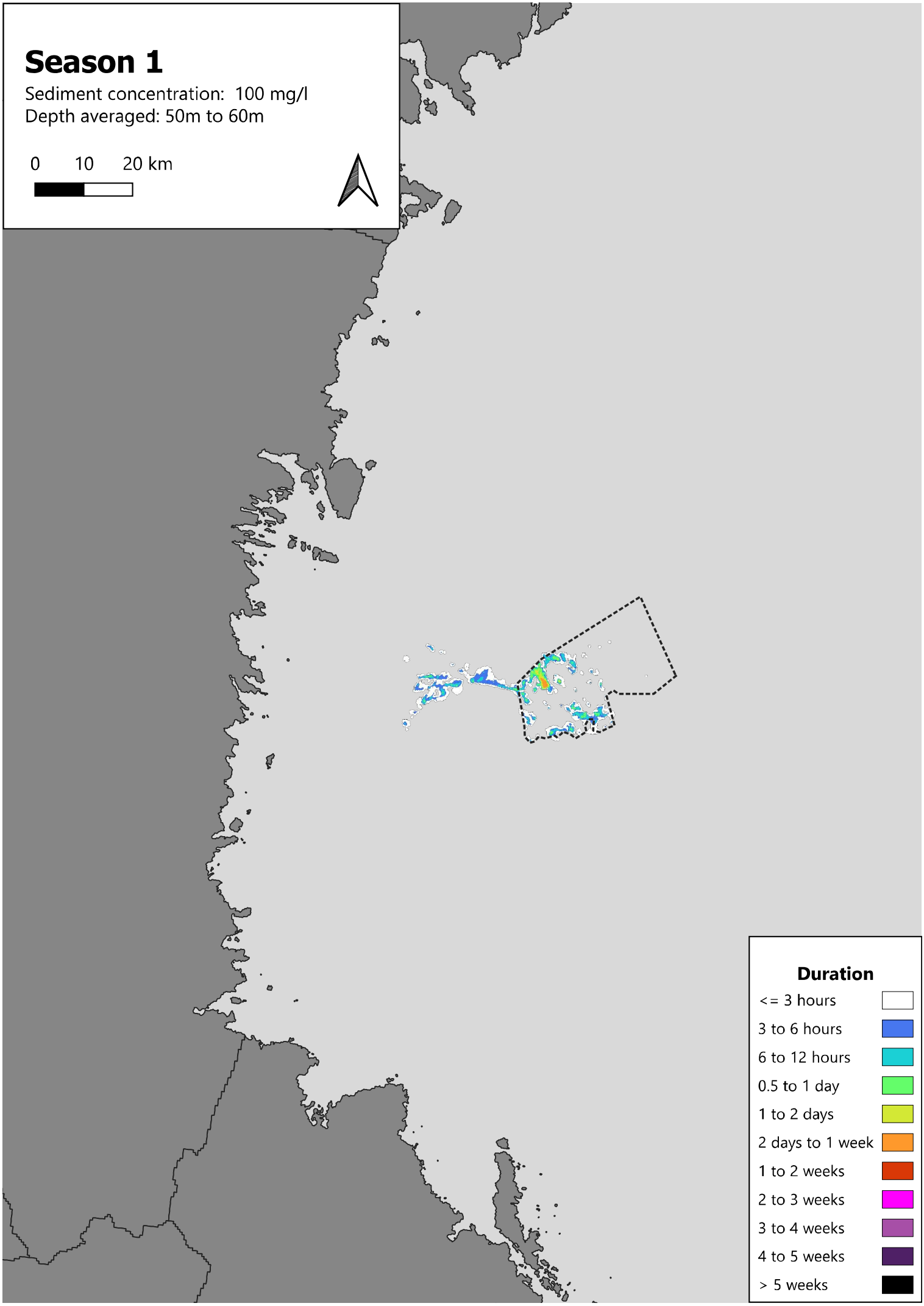

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

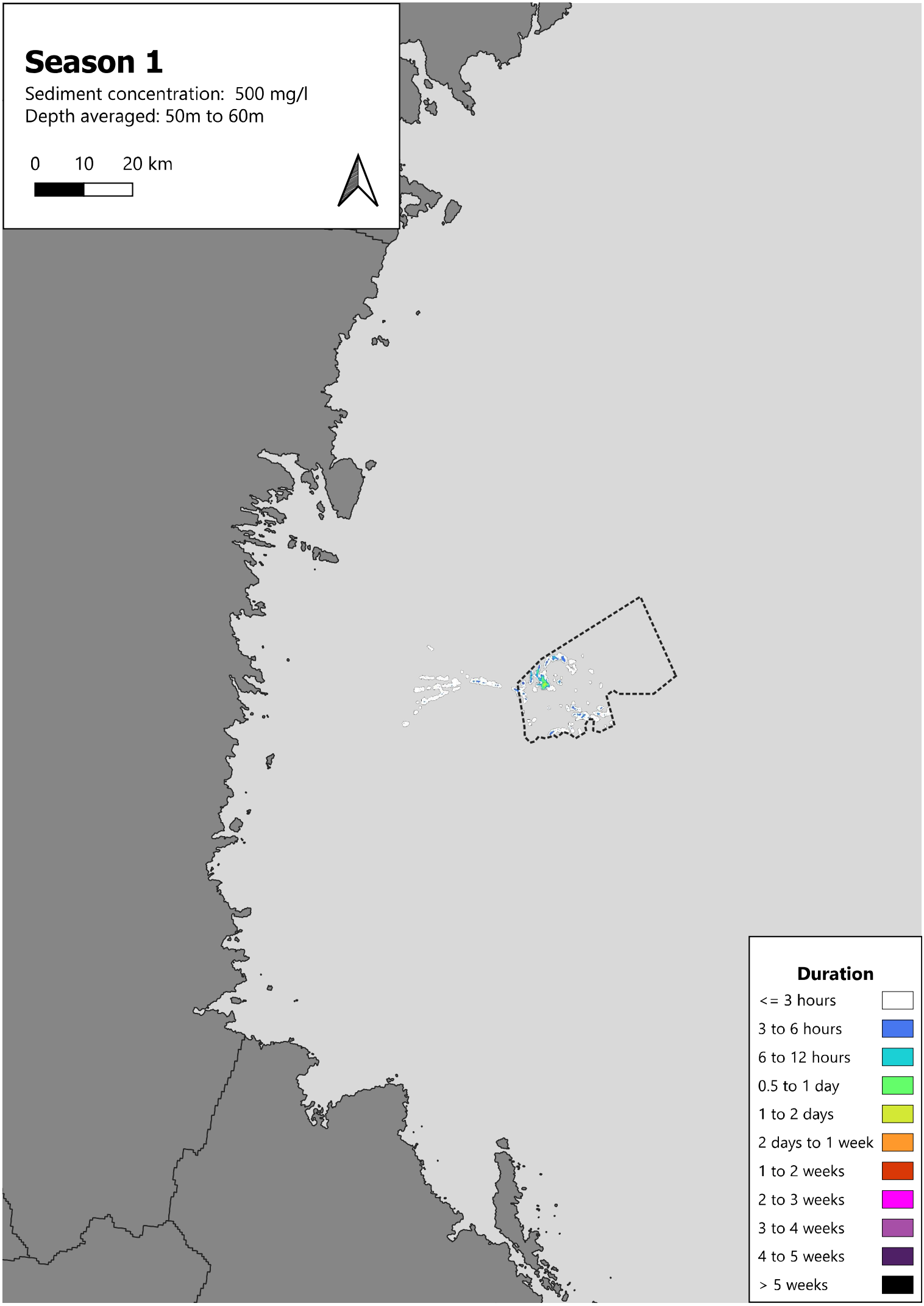

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

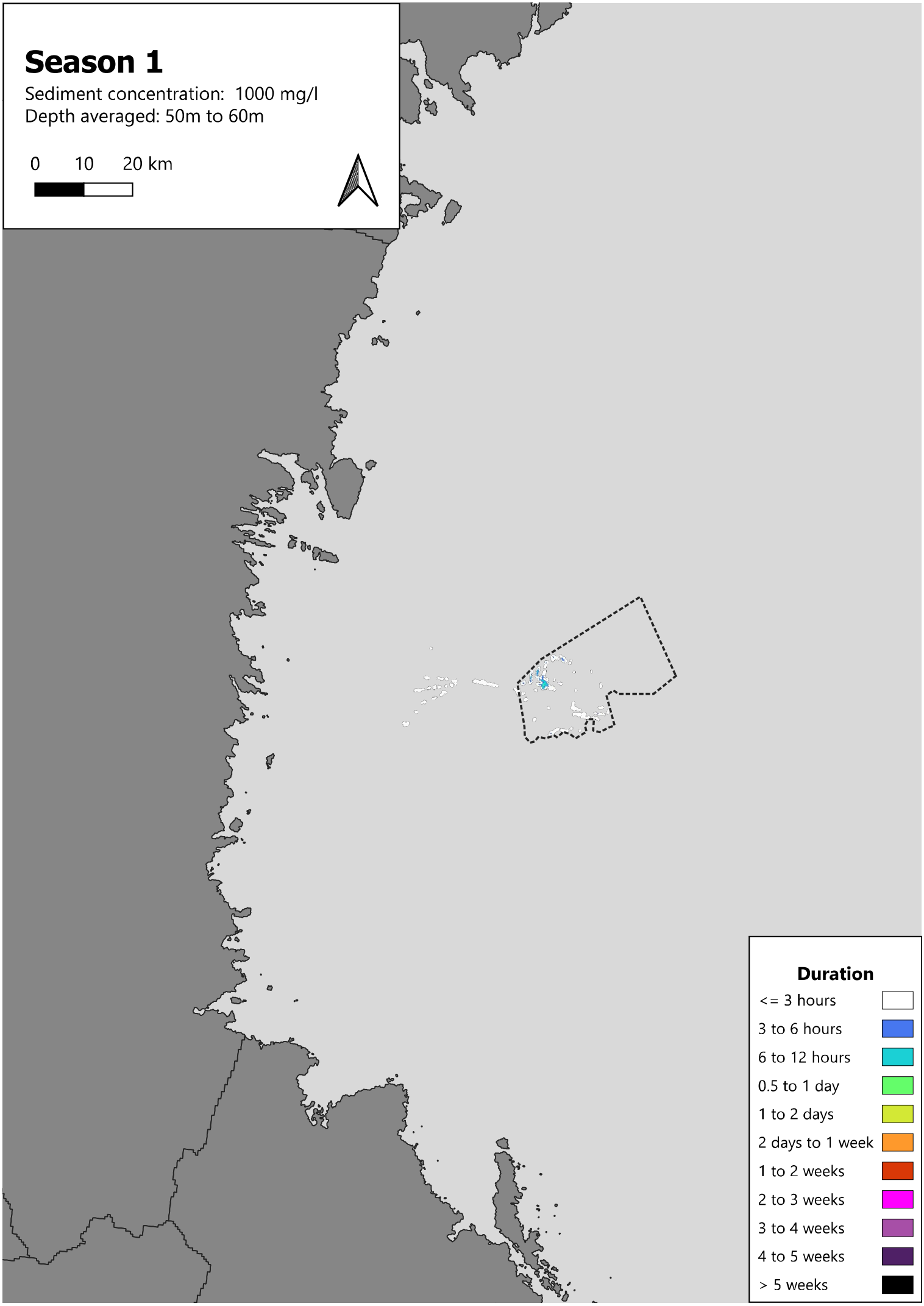

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

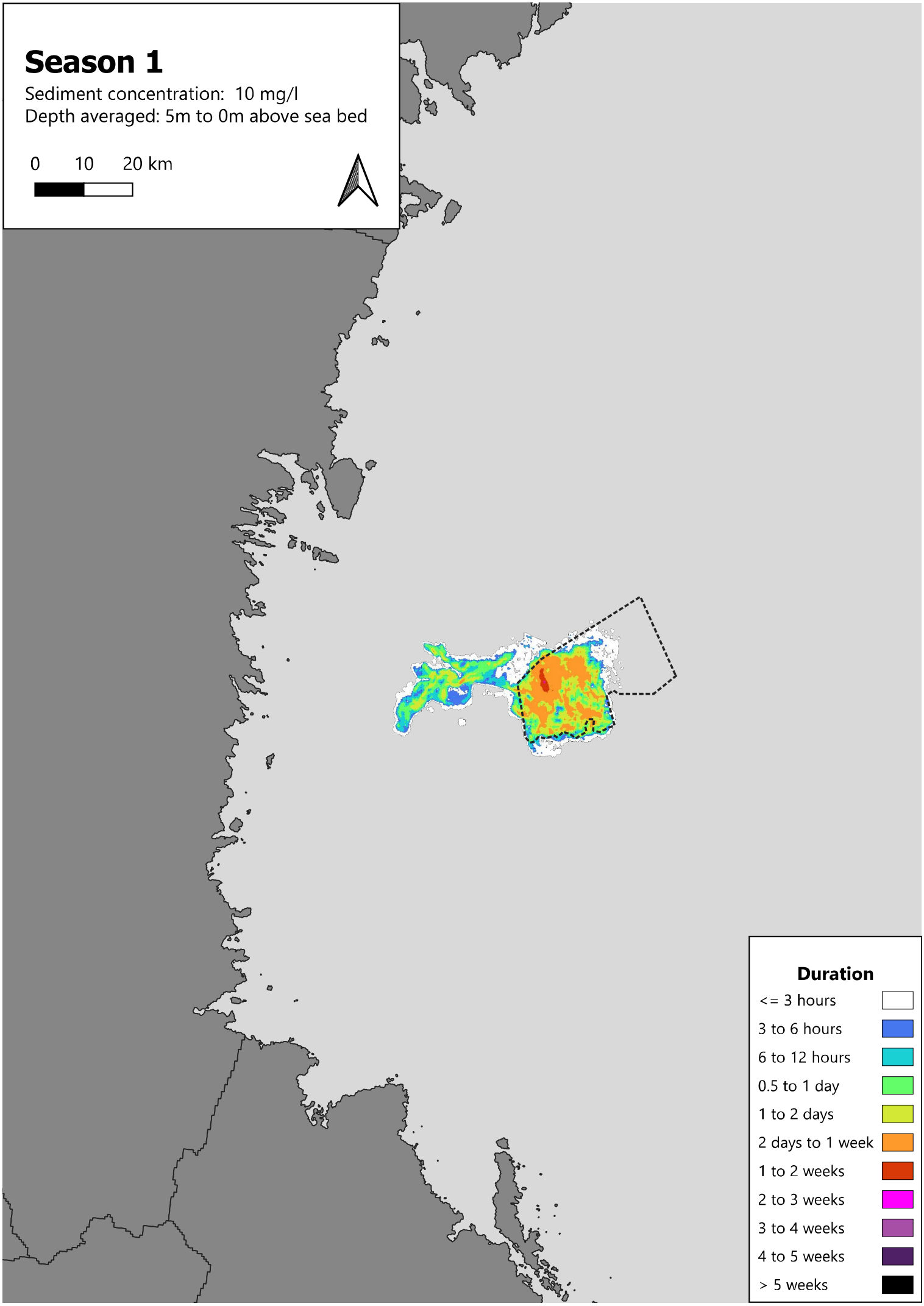

Season 1
Sediment concentration: 10 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

