Island trapped waves (ITWs) as a driver of primary production at Lastovo island (Adriatic Sea)

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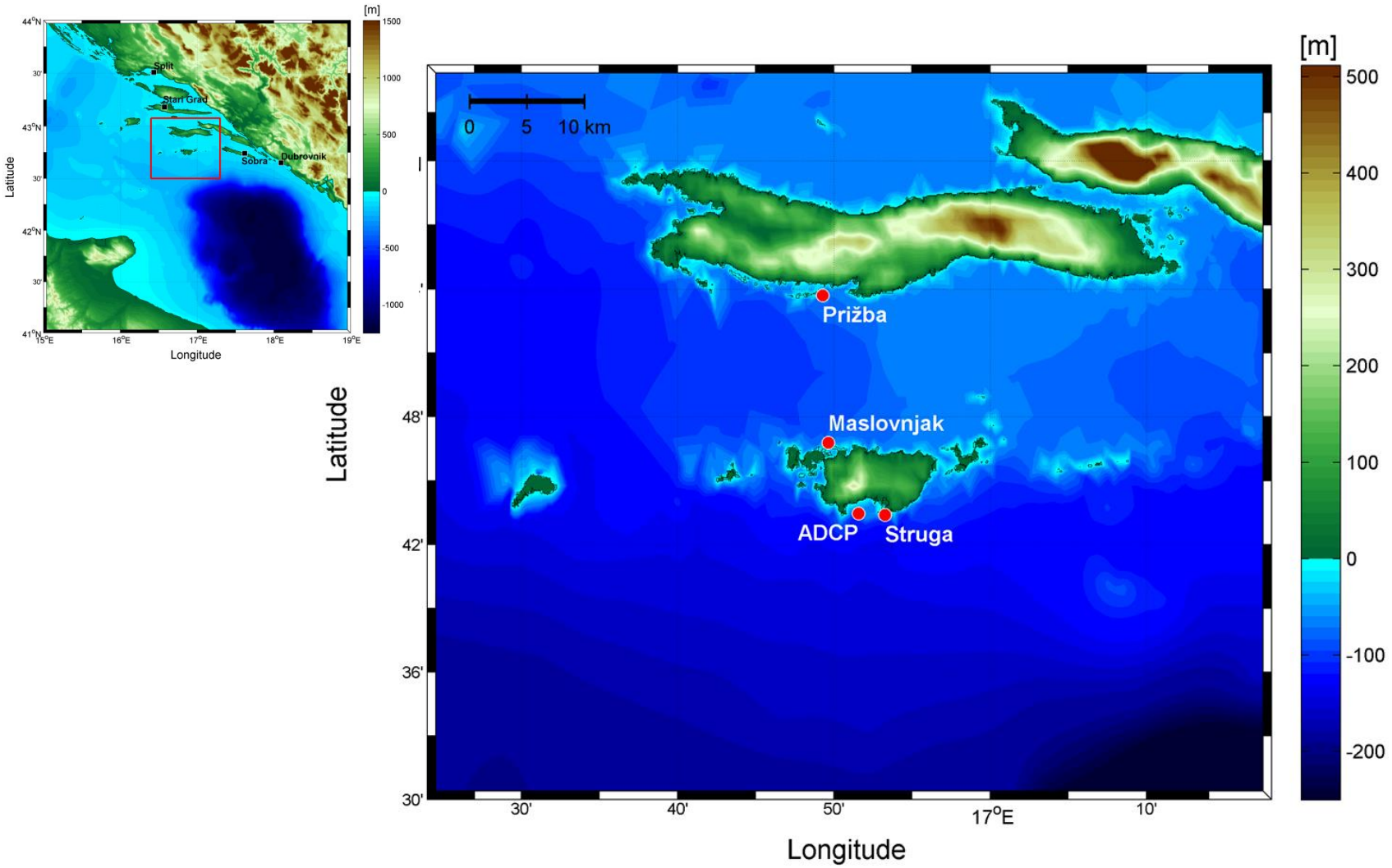
- Internal waves - ubiquitous phenomenon in the ocean; their effect on primary production has seldom been studied