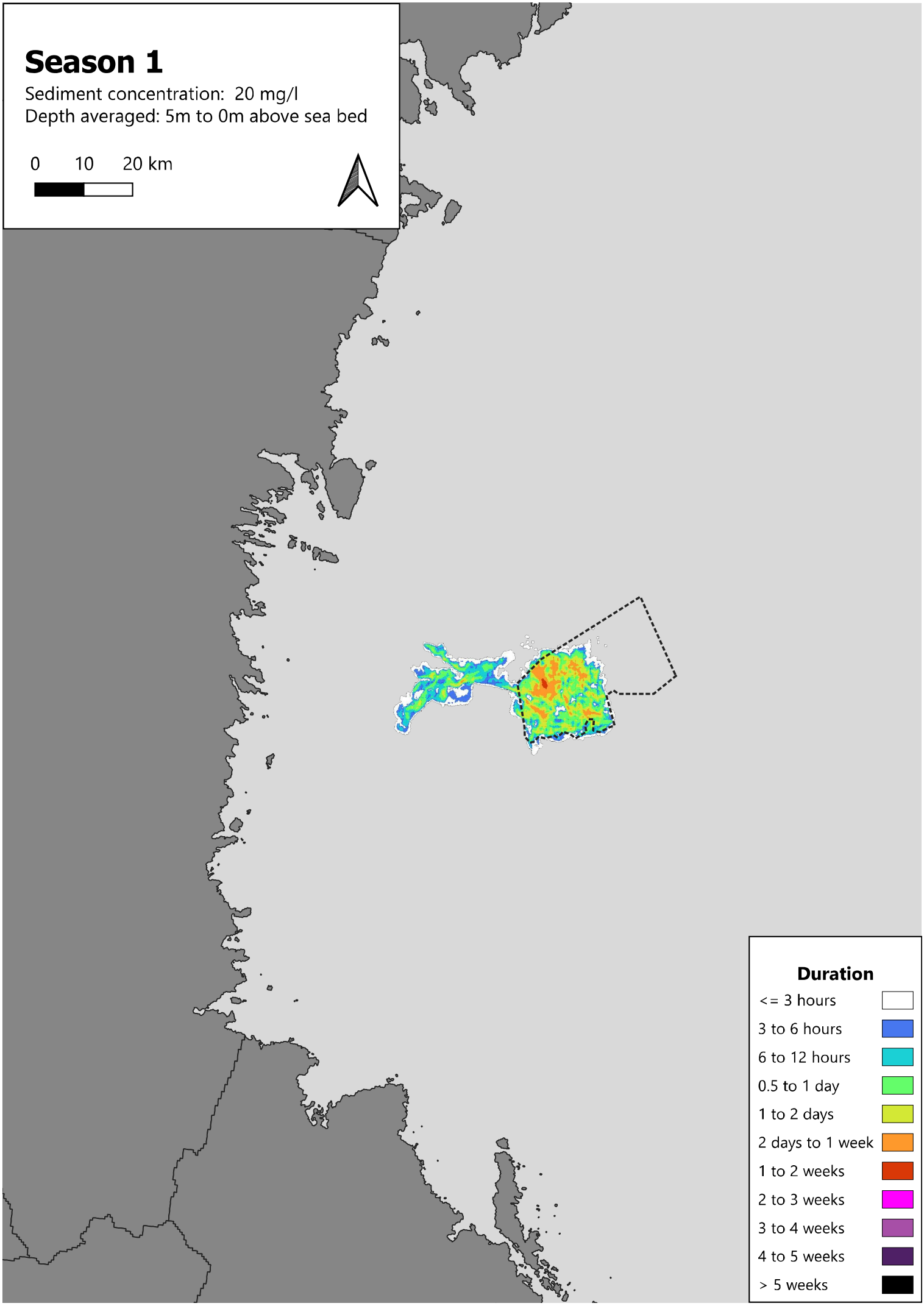

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

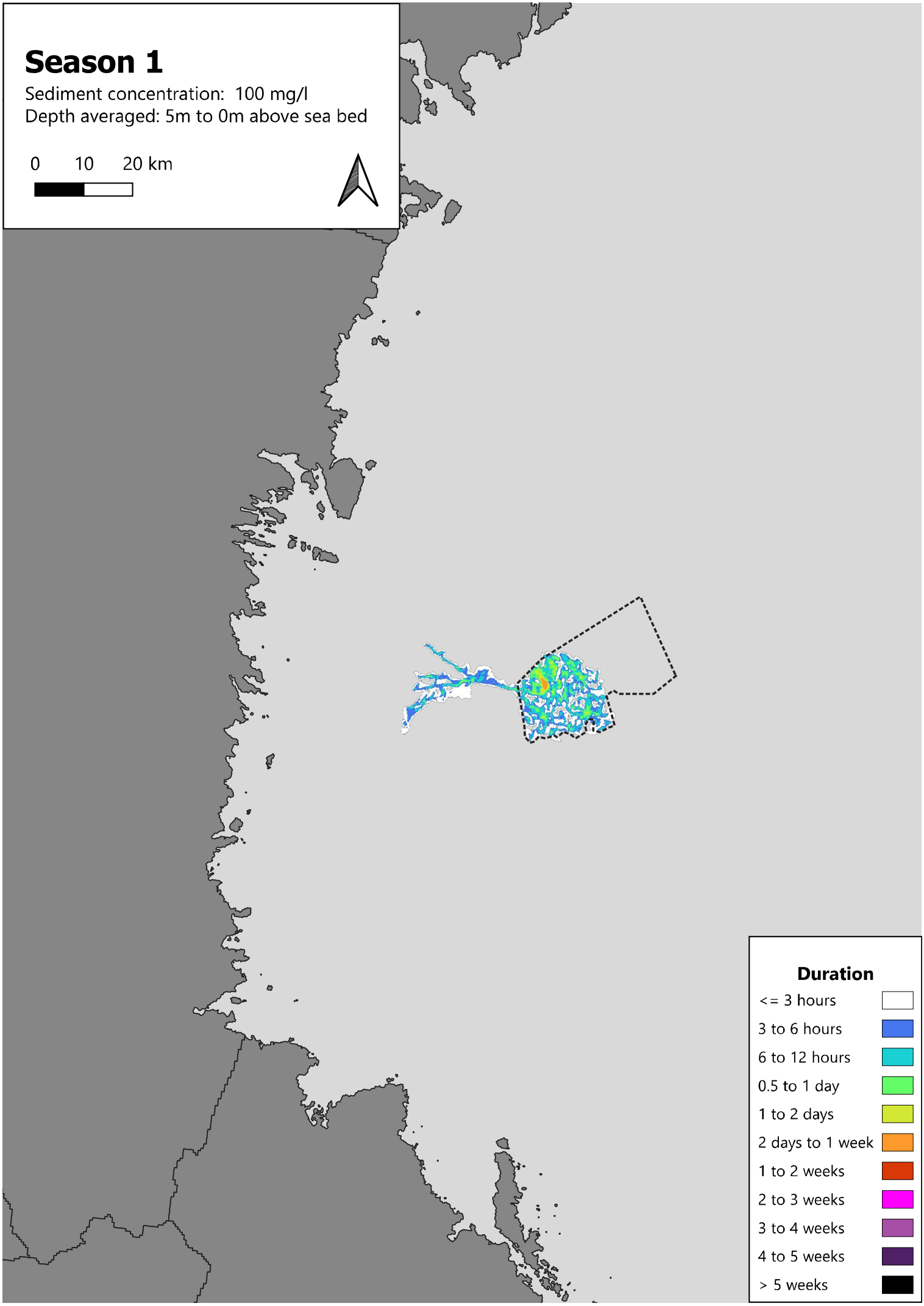

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

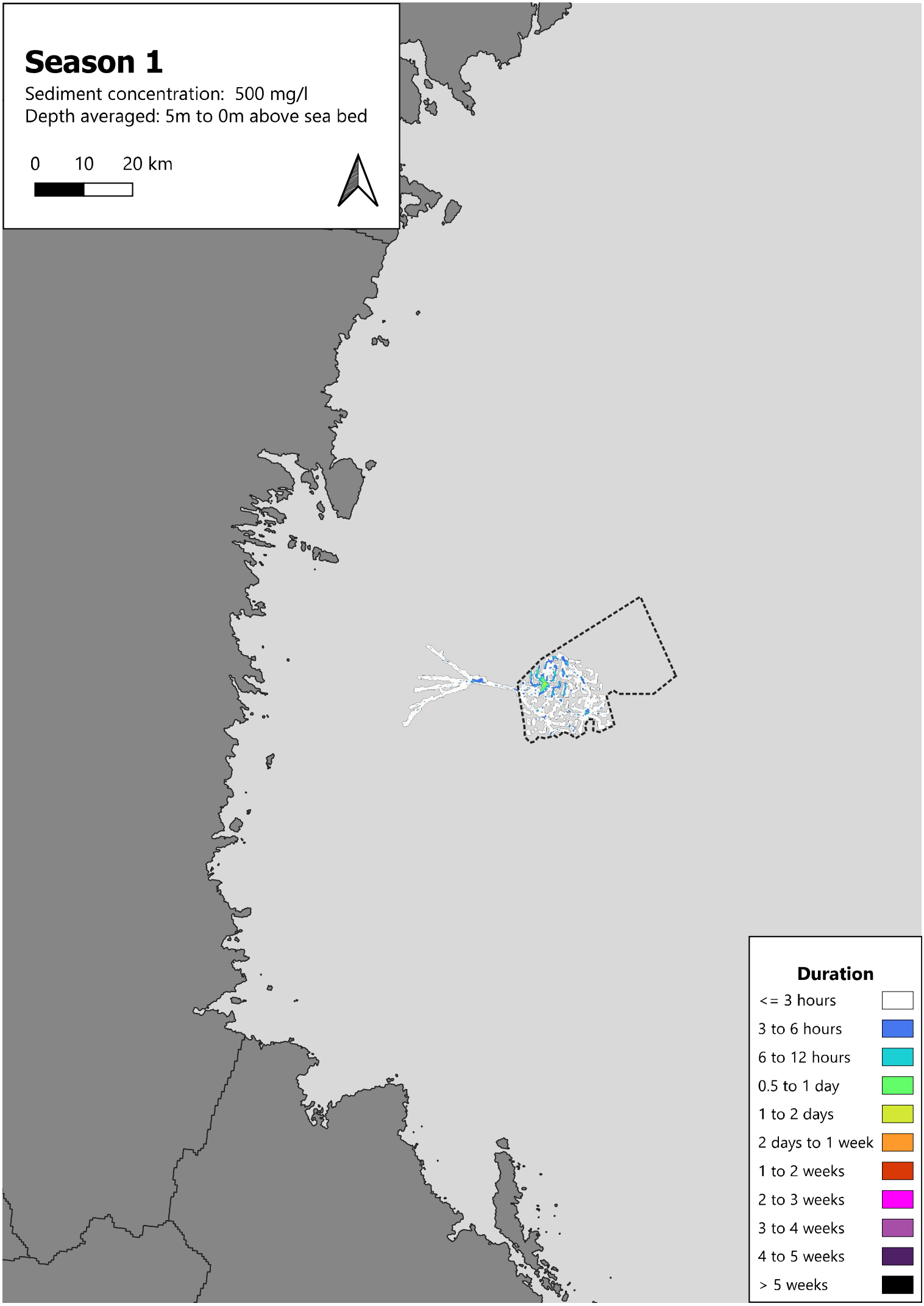

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

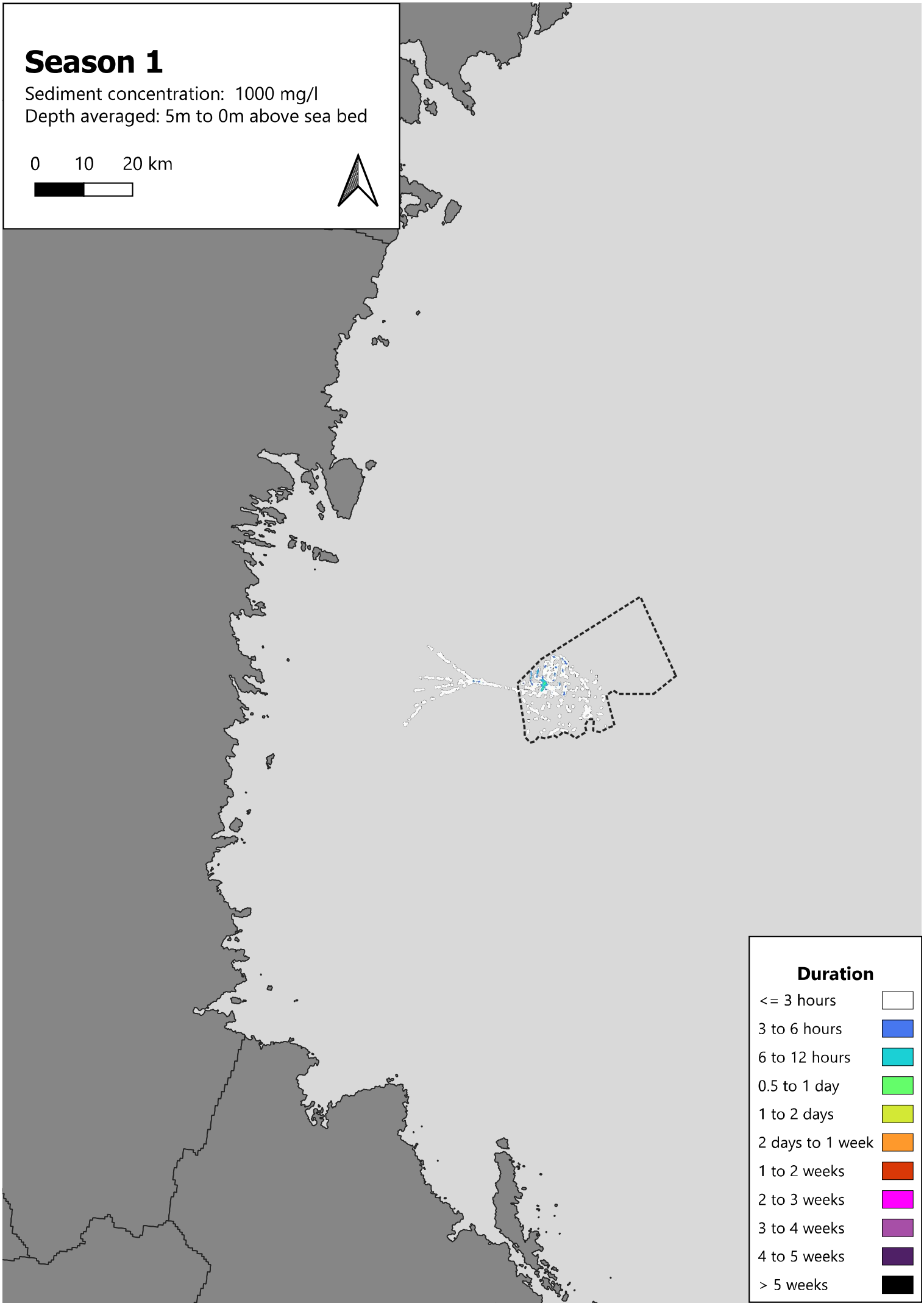

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks


Season 1
Sediment concentration: 10 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

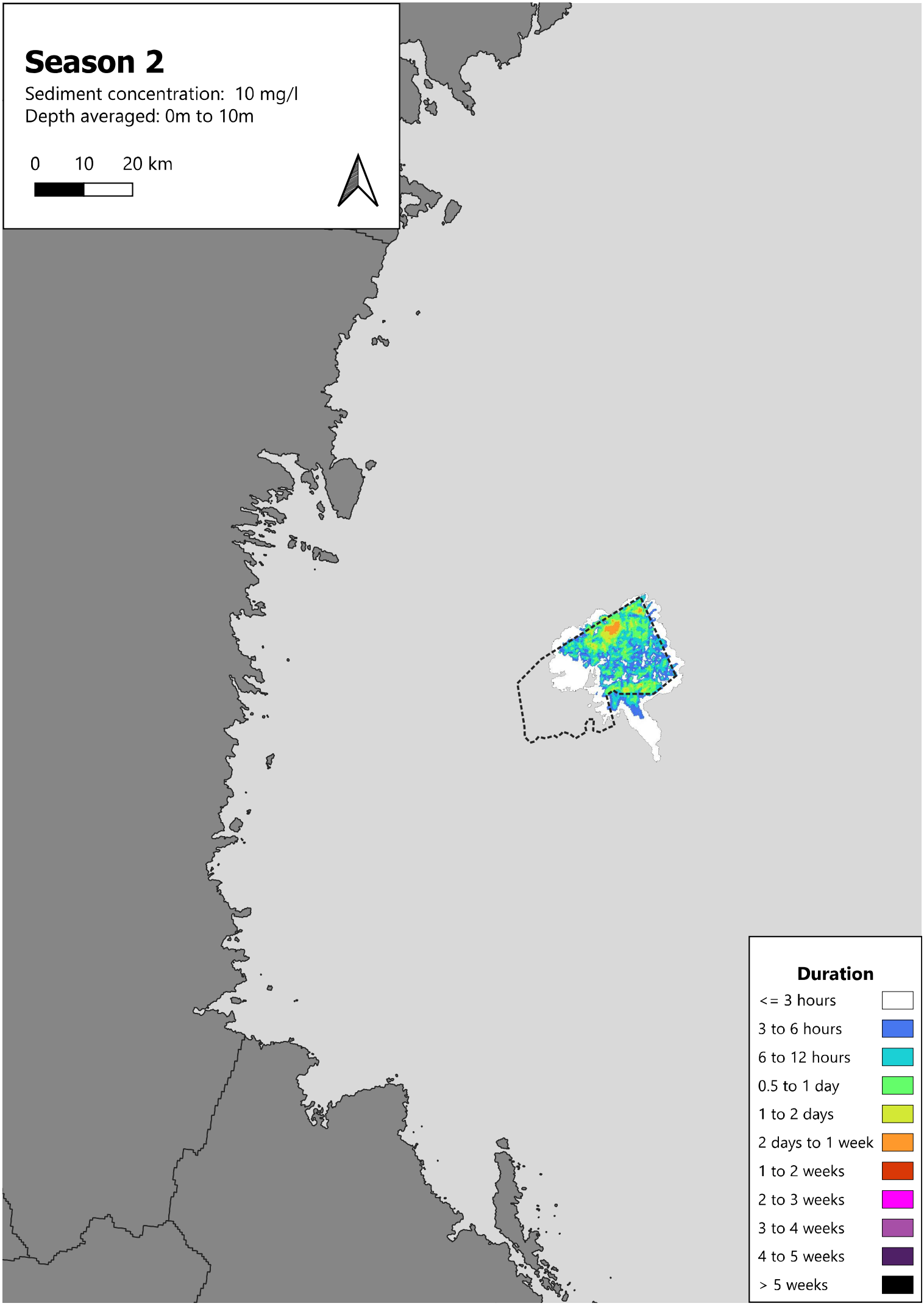

Season 1
Sediment concentration: 20 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

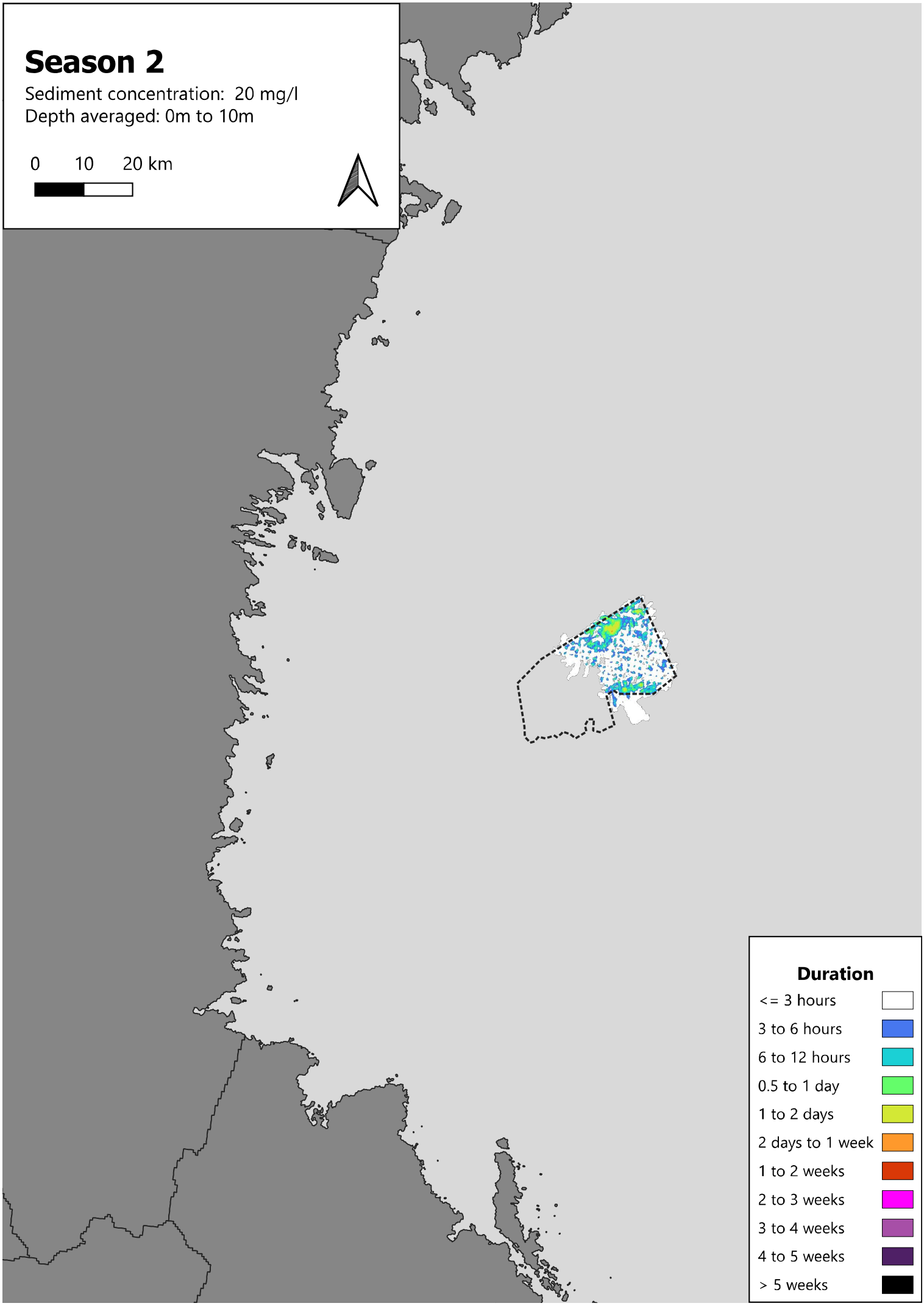

Season 1
Sediment concentration: 100 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

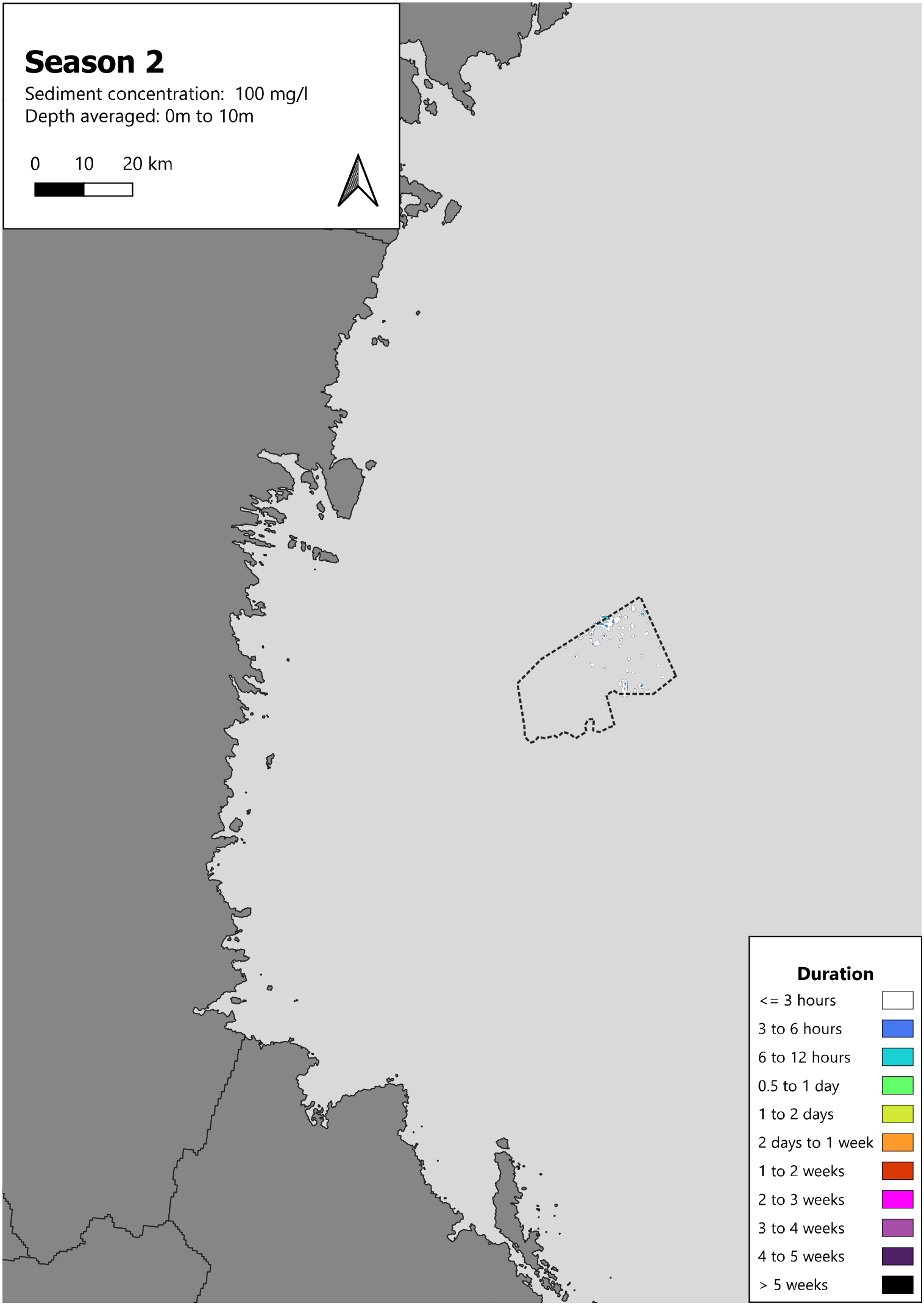

Season 1
Sediment concentration: 500 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

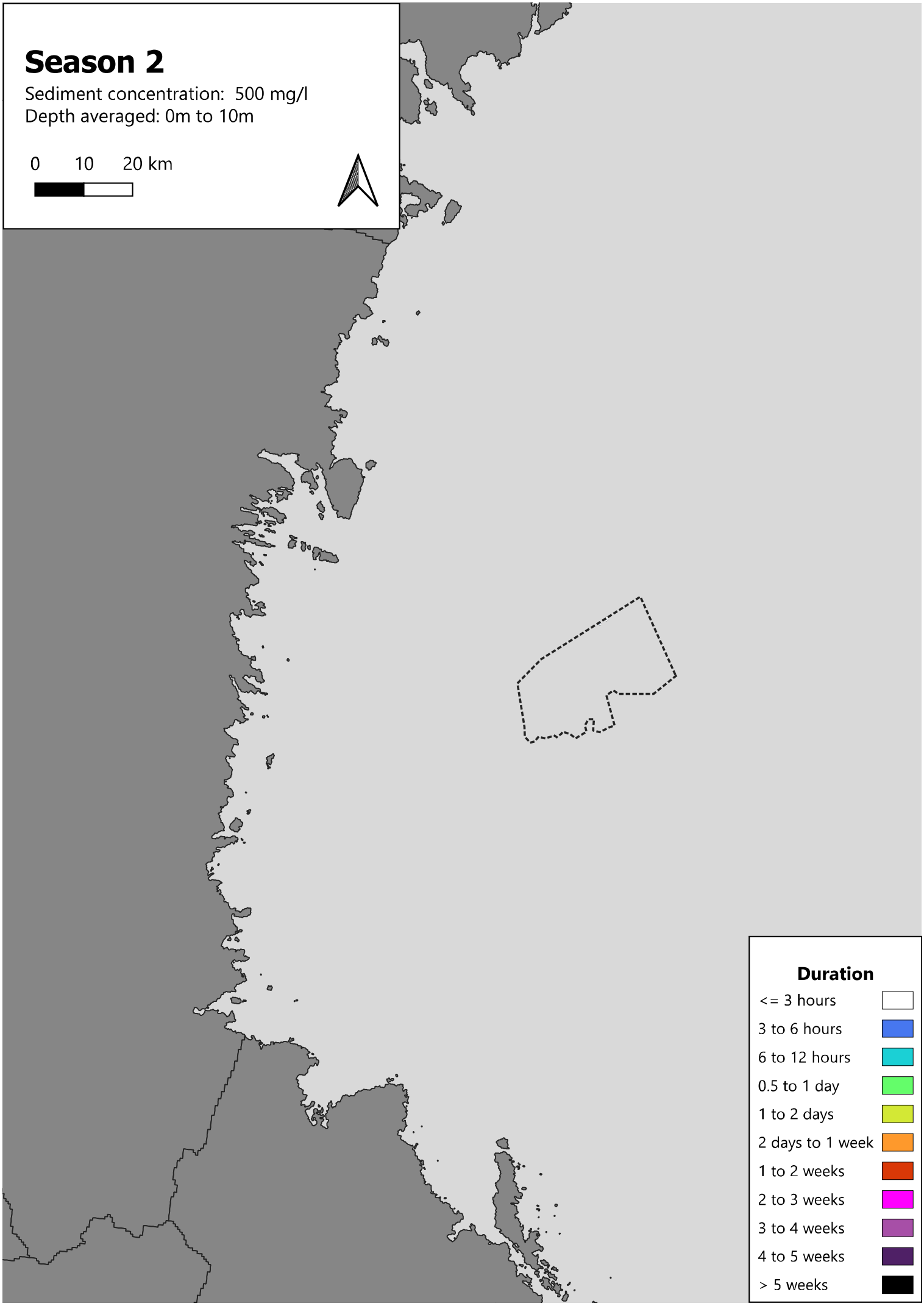

Season 1
Sediment concentration: 1000 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