- internal waves around islands: a peculiar case of coastal trapped internal waves which occurs around closed shoreline

island geometry and stratification coincide with external forcing → ITWs can be excited → case study – Northern hemisphere Island Lastovo

Map of the investigated area in the Adriatic Sea (Lastovo and Korčula islands, June – September 2021)



Temperature loggers:

- Prižba (5 m : 5 m: 45 m, except 25 m)
- Maslovnjak (5, 10, 15, 30, 40 and 45 m)
- Struga (5, 10, 20, 30, 35 and 45 m)
- Early June – late September 2021
- dt = 5 min

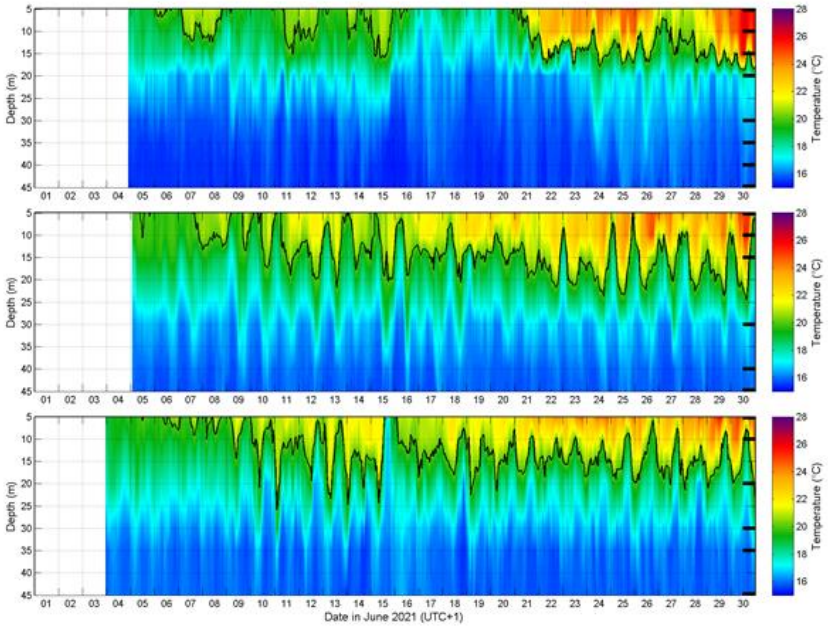
ADCP (300 kHz):

- Early June – early October 2021
- bin depths: 11 m : 4 m : 83 m
- dt = 10 min

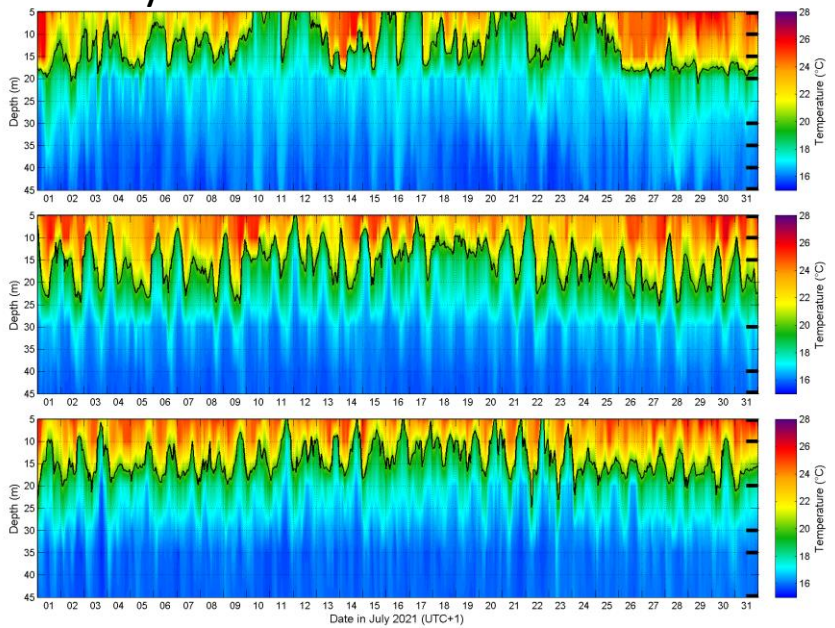
In July 2021 - Ship-based survey at Struga