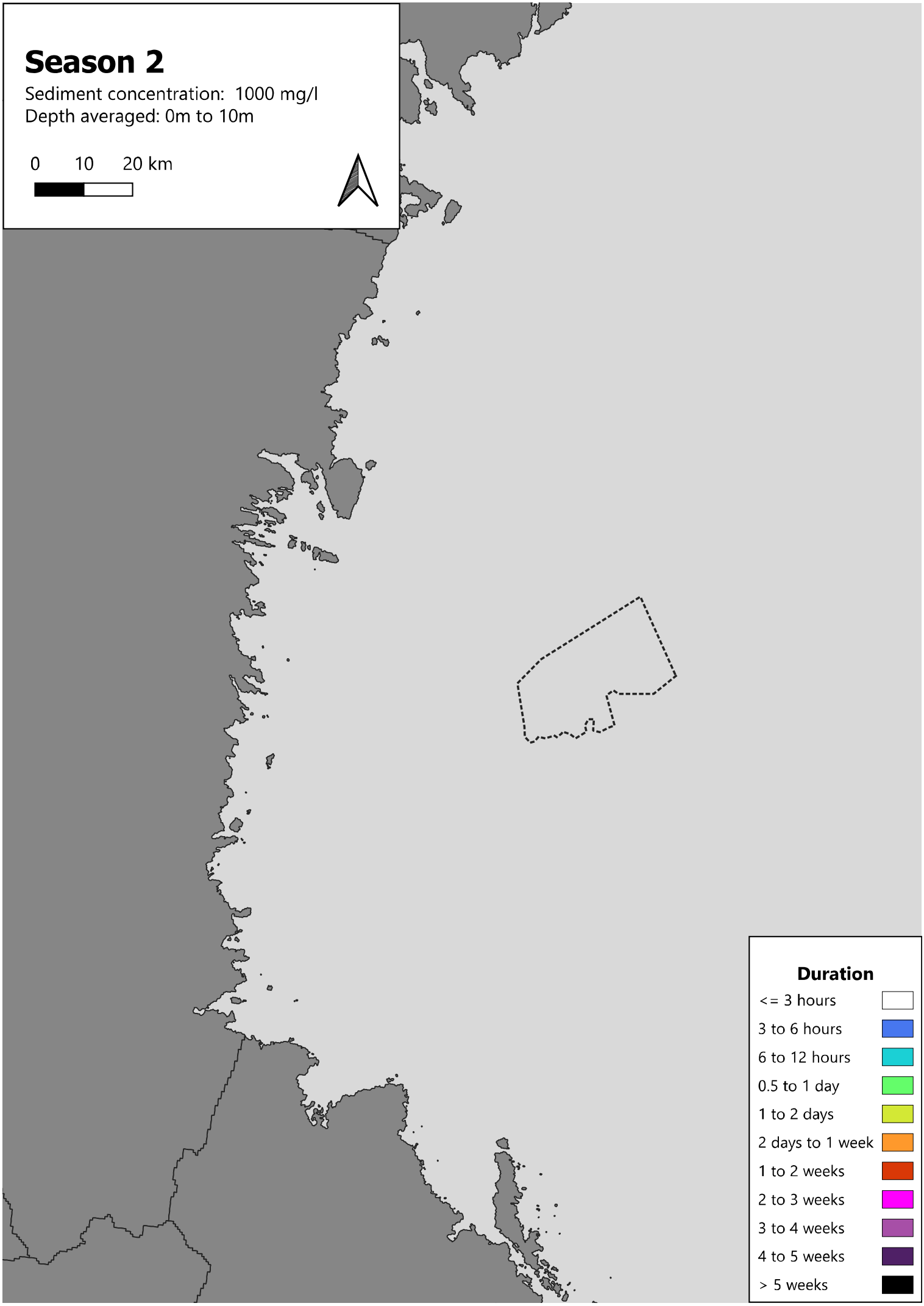
# Appendix 18 Sediment dispersal: Concentration – Season 2

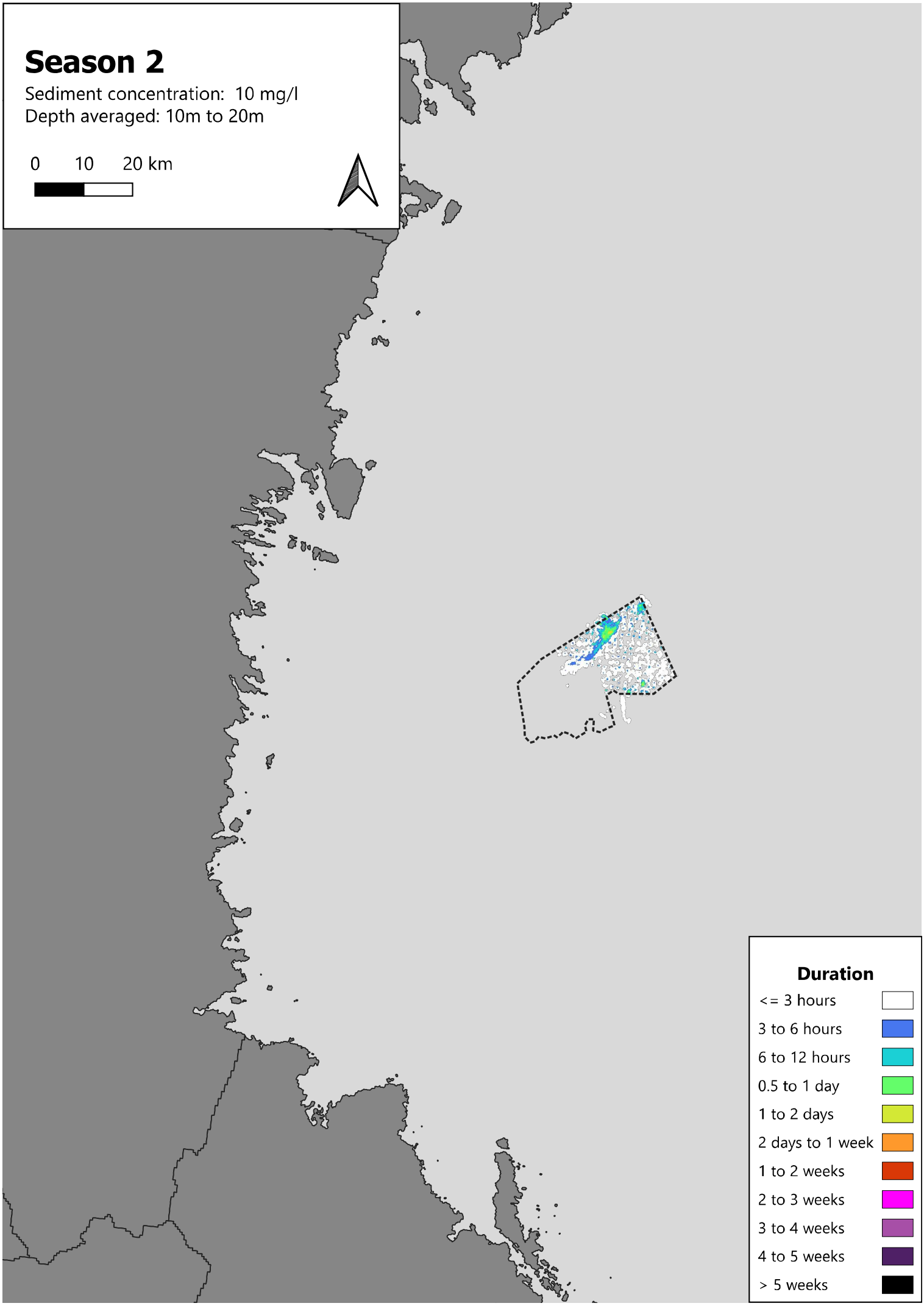

Season 2
Sediment concentration: 10 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

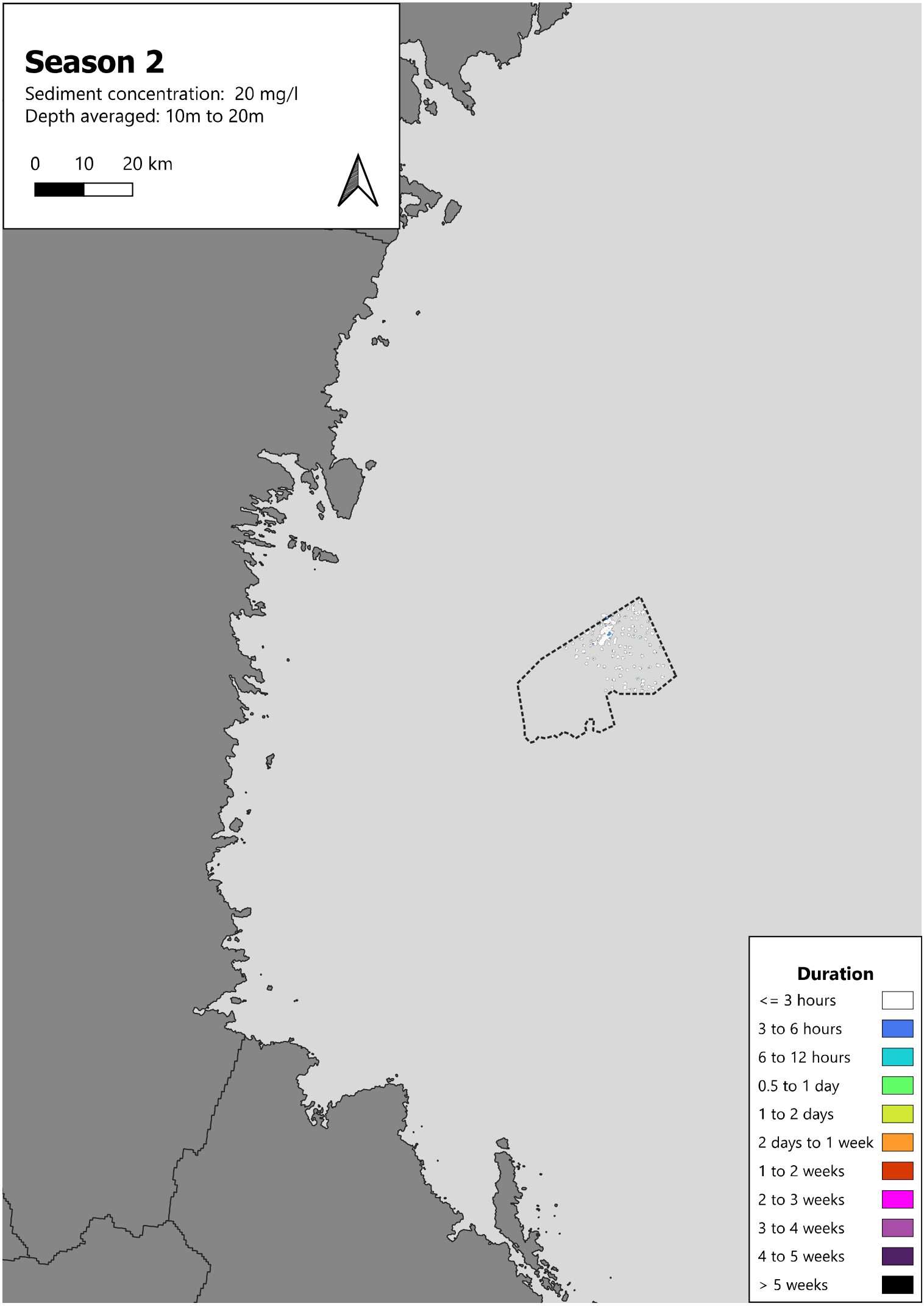

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

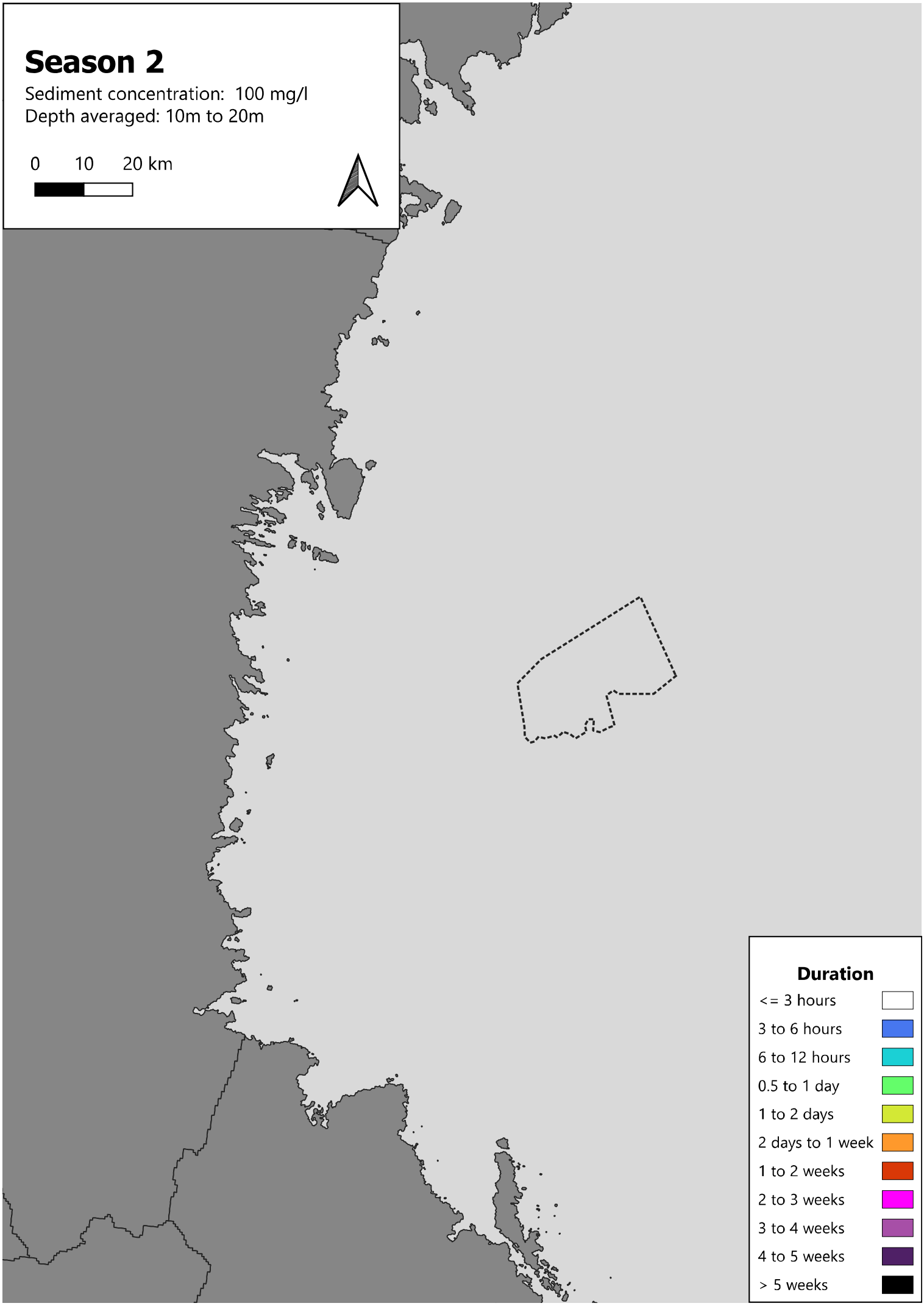

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

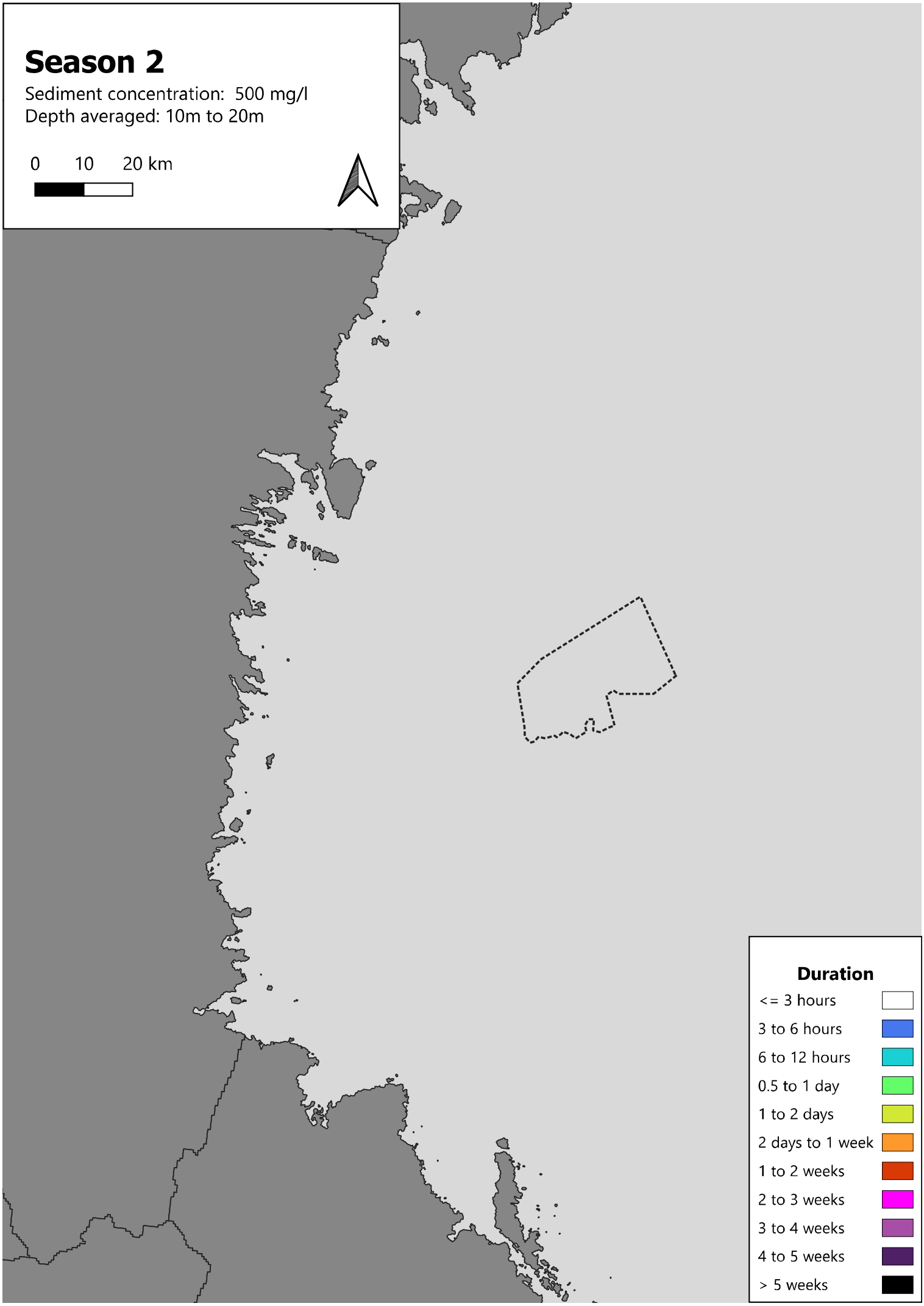

Season 2
Sediment concentration: 500 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

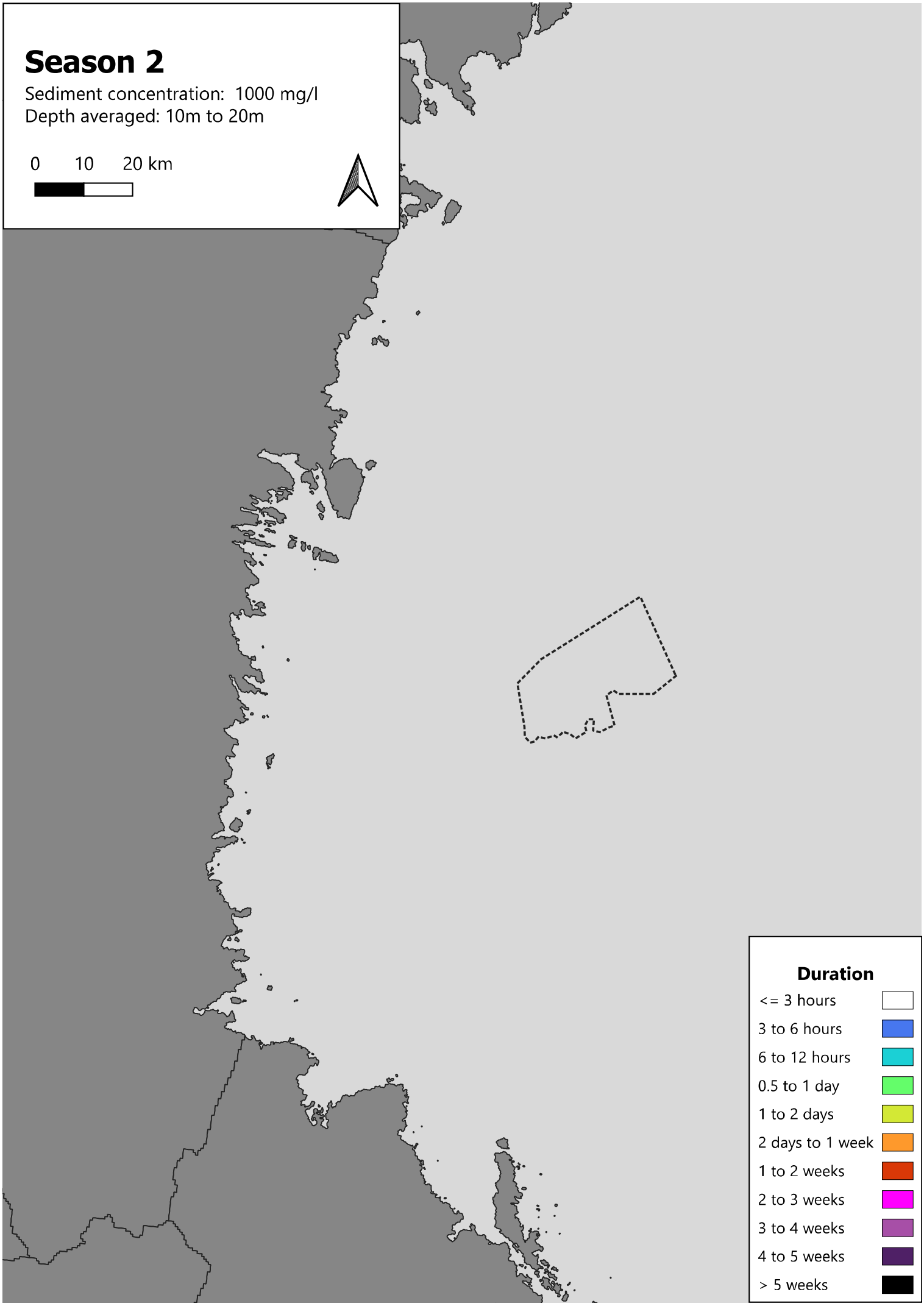

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 0m to 10m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