- CTD measurements twice a day, around 06:00 (UTC+2) when deep thermocline was expected at the location, and around 18:00 (UTC+2) when shallow thermocline was expected.

June 2021



July 2021



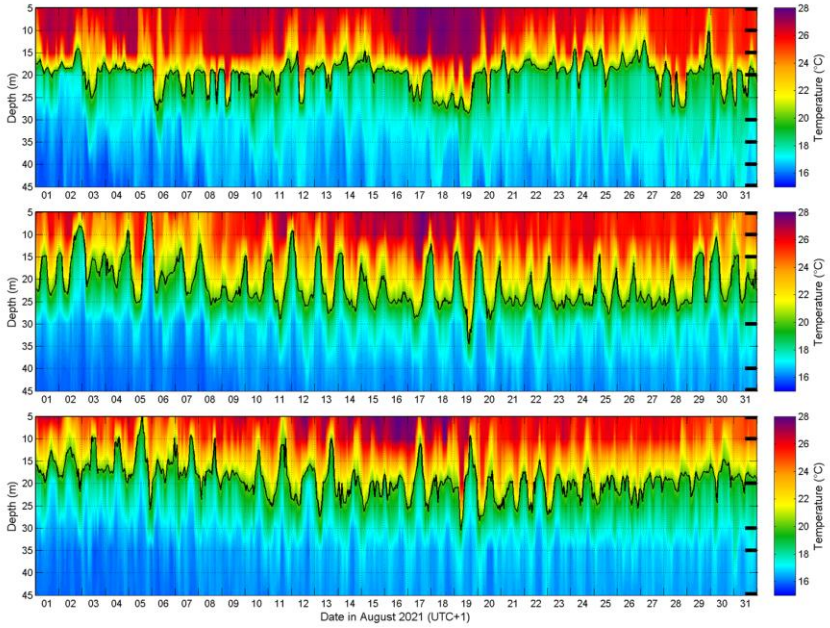
Prižba

Maslovnjak

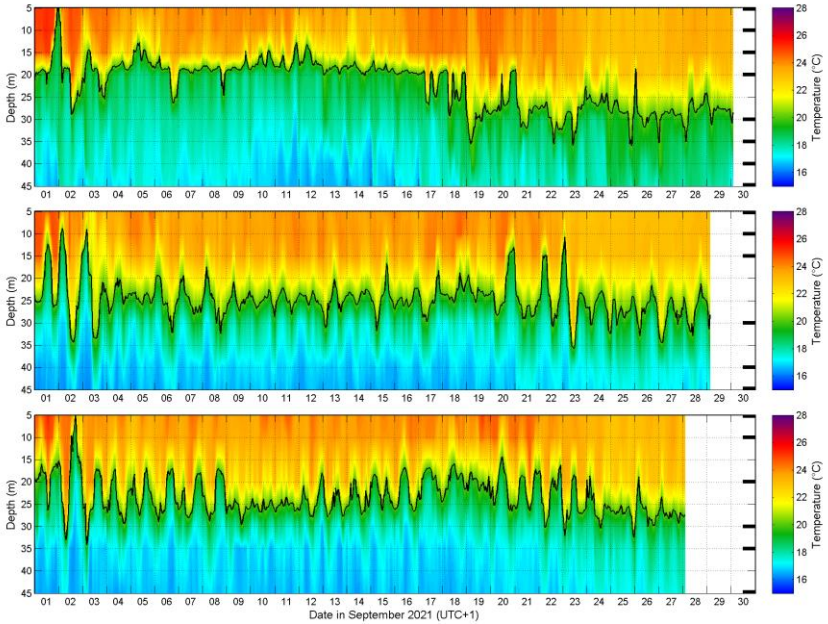
Struga

Temperature oscillations at opposite sides of the island off phase, indicating the clockwise propagation of the internal waves around the Lastovo island.