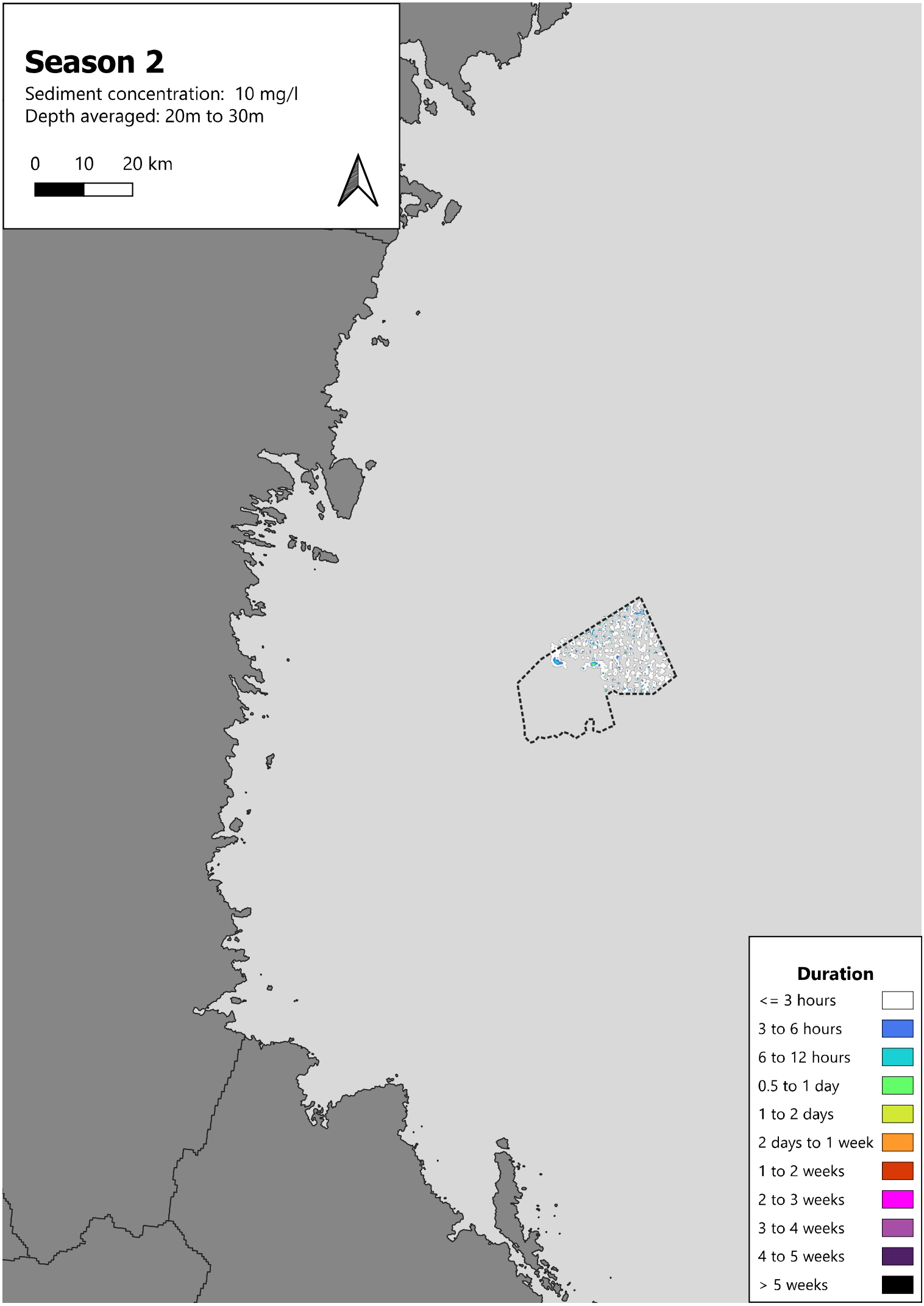

Season 2
Sediment concentration: 10 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

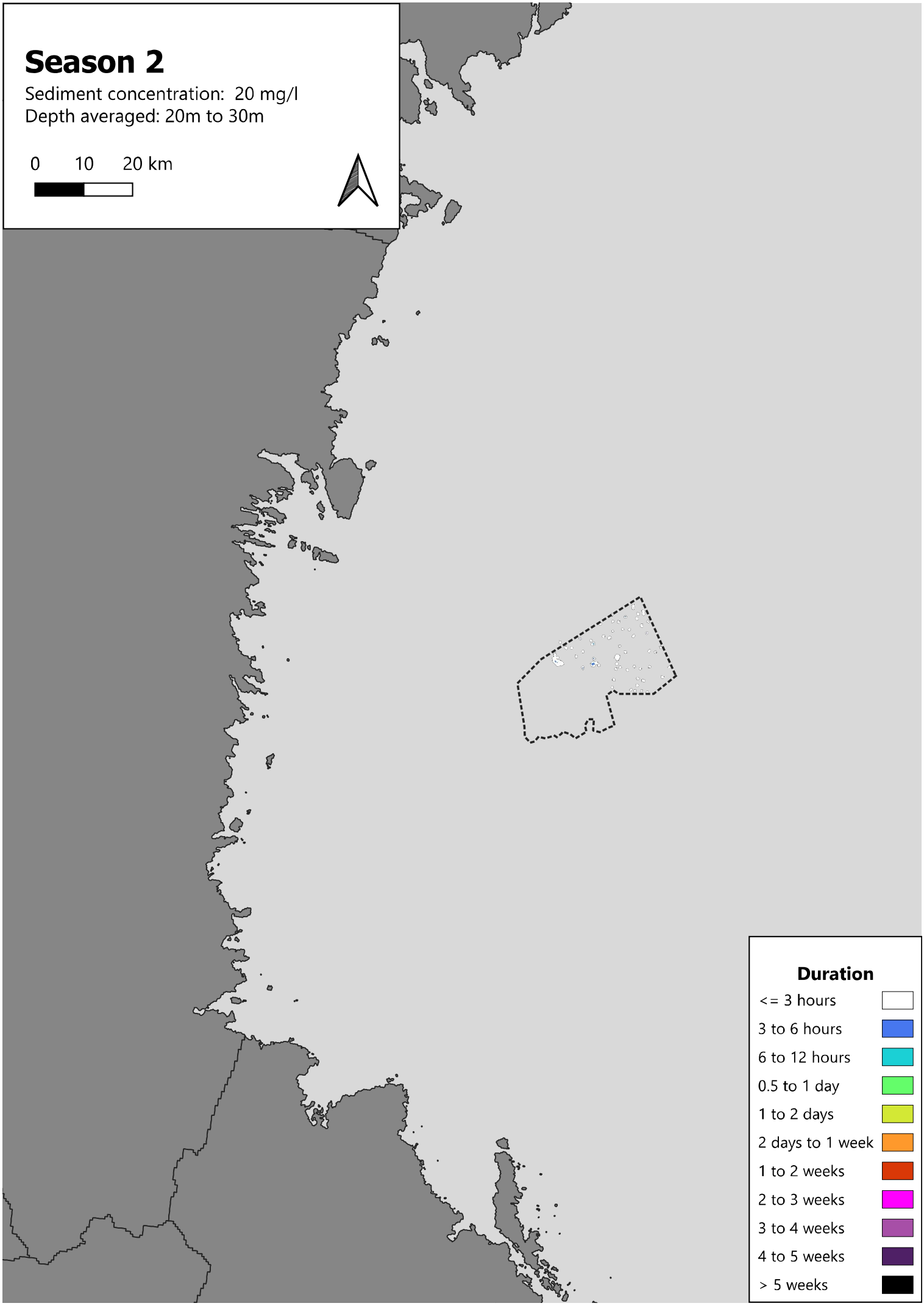

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

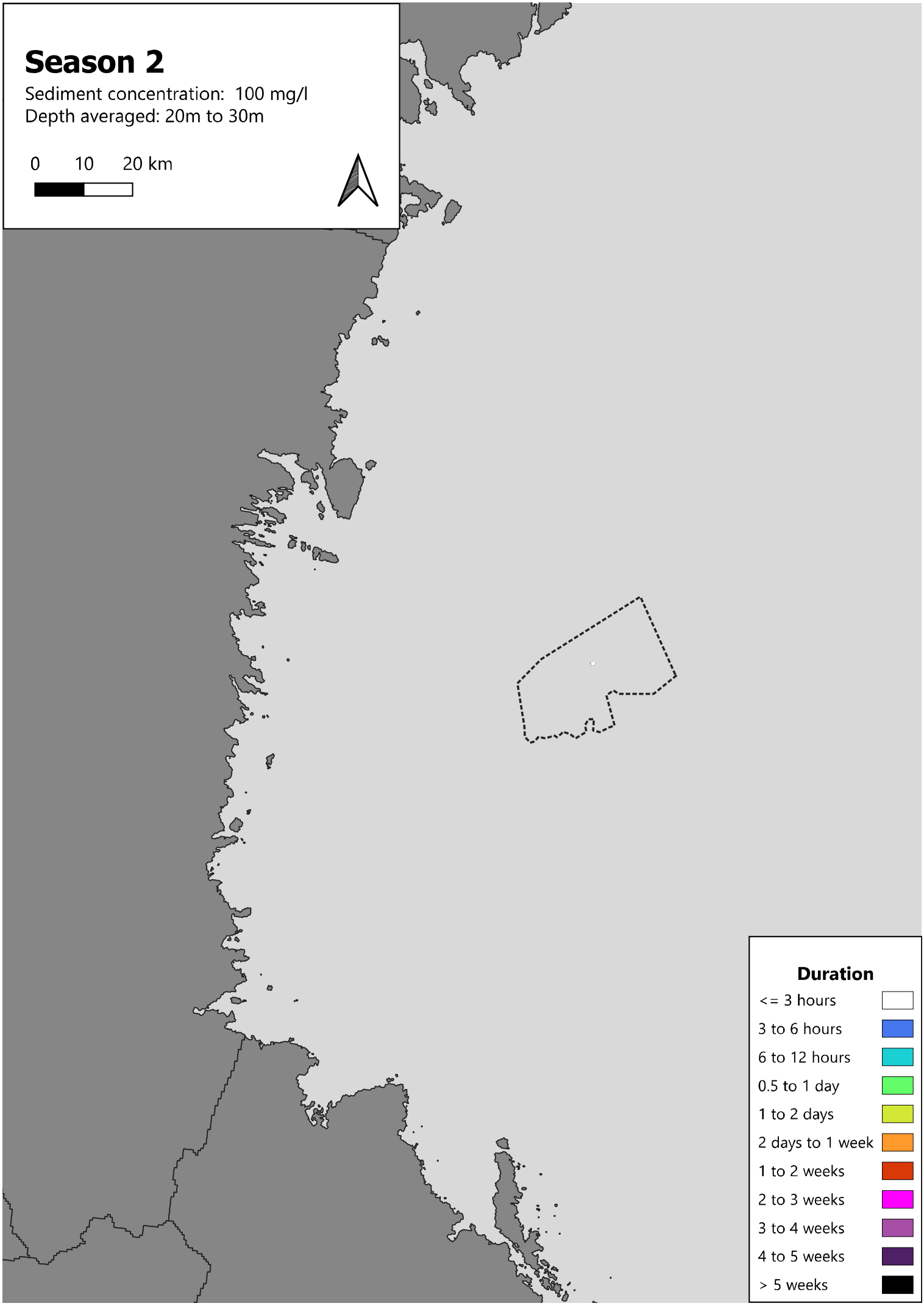

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

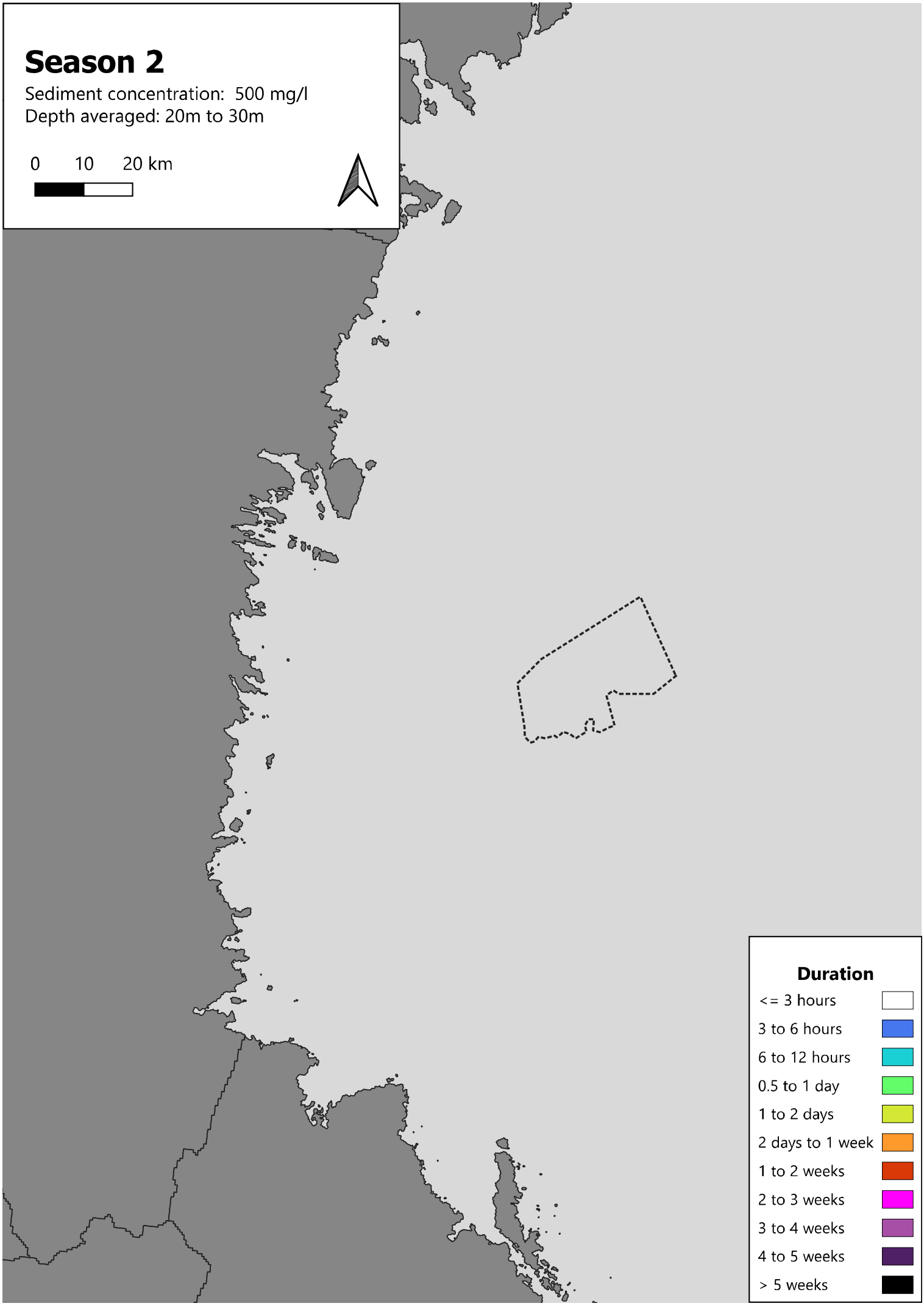

Season 2
Sediment concentration: 500 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

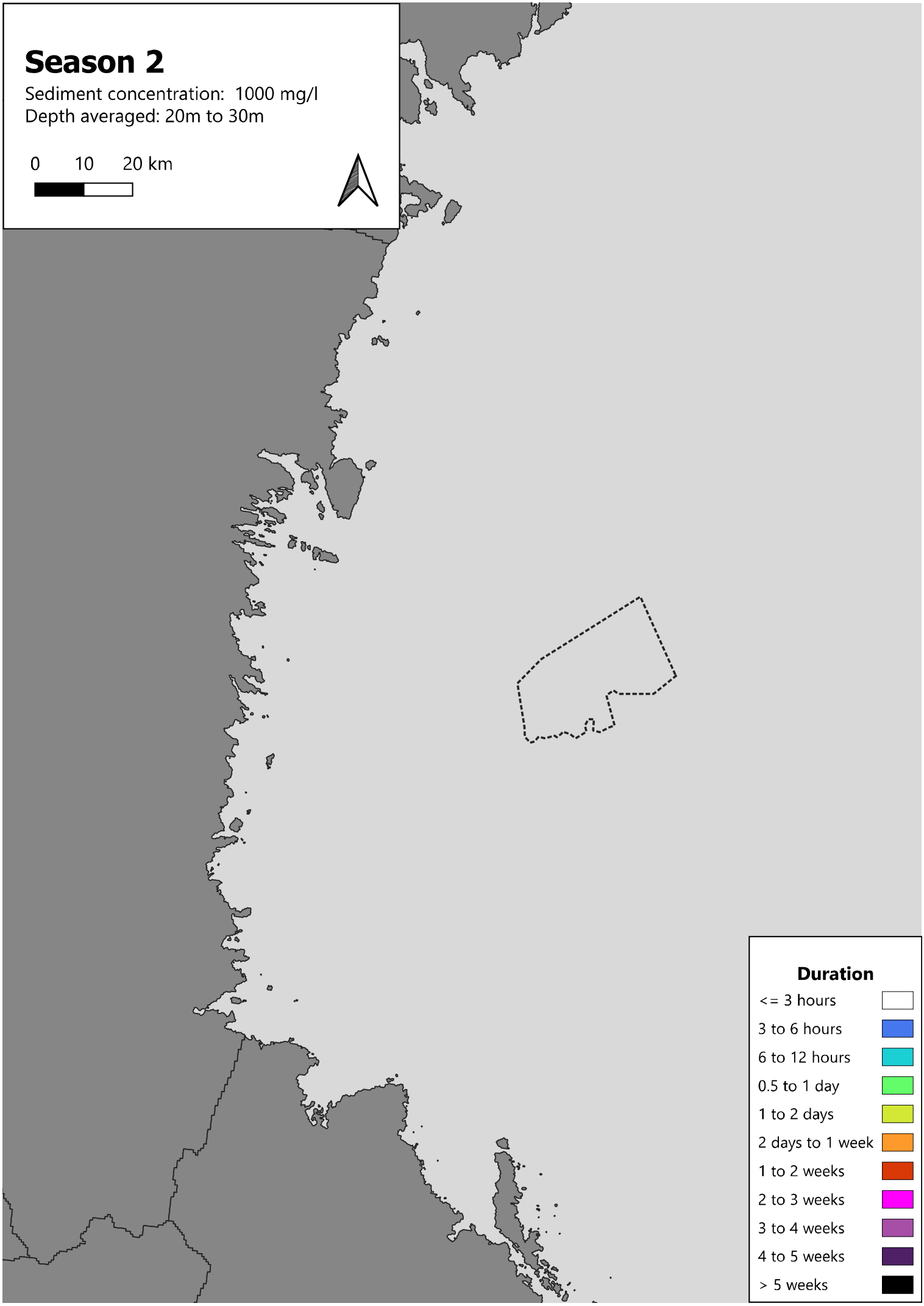

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 10m to 20m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

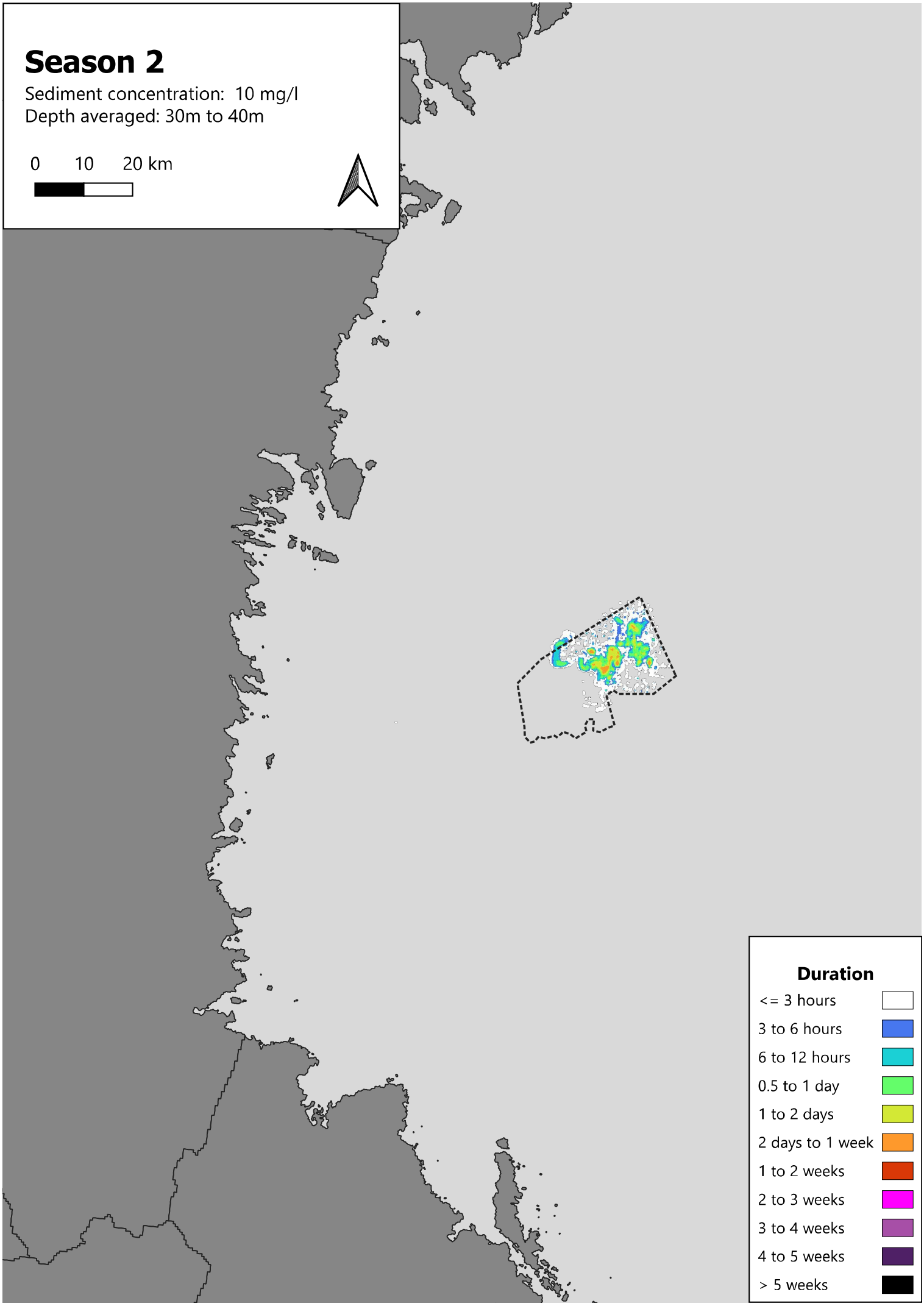

Season 2
Sediment concentration: 10 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

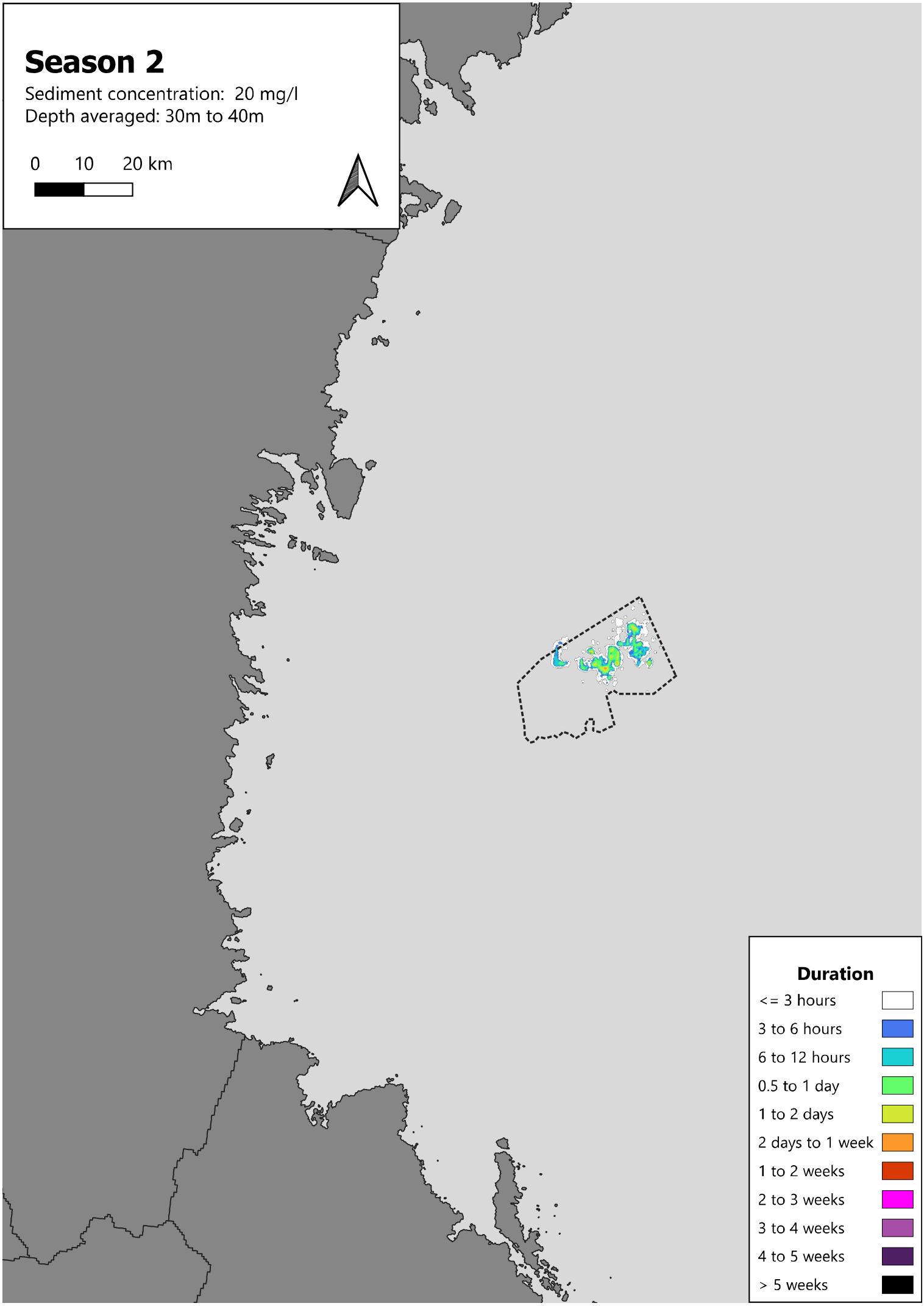

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

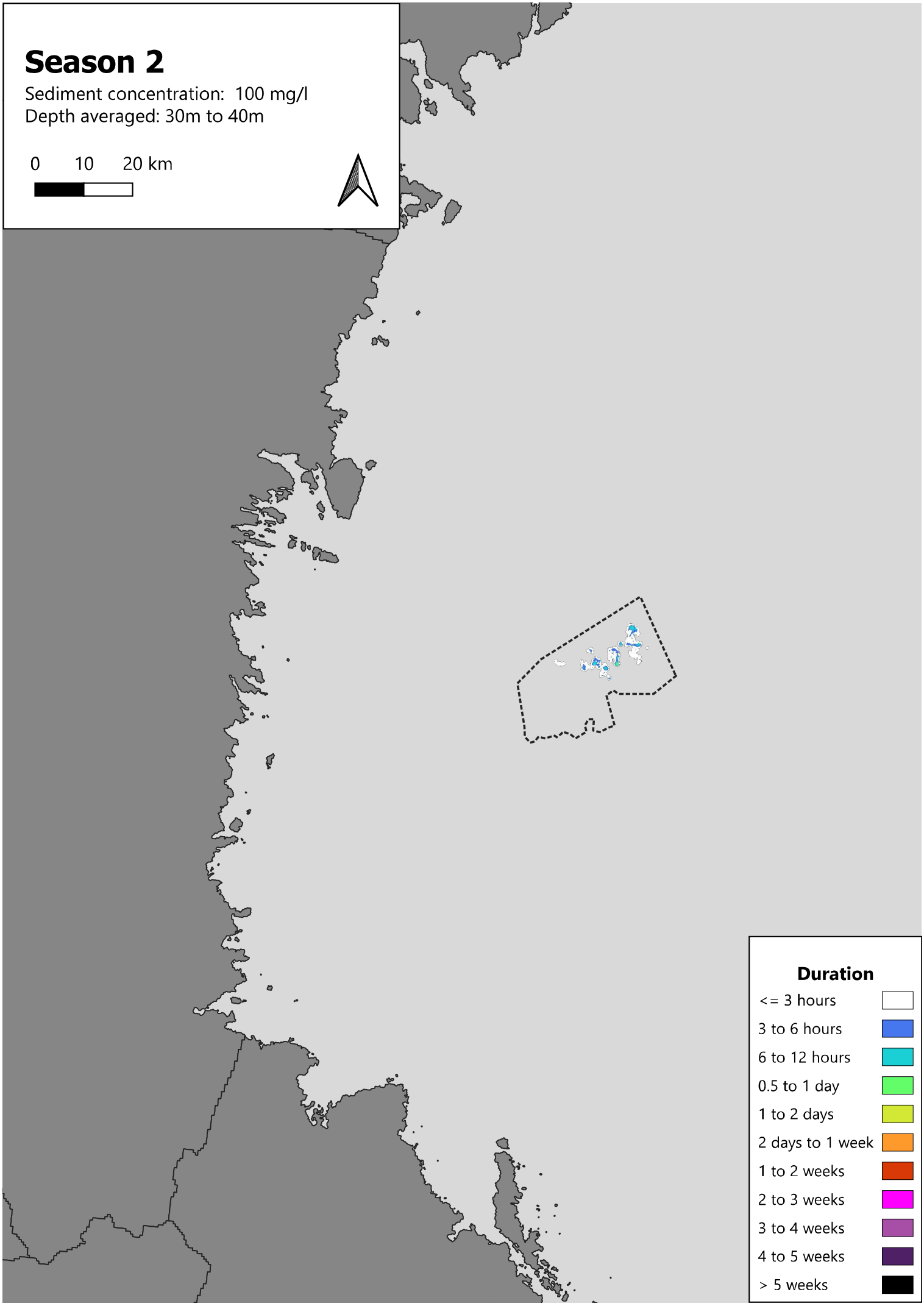

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

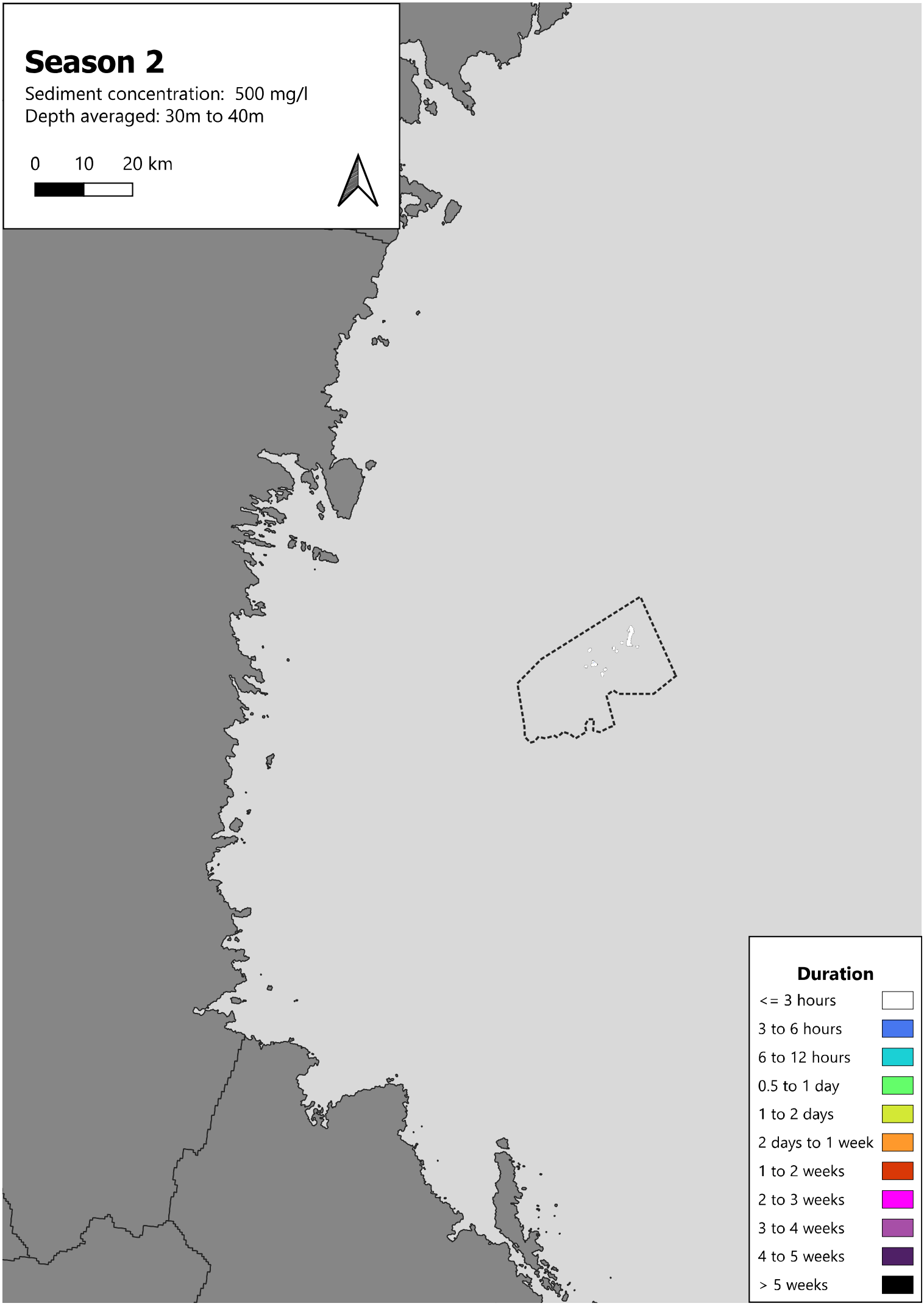

Season 2
Sediment concentration: 500 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

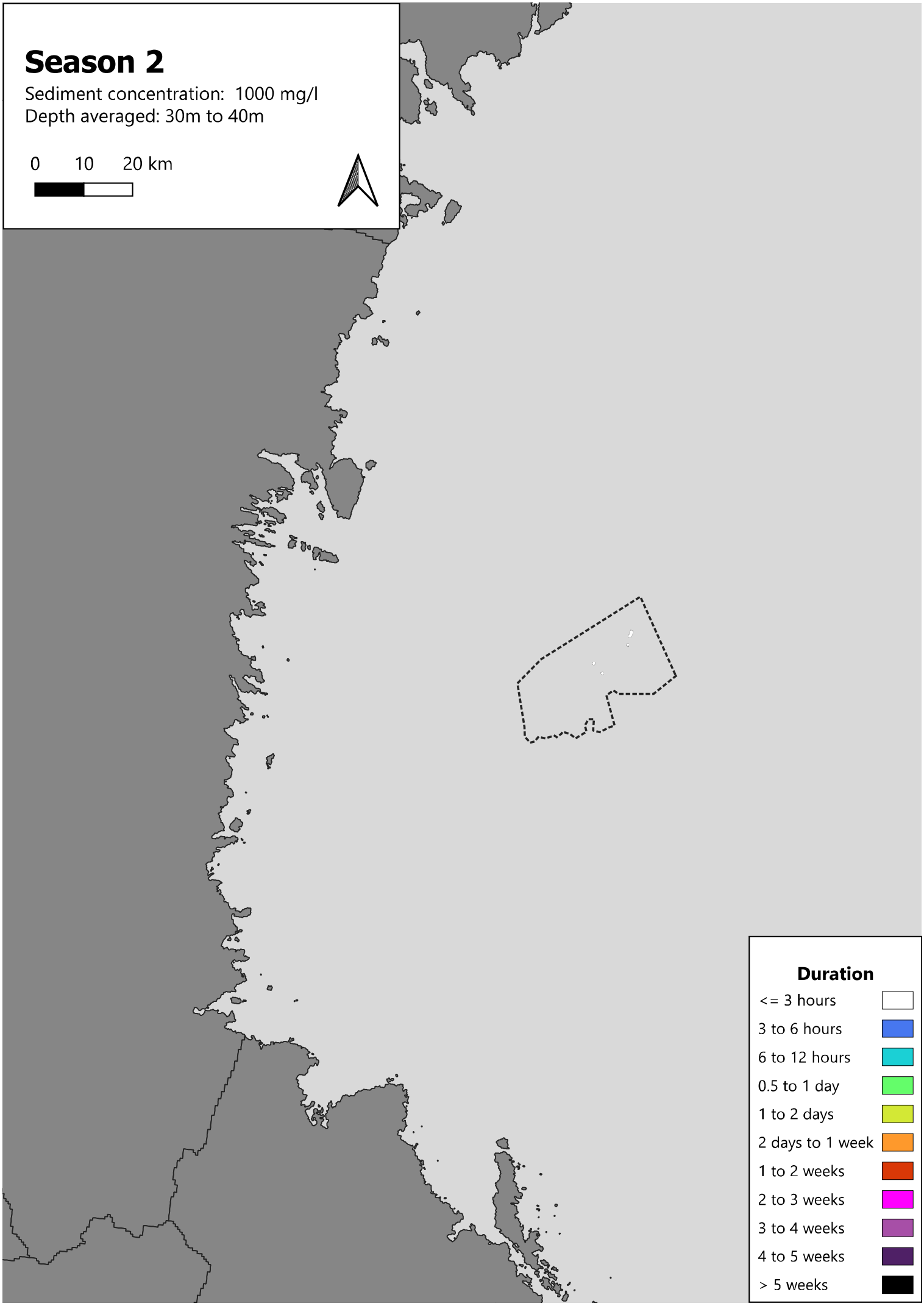

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 20m to 30m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

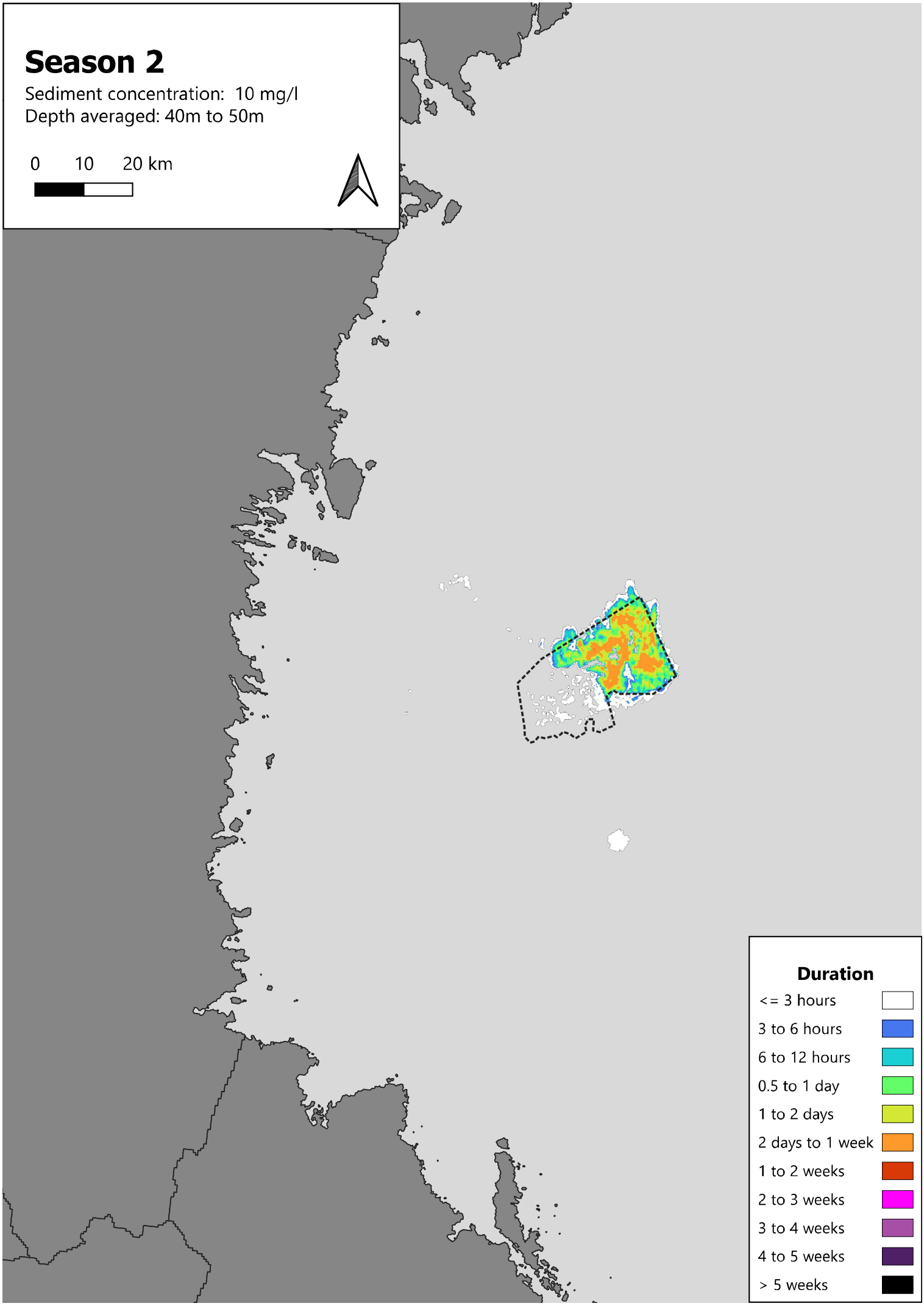

Season 2
Sediment concentration: 10 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