August 2021



September 2021



Prižba

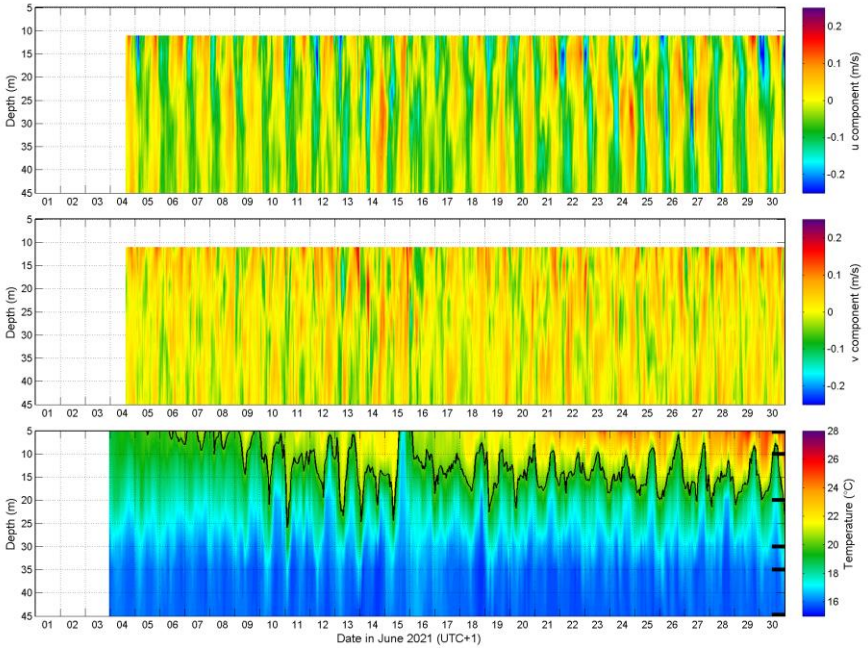
Maslovnjak

Struga

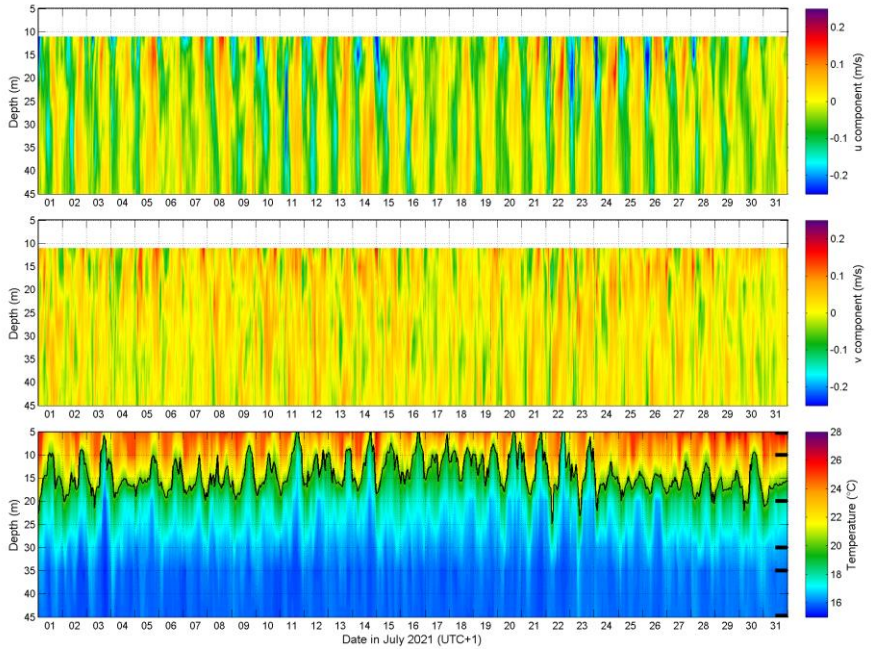
Several episodes with large diurnal thermocline oscillations, with range surpassing 20 m observed.