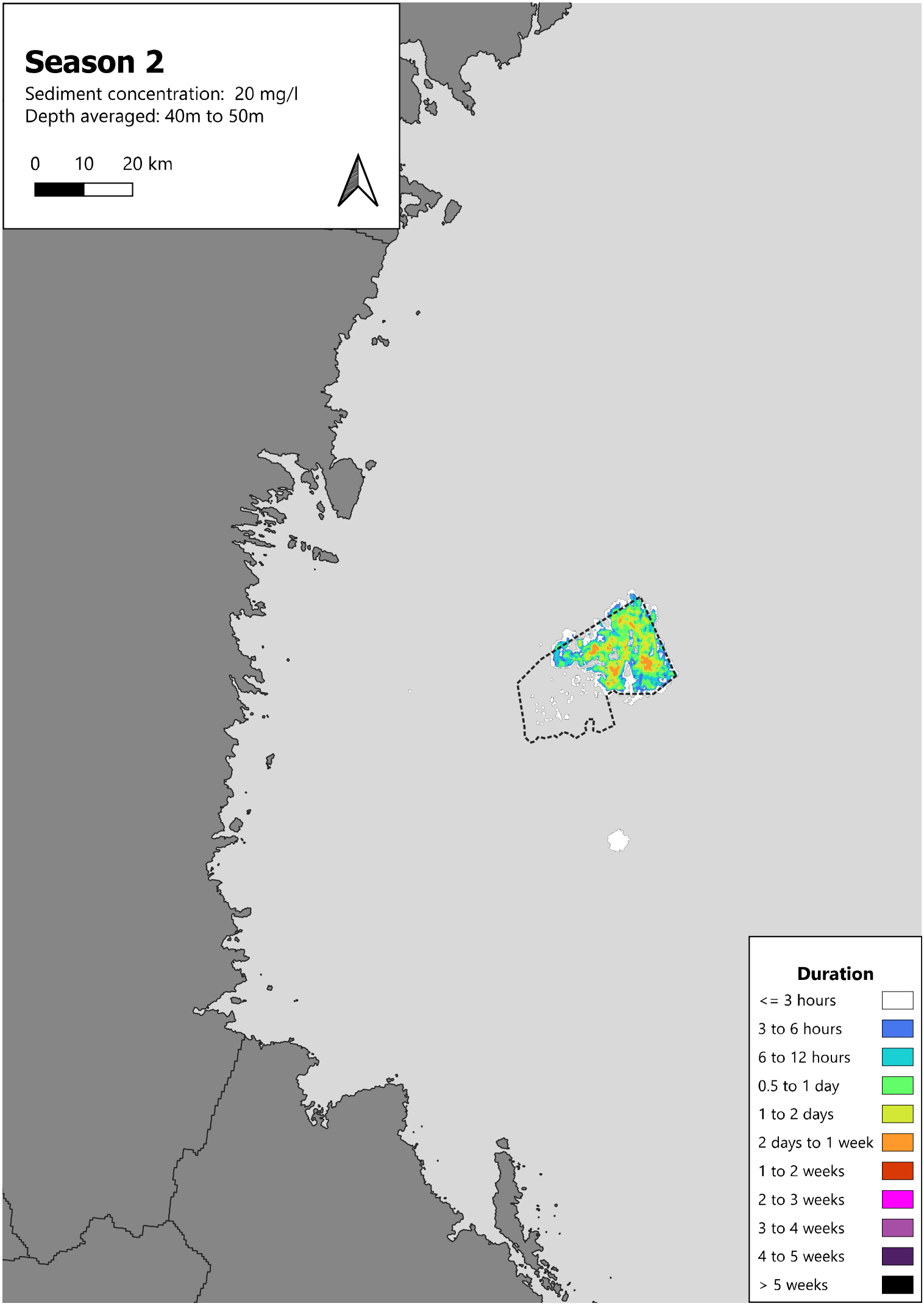

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

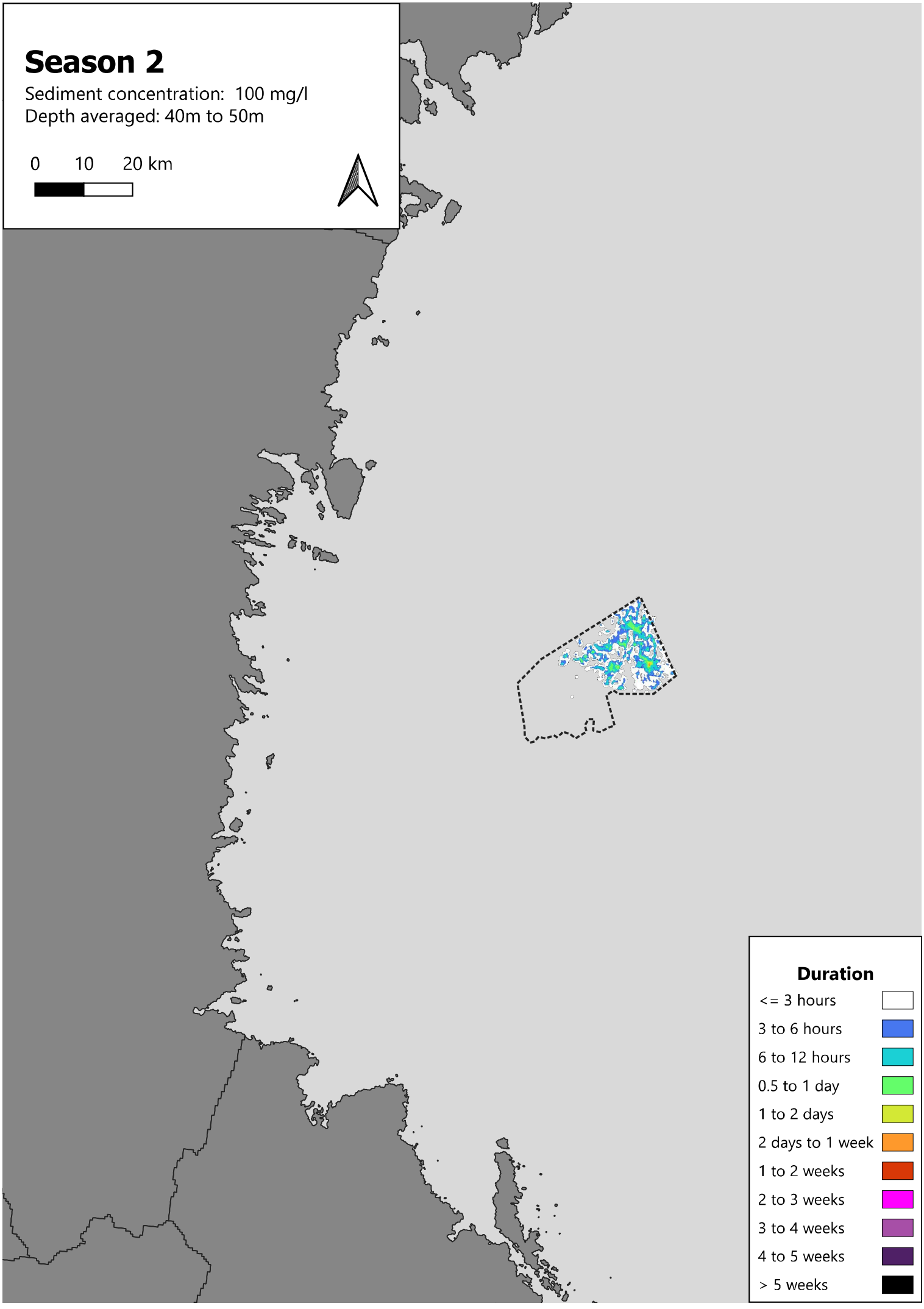

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

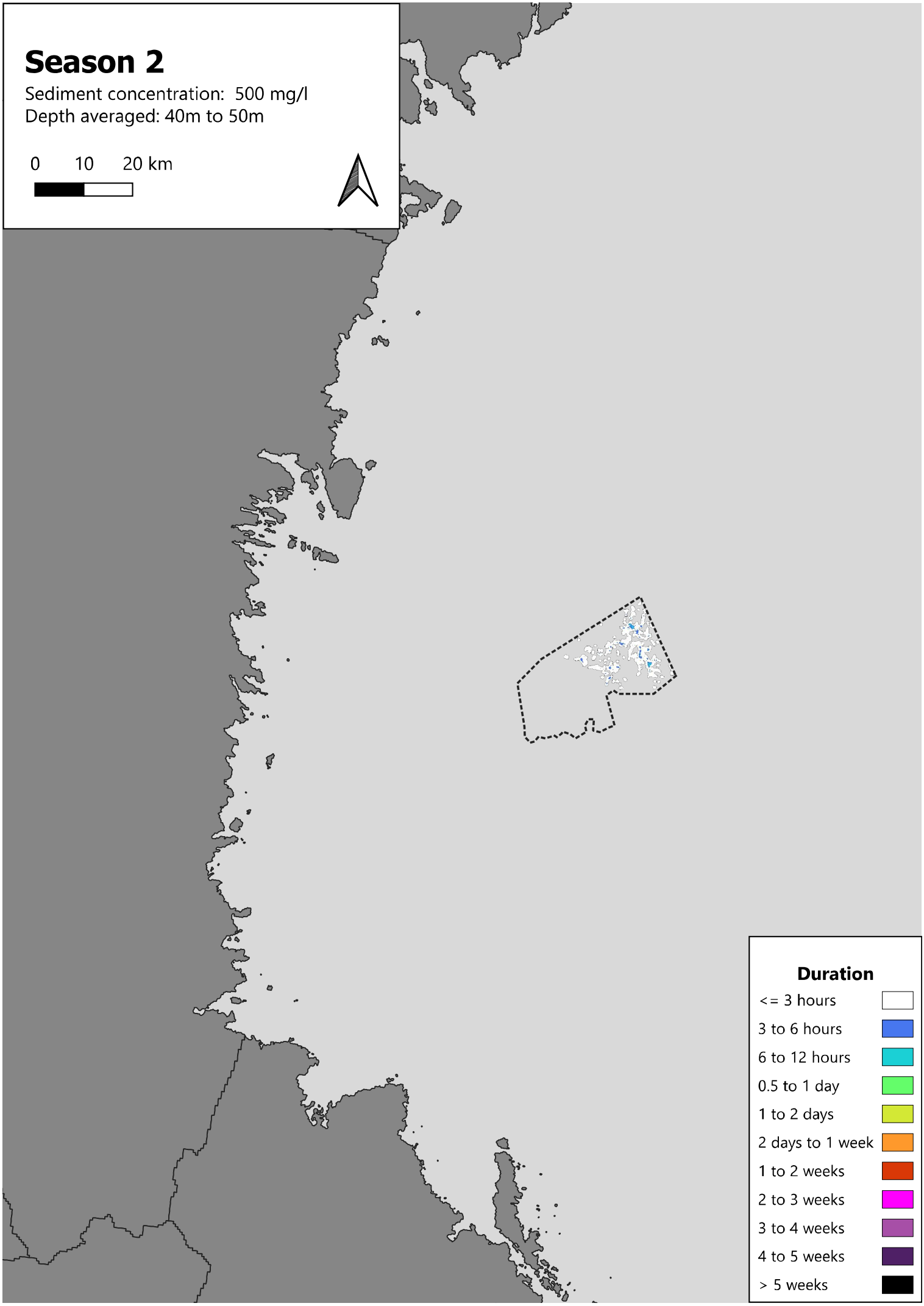

Season 2
Sediment concentration: 500 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

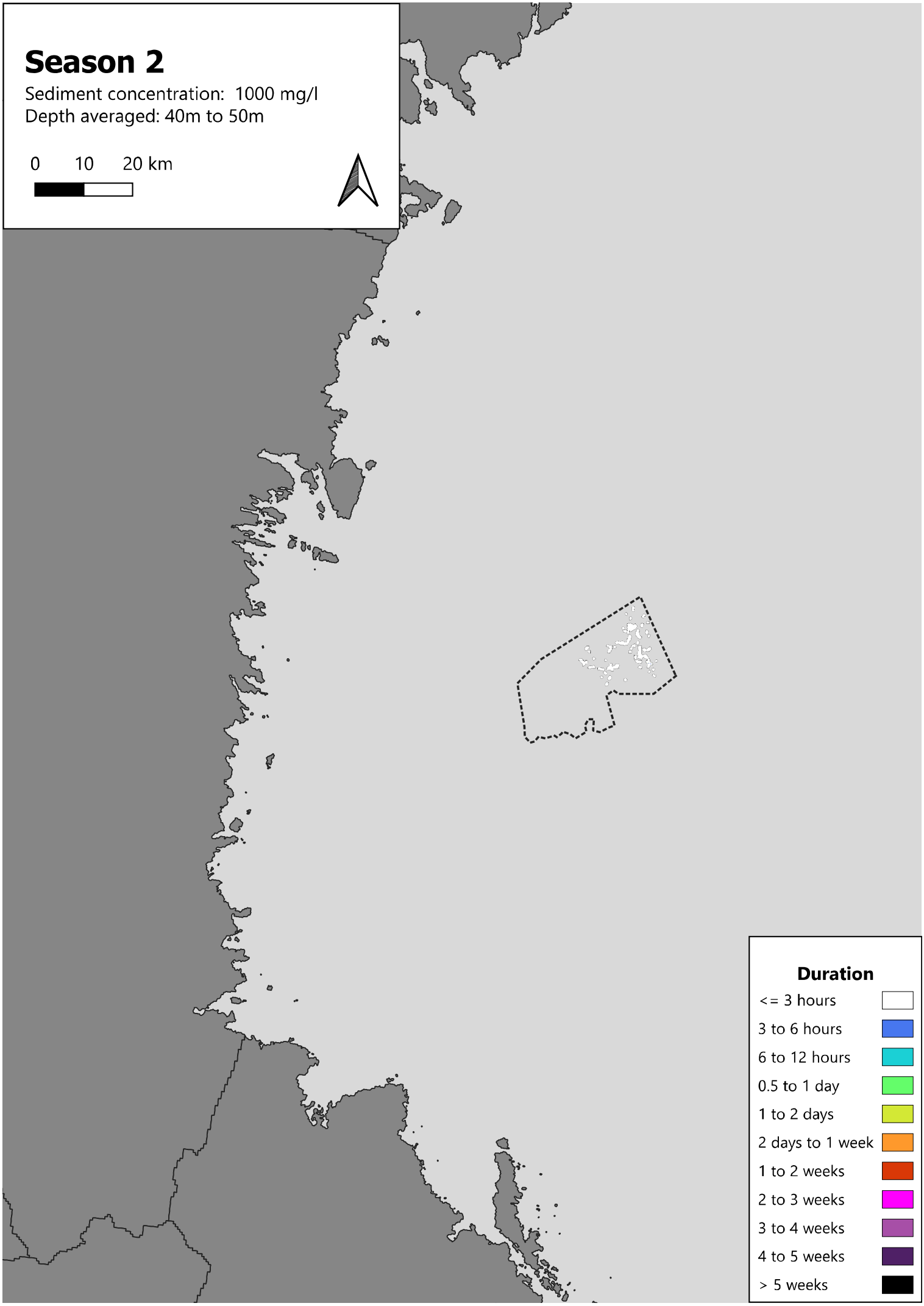

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 30m to 40m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

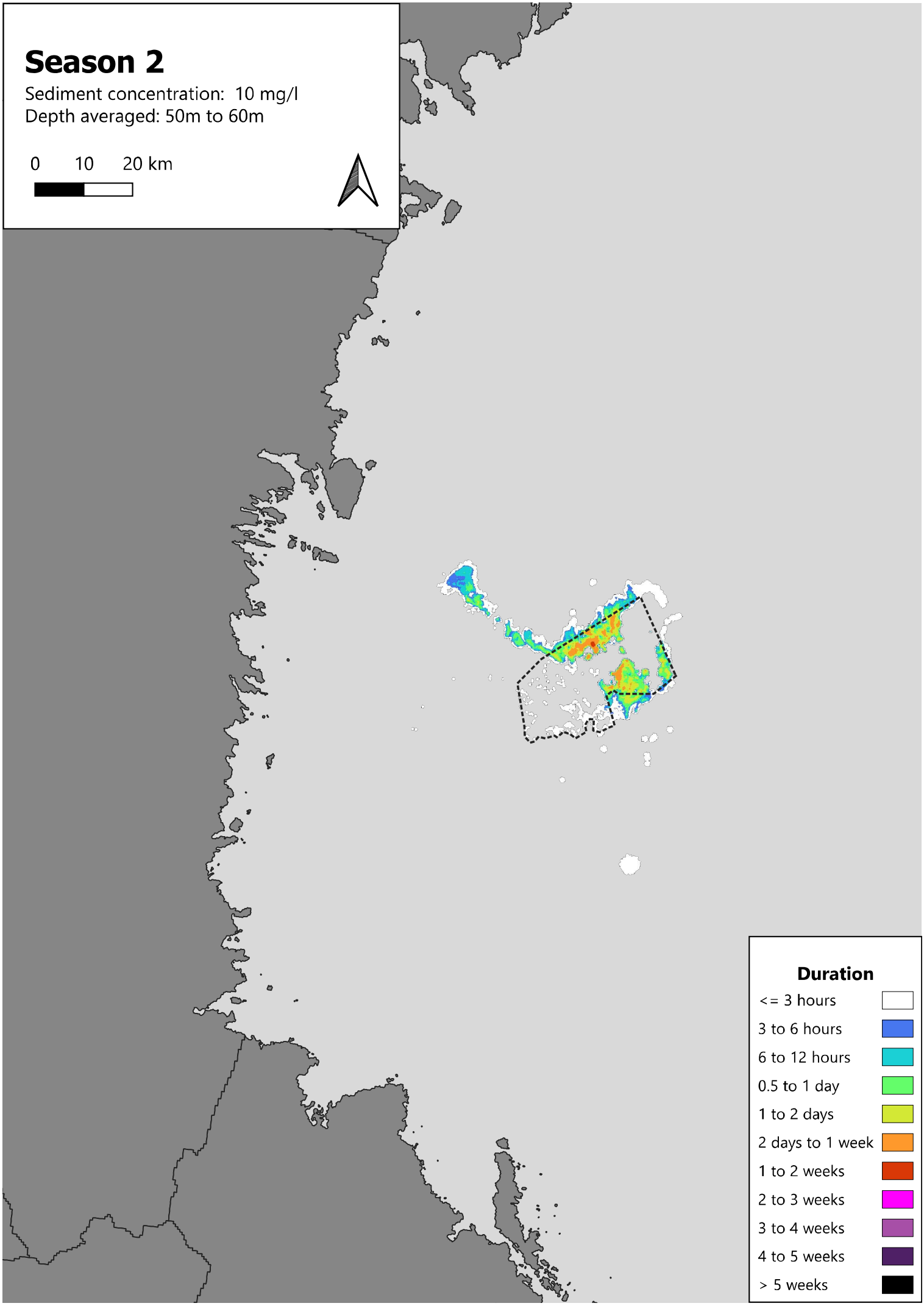

Season 2
Sediment concentration: 10 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