Temperature - 20°C isotherm denoted

June 2021



July 2021

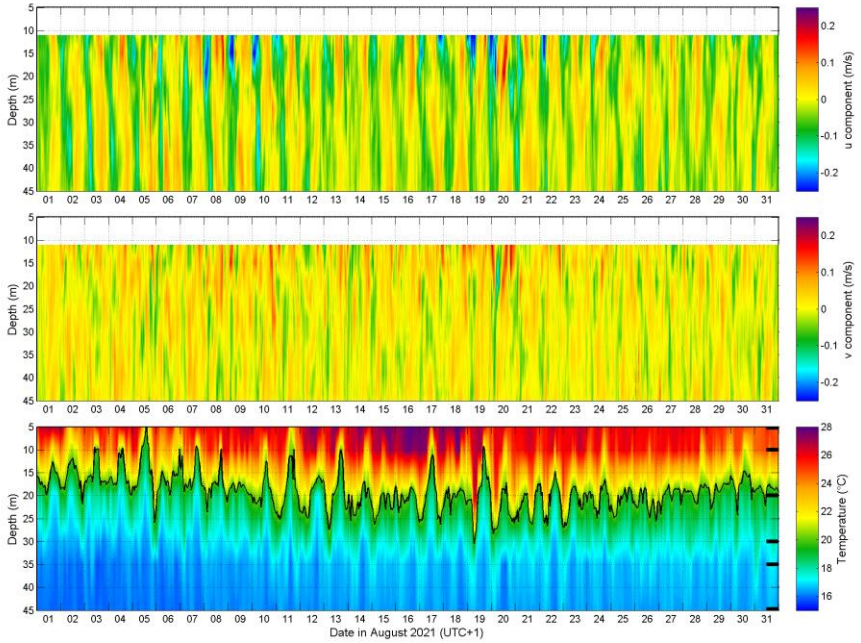


ADCP
u component

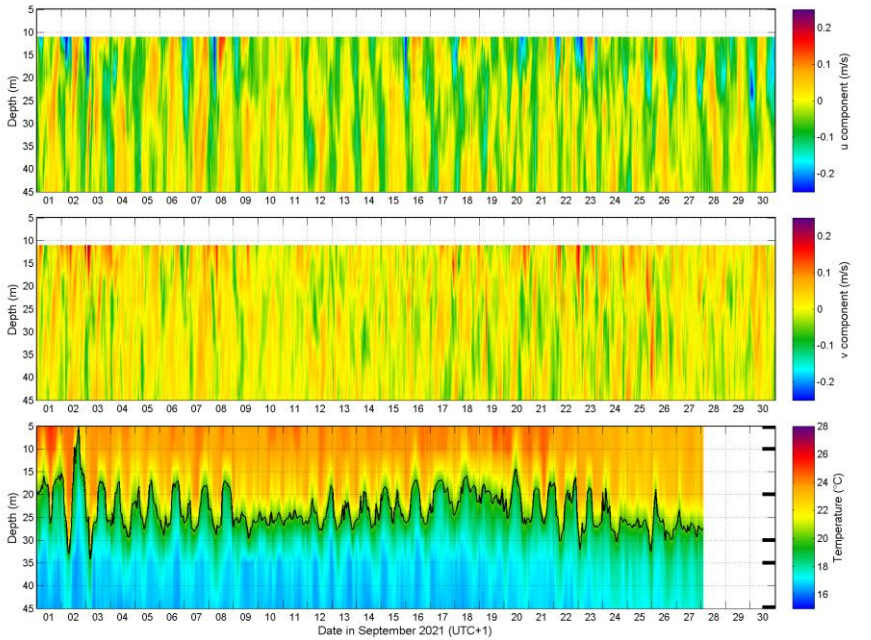
ADCP
v component

Struga temperature

August 2021



September 2021