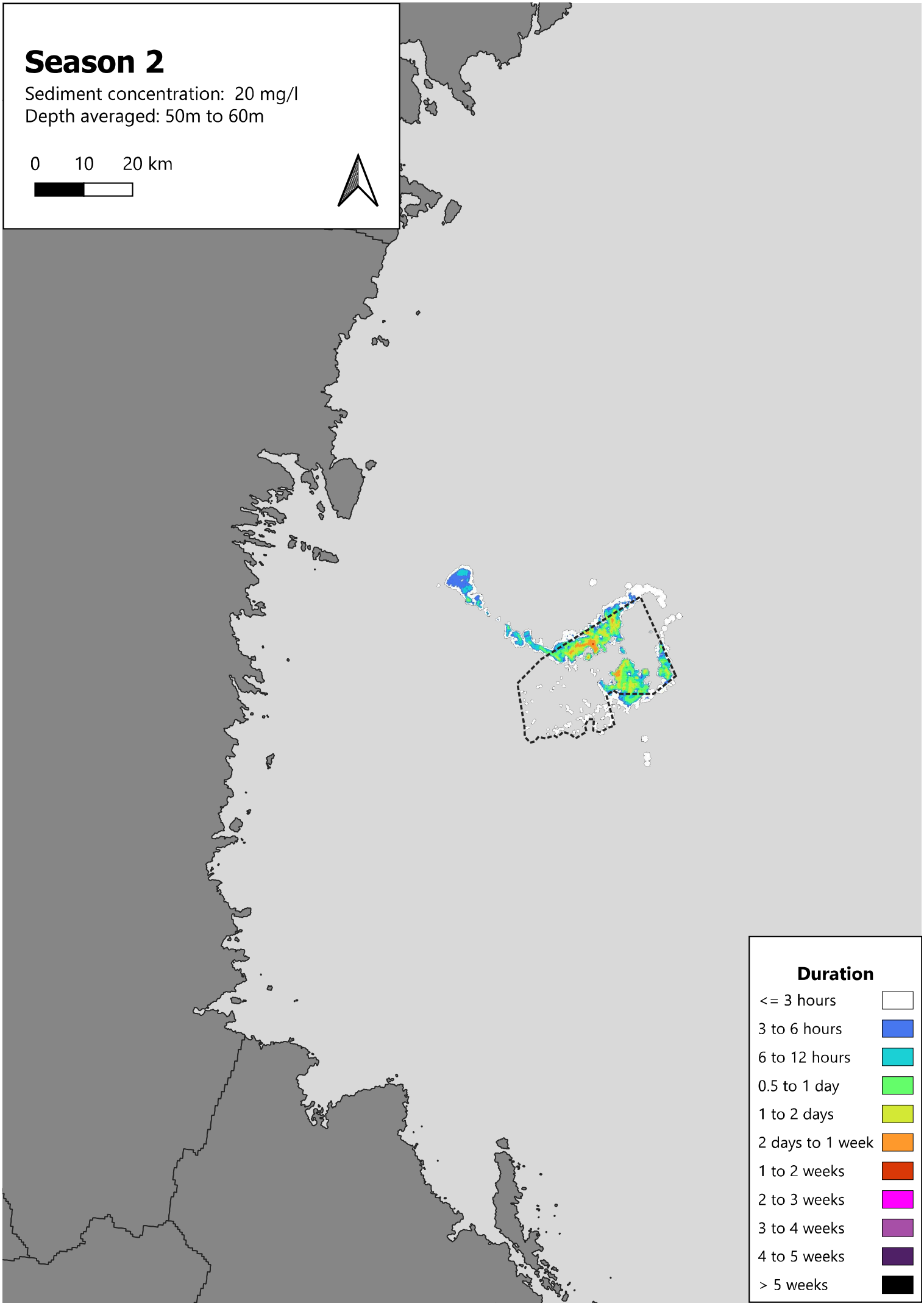

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

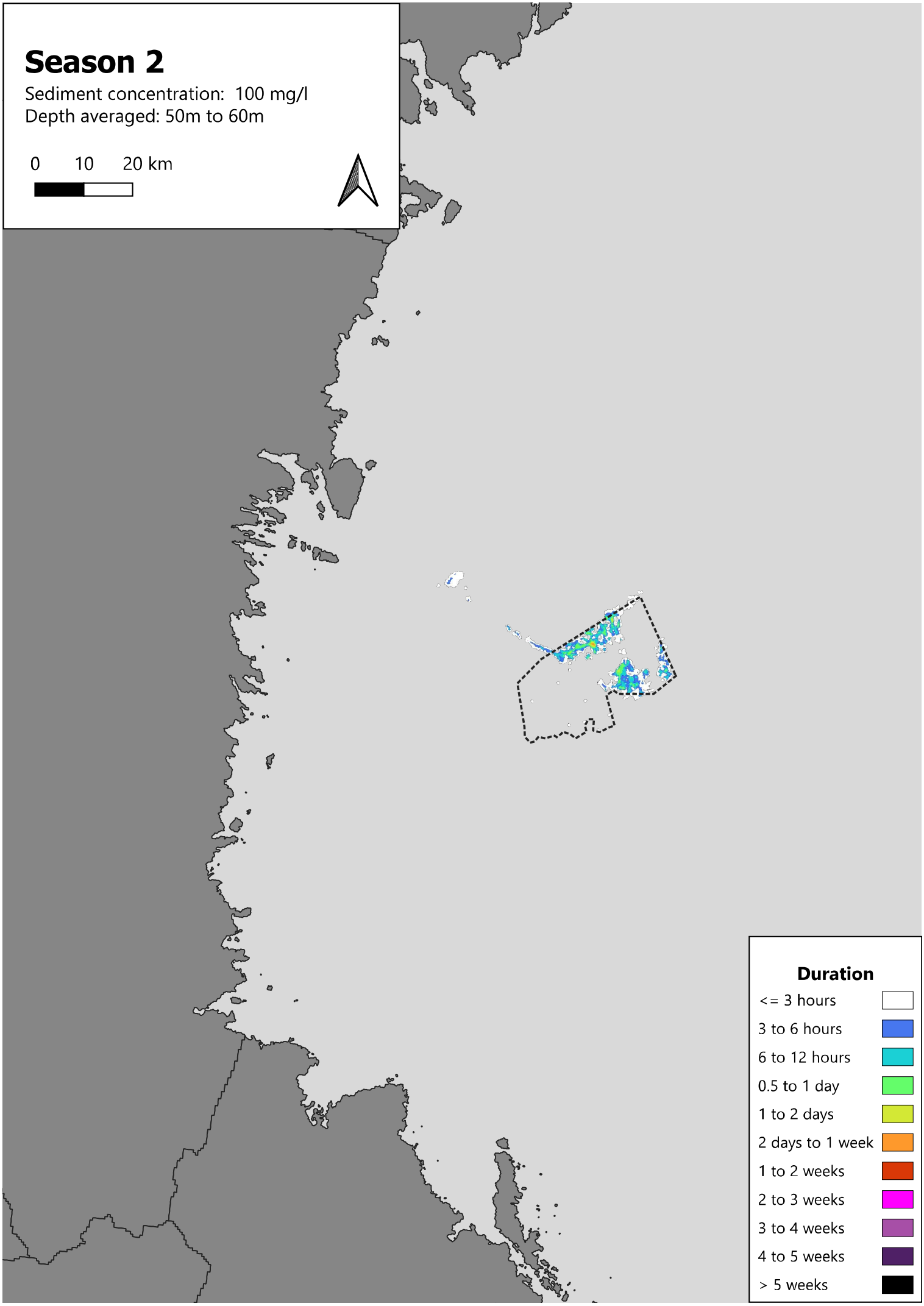

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

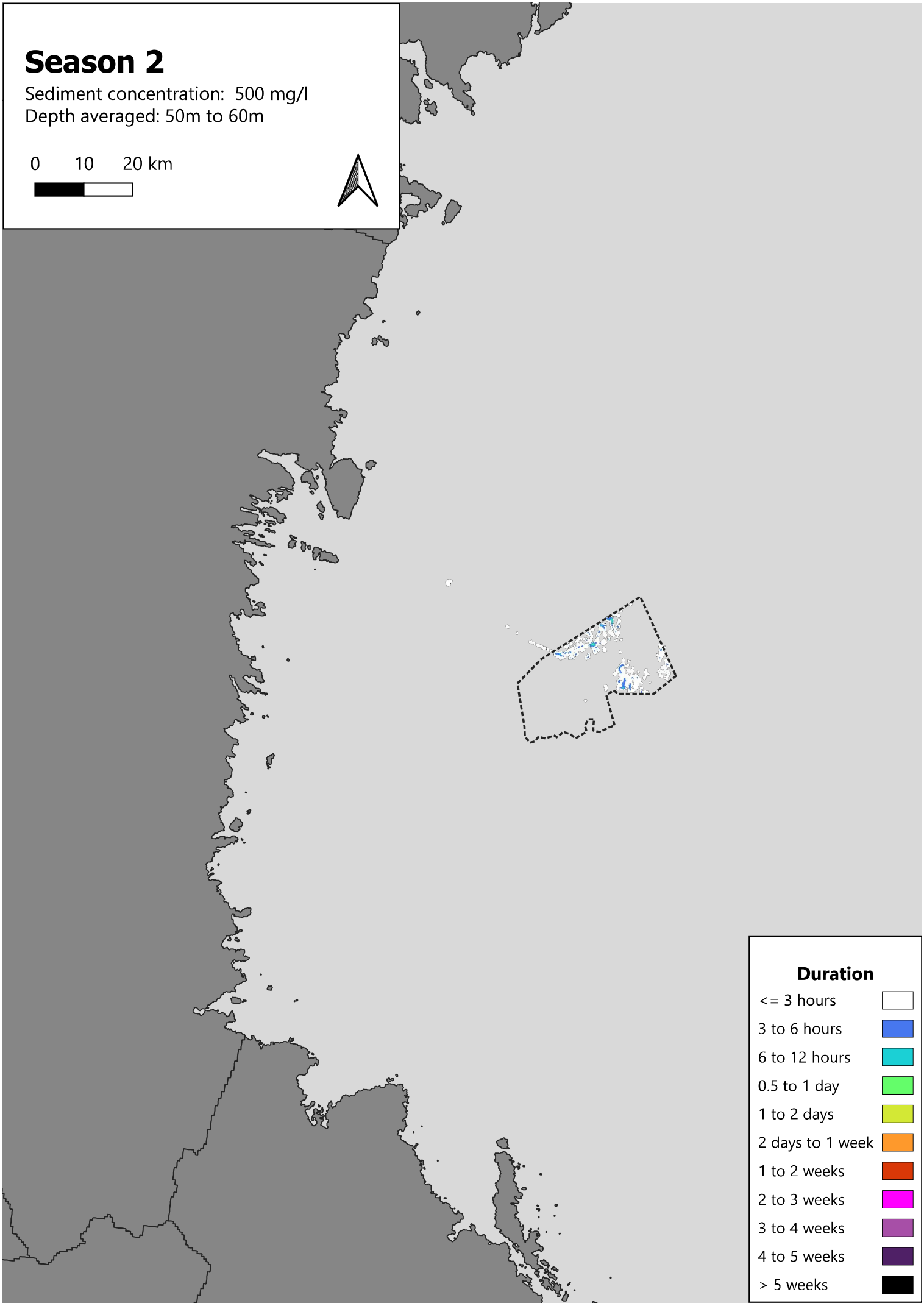

Season 2
Sediment concentration: 500 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

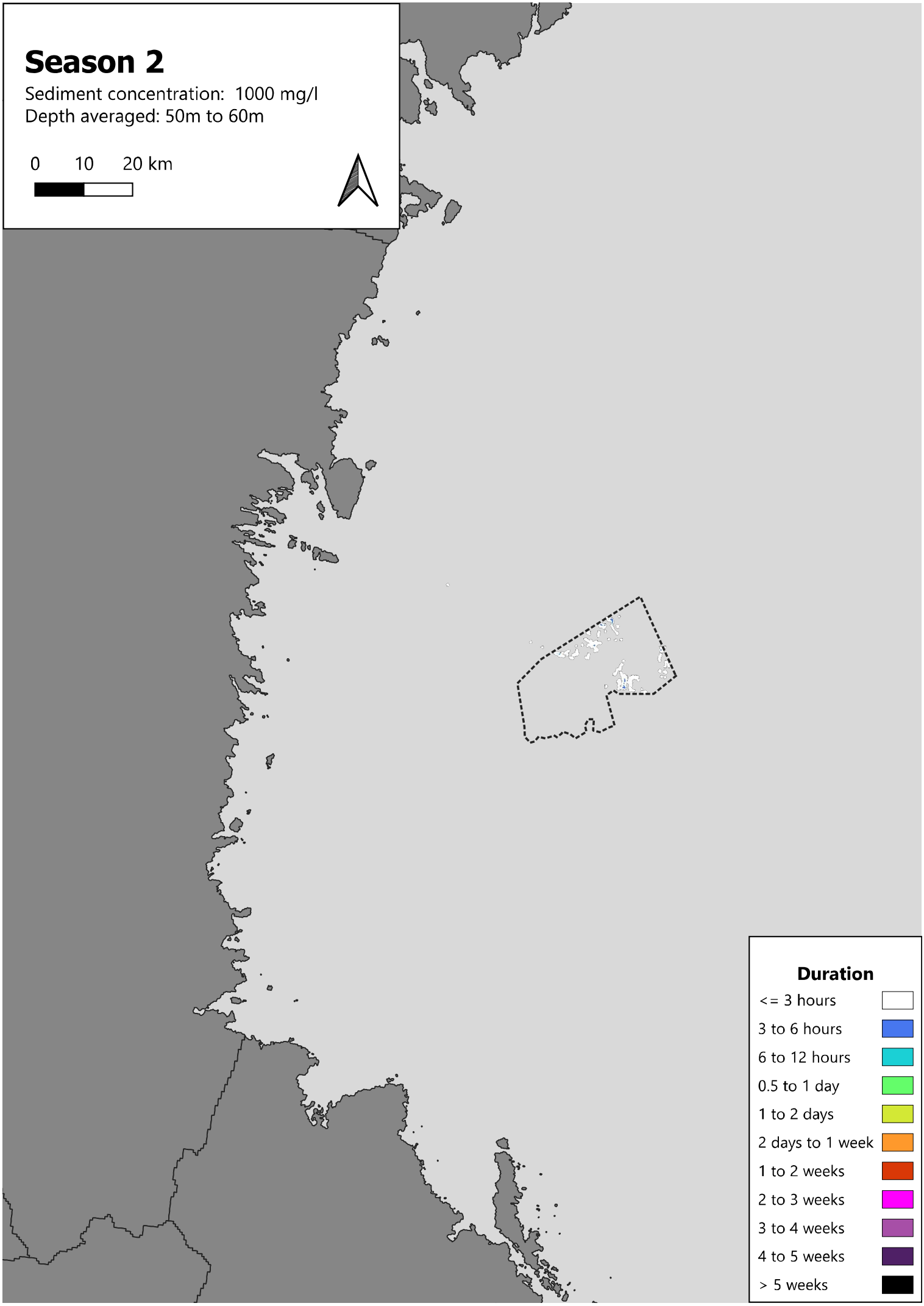

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 40m to 50m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

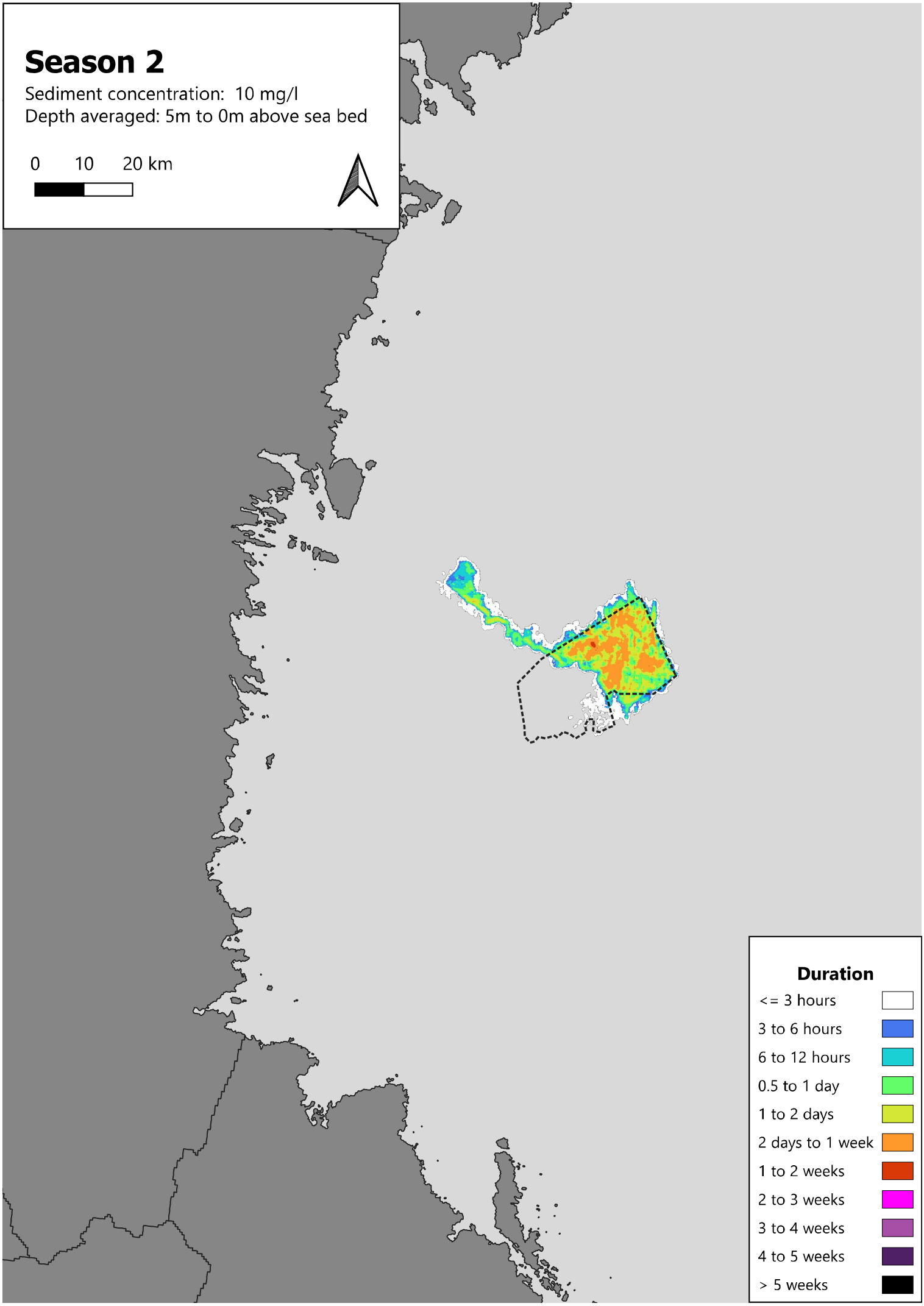

Season 2
Sediment concentration: 10 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

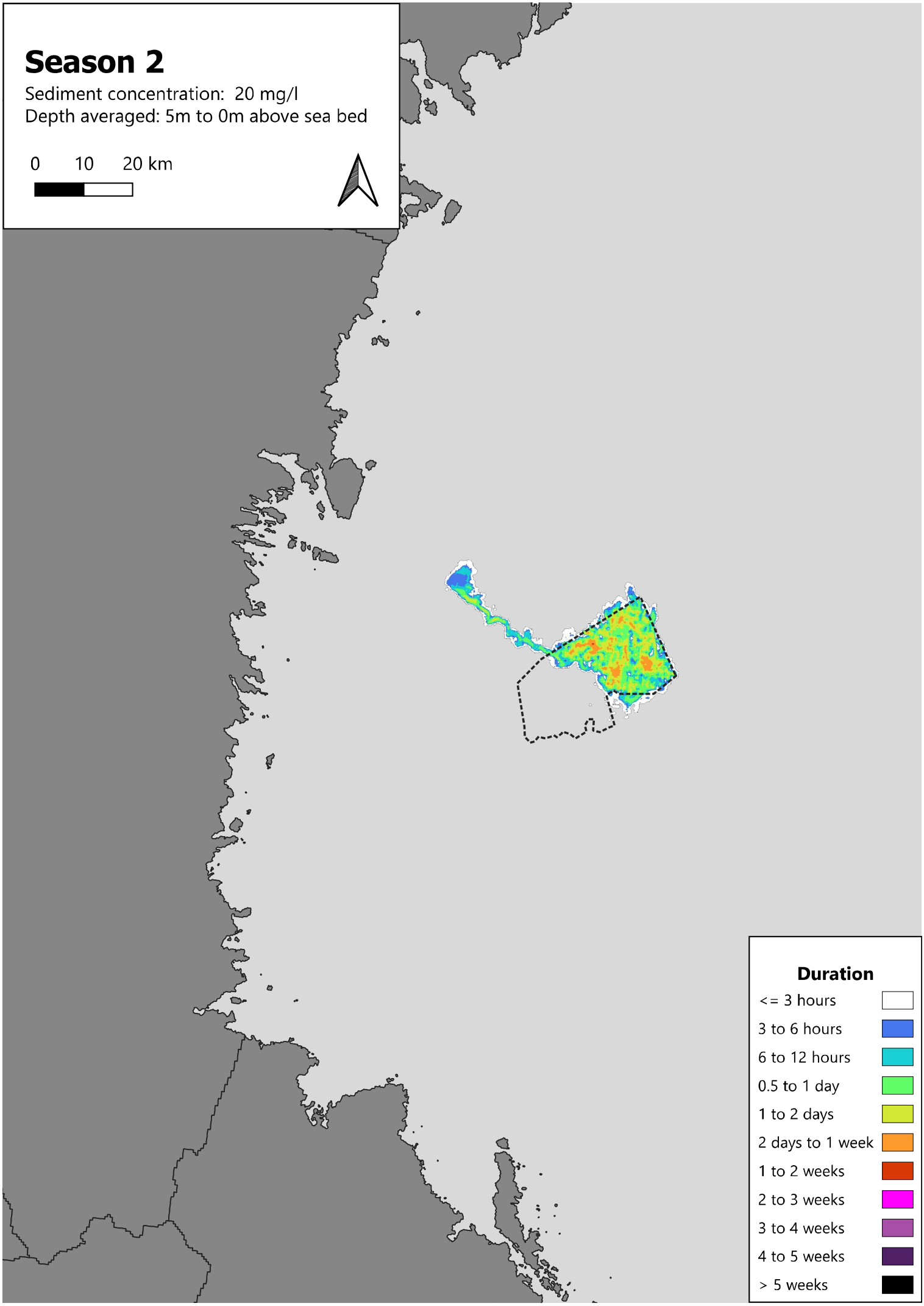

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

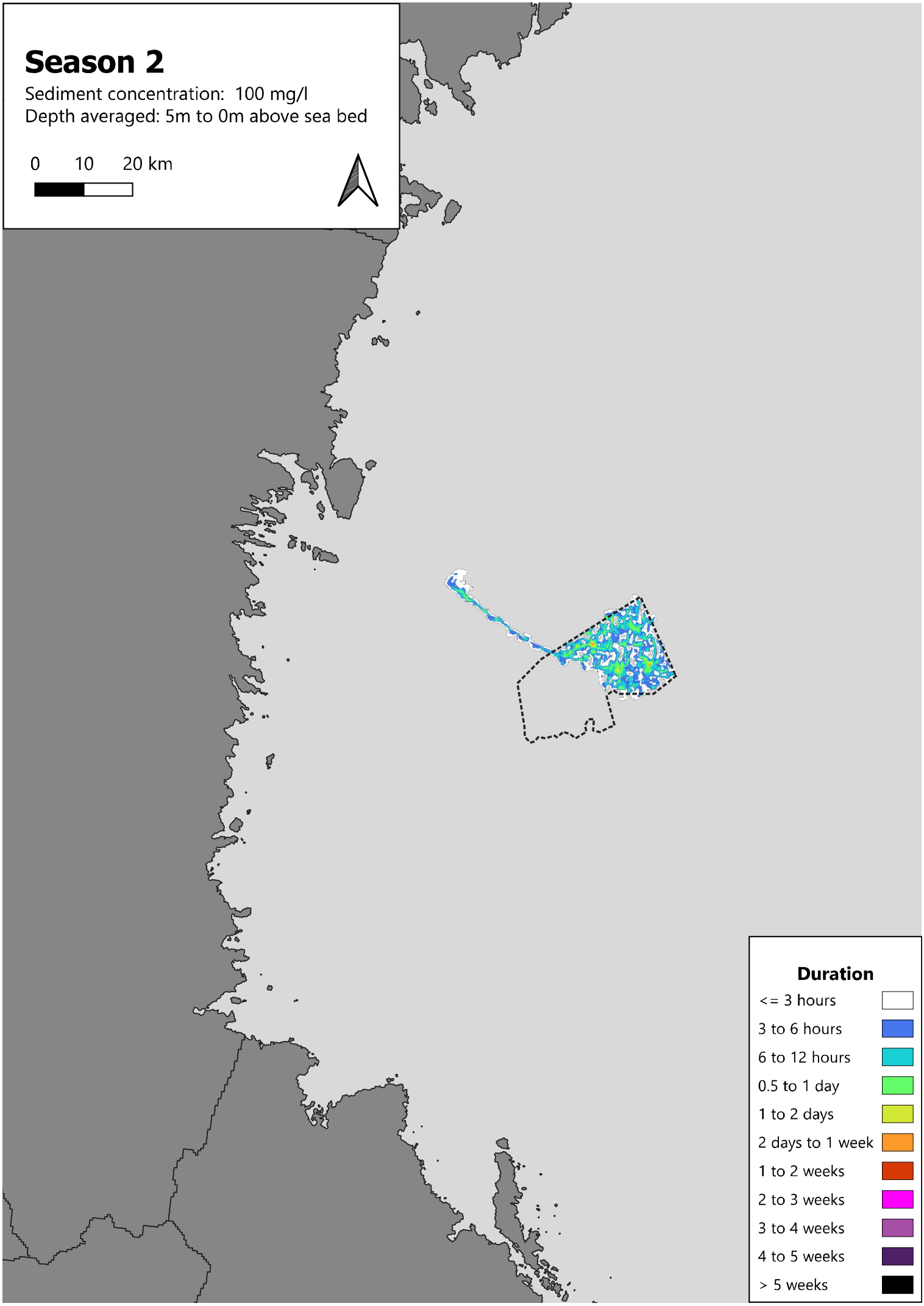

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

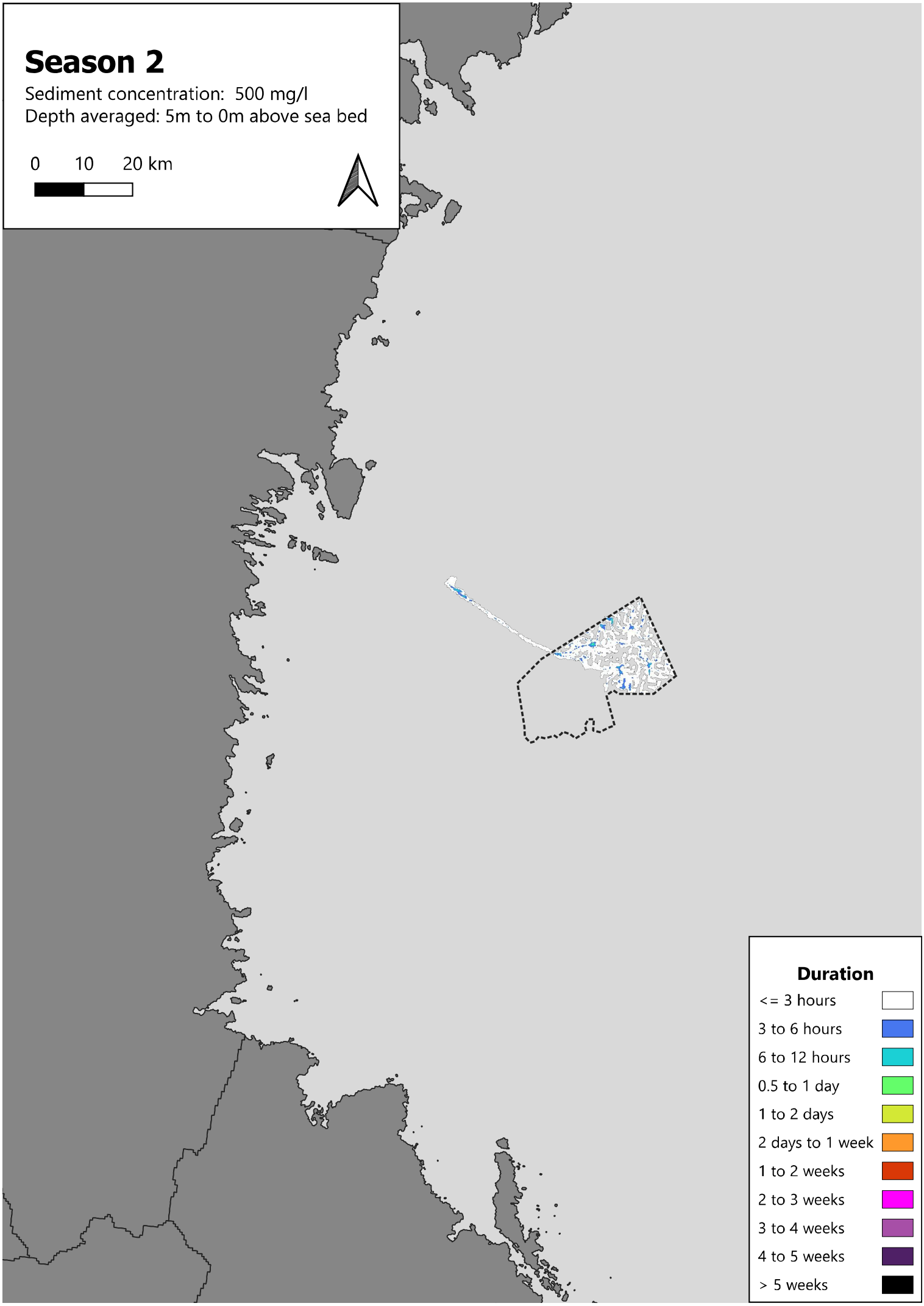

Season 2
Sediment concentration: 500 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