ADCP
u component

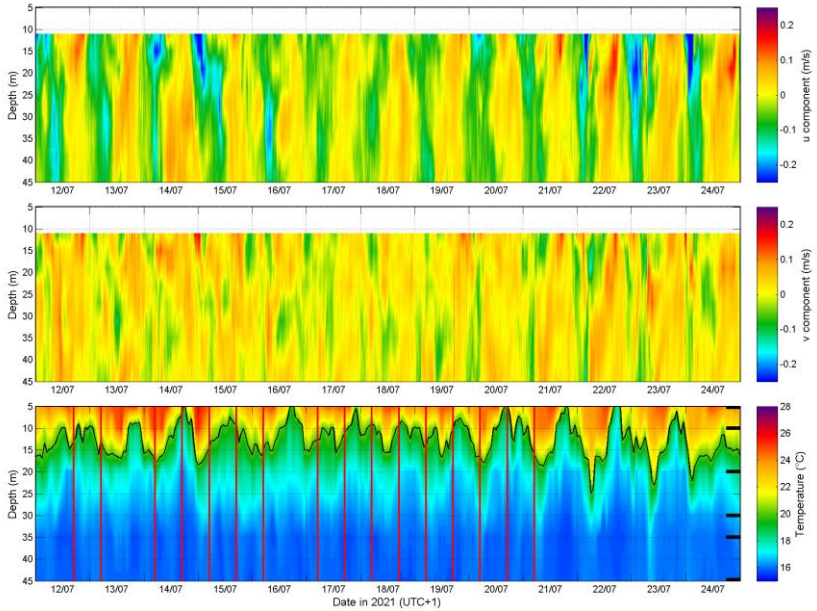
ADCP
v component

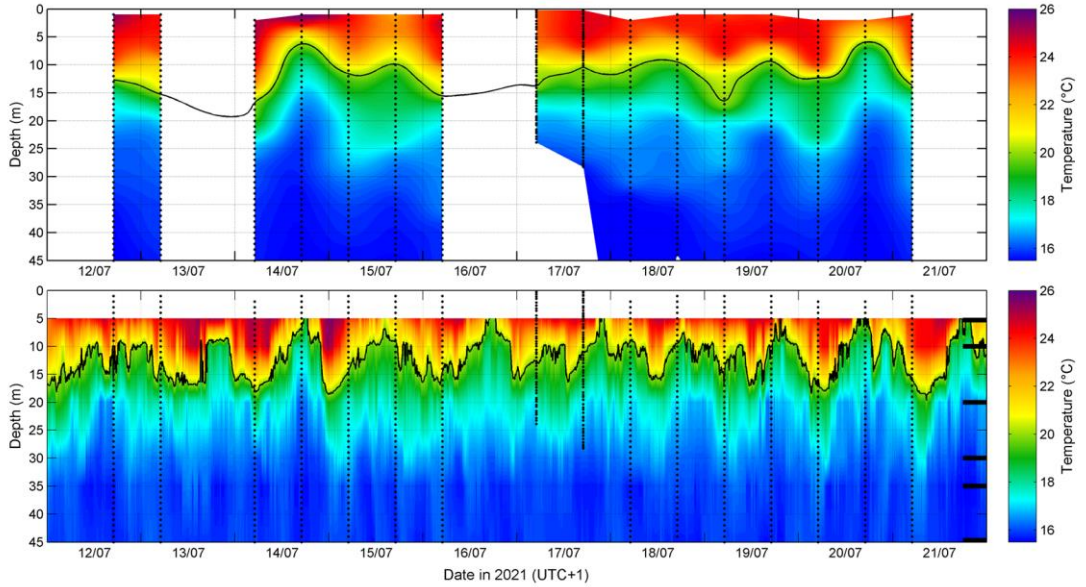
Struga temperature

ADCP
u component

ADCP
v component

Struga CTD profiles
denoted (red lines)