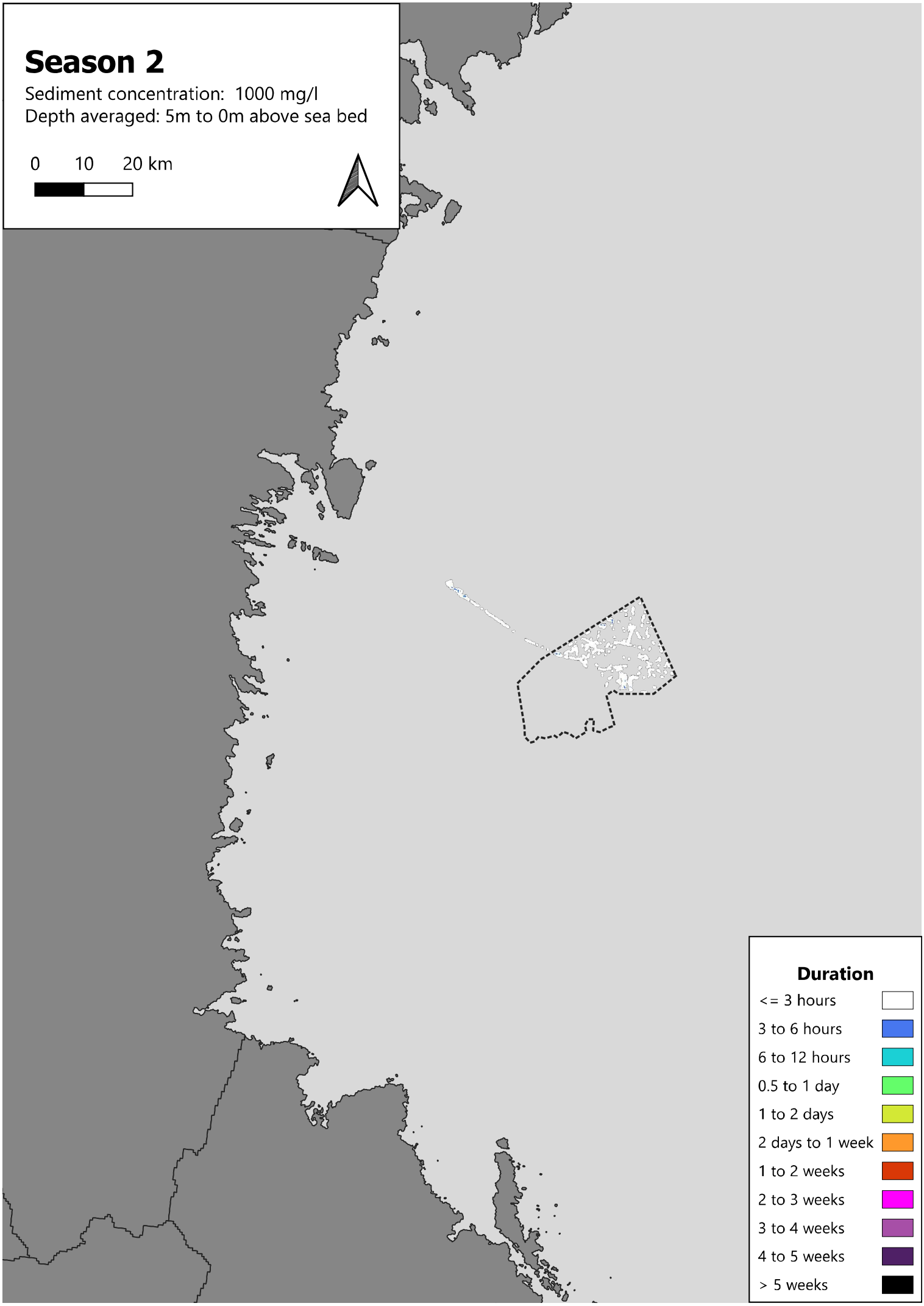

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 50m to 60m
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks


Season 2
Sediment concentration: 10 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

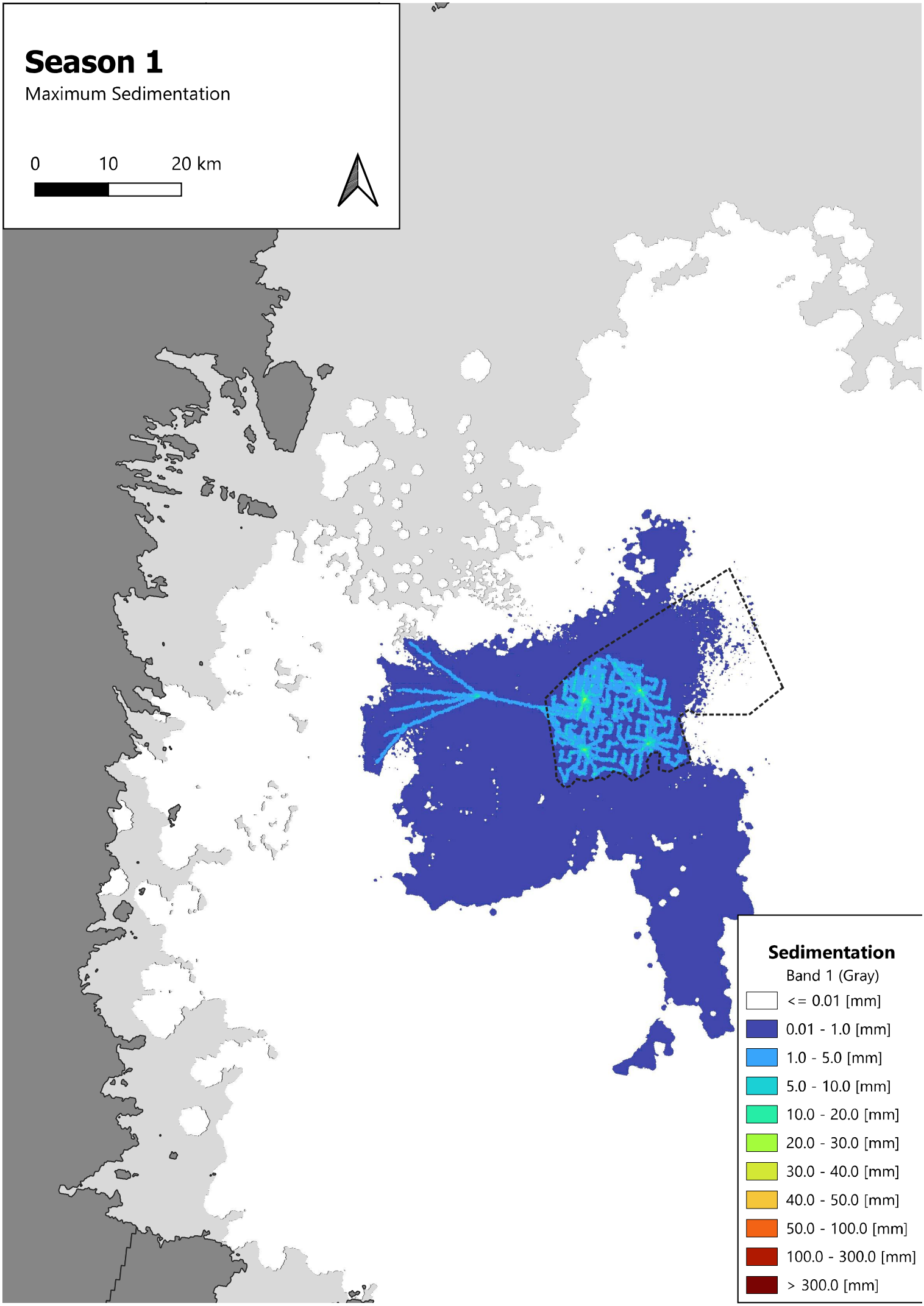

Season 2
Sediment concentration: 20 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

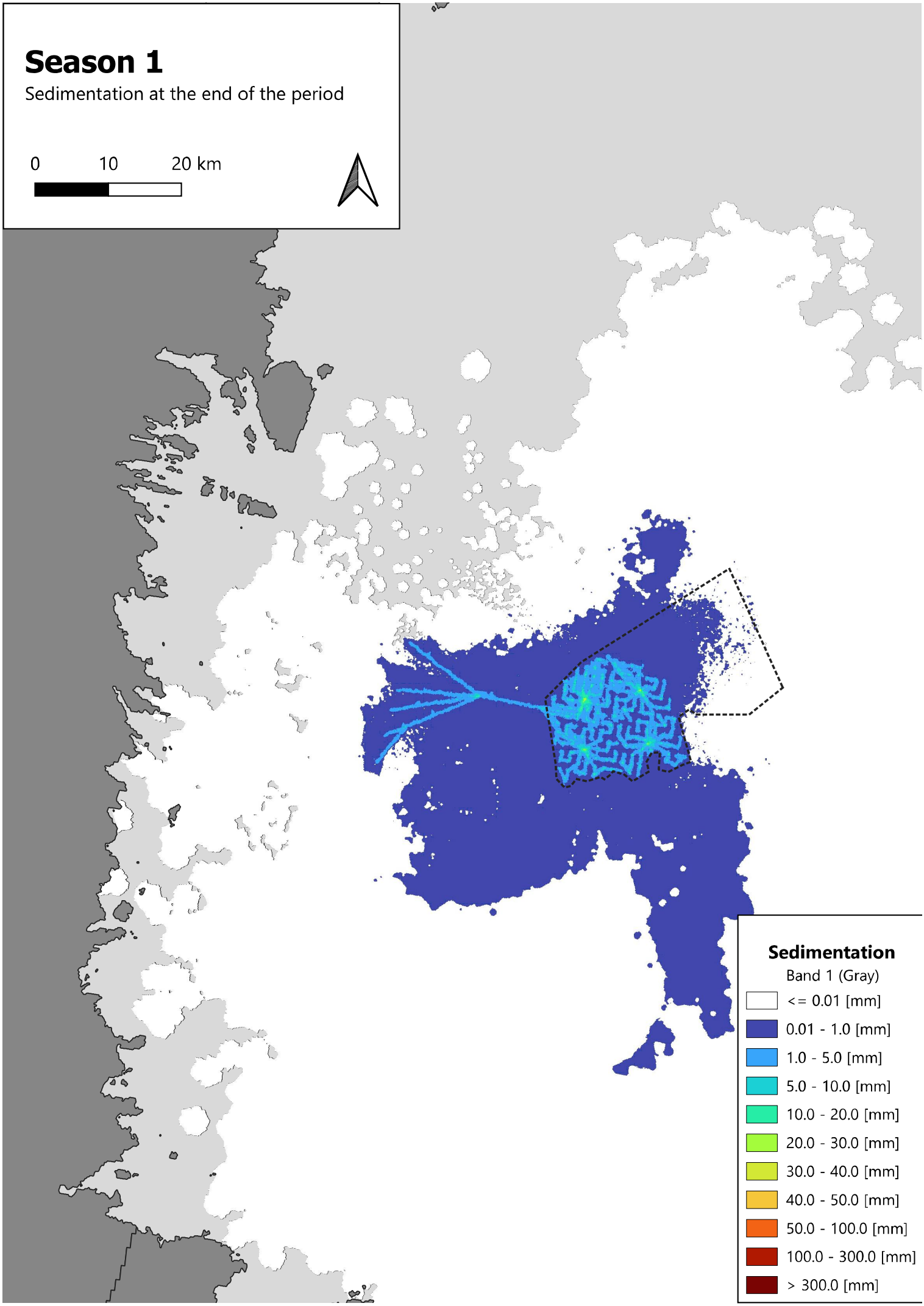

Season 2
Sediment concentration: 100 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks


Season 2
Sediment concentration: 500 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

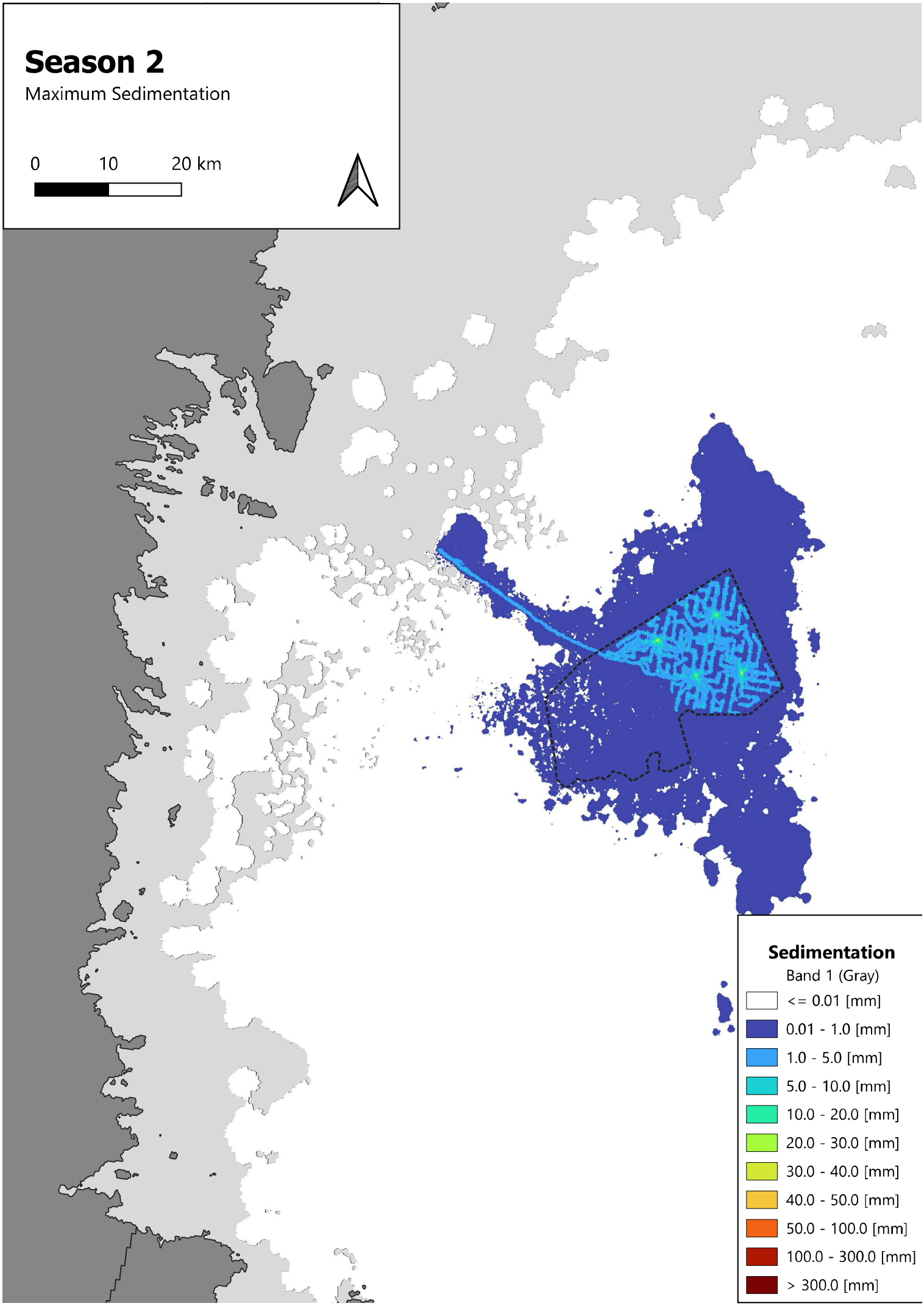

Season 2
Sediment concentration: 1000 mg/l
Depth averaged: 5m to 0m above sea bed
0 10 20 km
Duration
<= 3 hours
3 to 6 hours
6 to 12 hours
0.5 to 1 day
1 to 2 days
2 days to 1 week
1 to 2 weeks
2 to 3 weeks
3 to 4 weeks
4 to 5 weeks
> 5 weeks

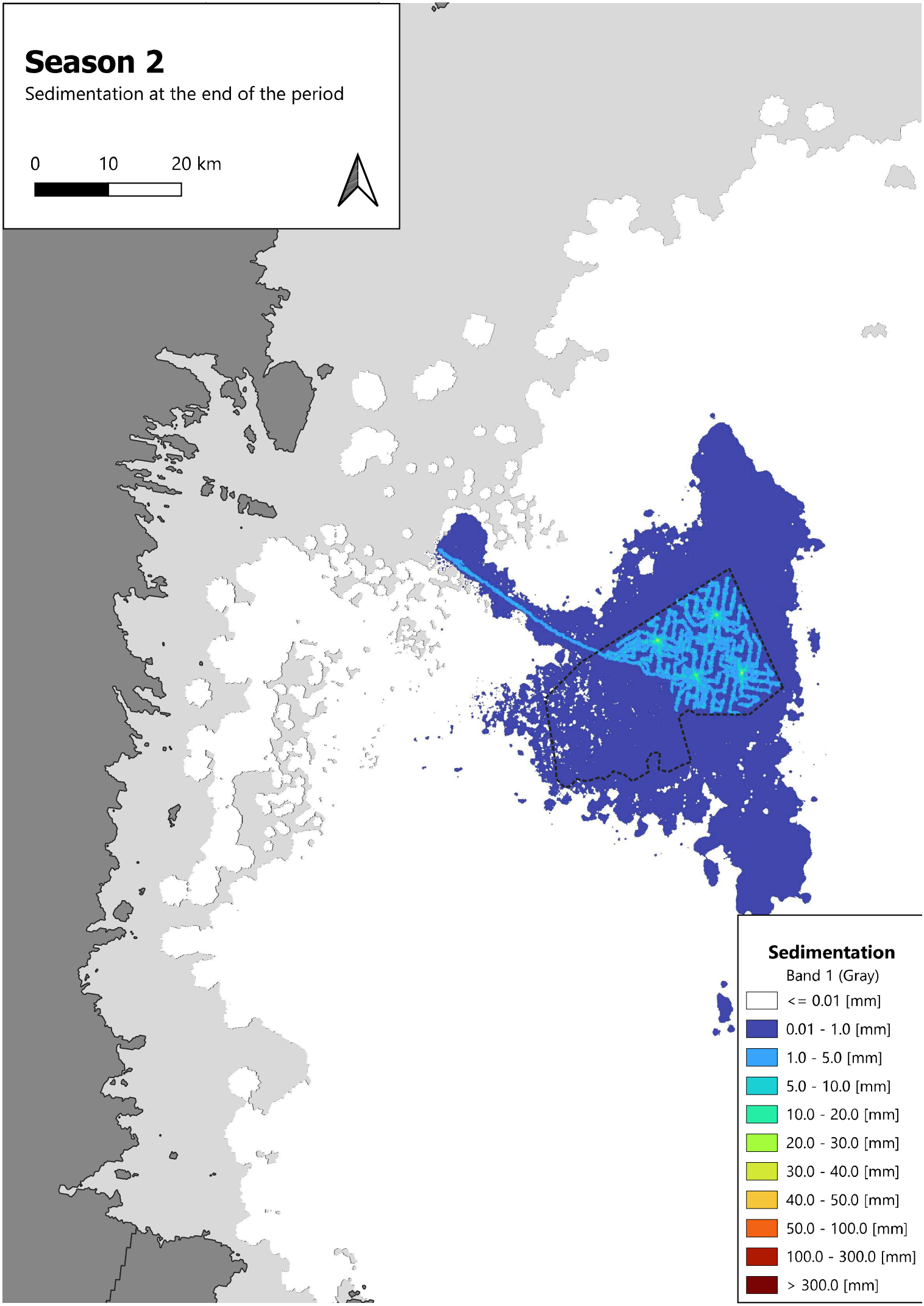
# Appendix 19 Sediment dispersal: Sedimentation – season 1


Season 1
Maximum Sedimentation
0
10
20 km
Sedimentation
Band 1 (Gray)
<= 0.01 [mm]
0.01 - 1.0 [mm]
1.0 - 5.0 [mm]
5.0 - 10.0 [mm]
10.0 - 20.0 [mm]
20.0 - 30.0 [mm]
30.0 - 40.0 [mm]
40.0 - 50.0 [mm]
50.0 - 100.0 [mm]
100.0 - 300.0 [mm]
> 300.0 [mm]


Season 1
Sedimentation at the end of the period
0
10
20 km
Sedimentation
Band 1 (Gray)
<= 0.01 [mm]
0.01 - 1.0 [mm]
1.0 - 5.0 [mm]
5.0 - 10.0 [mm]
10.0 - 20.0 [mm]
20.0 - 30.0 [mm]
30.0 - 40.0 [mm]
40.0 - 50.0 [mm]
50.0 - 100.0 [mm]
100.0 - 300.0 [mm]
> 300.0 [mm]

# Appendix 20 Sediment dispersal: Sedimentation – season 2


Season 2
Maximum Sedimentation
0
10
20 km
Sedimentation
Band 1 (Gray)
<= 0.01 [mm]
0.01 - 1.0 [mm]
1.0 - 5.0 [mm]
5.0 - 10.0 [mm]
10.0 - 20.0 [mm]
20.0 - 30.0 [mm]
30.0 - 40.0 [mm]
40.0 - 50.0 [mm]
50.0 - 100.0 [mm]
100.0 - 300.0 [mm]
> 300.0 [mm]


Season 2
Sedimentation at the end of the period
0
10
20 km
Sedimentation
Band 1 (Gray)
<= 0.01 [mm]
0.01 - 1.0 [mm]
1.0 - 5.0 [mm]
5.0 - 10.0 [mm]
10.0 - 20.0 [mm]
20.0 - 30.0 [mm]
30.0 - 40.0 [mm]
40.0 - 50.0 [mm]
50.0 - 100.0 [mm]
100.0 - 300.0 [mm]
> 300.0 [mm]