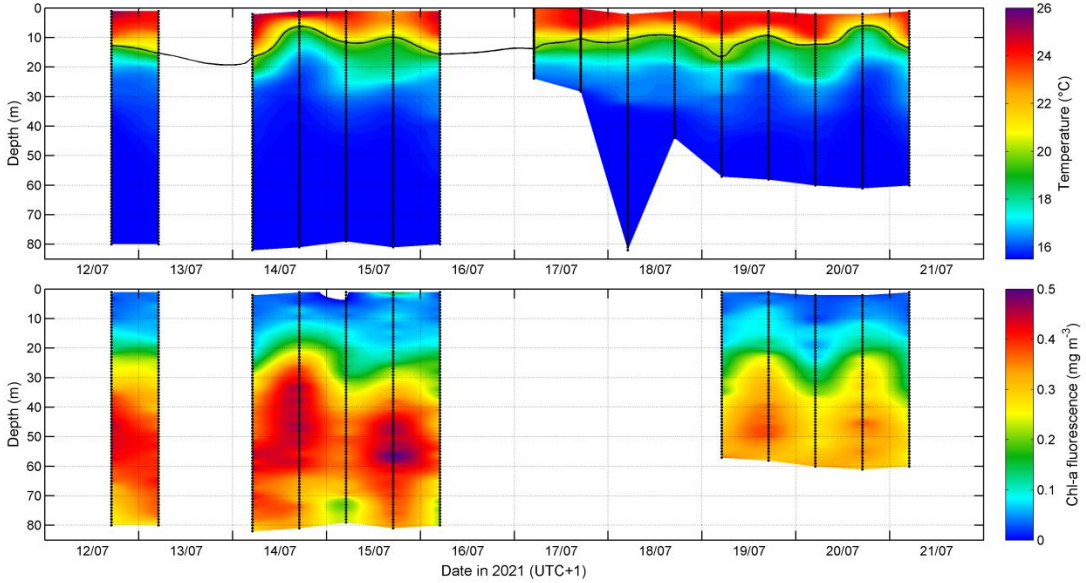


CTD vs loggers (July 2021)

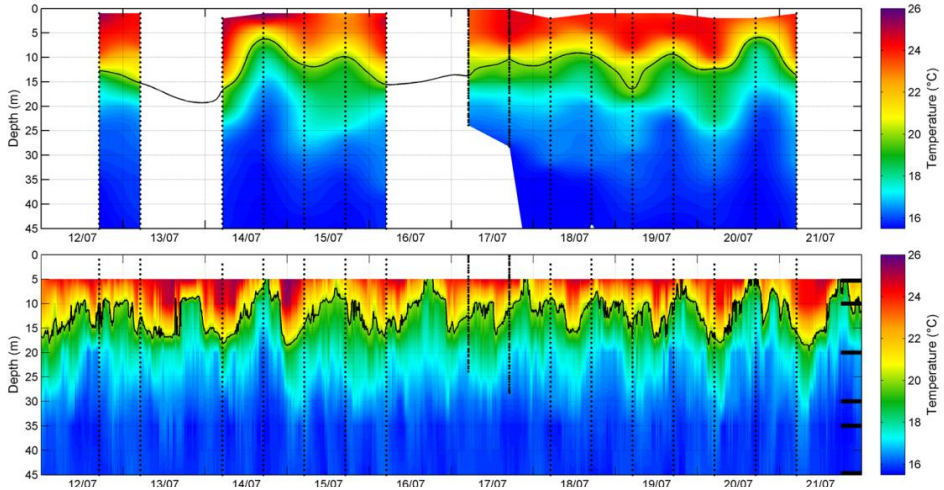
- Deep chlorophyll maxima in the 40–60 m depth layer were following thermocline oscillations

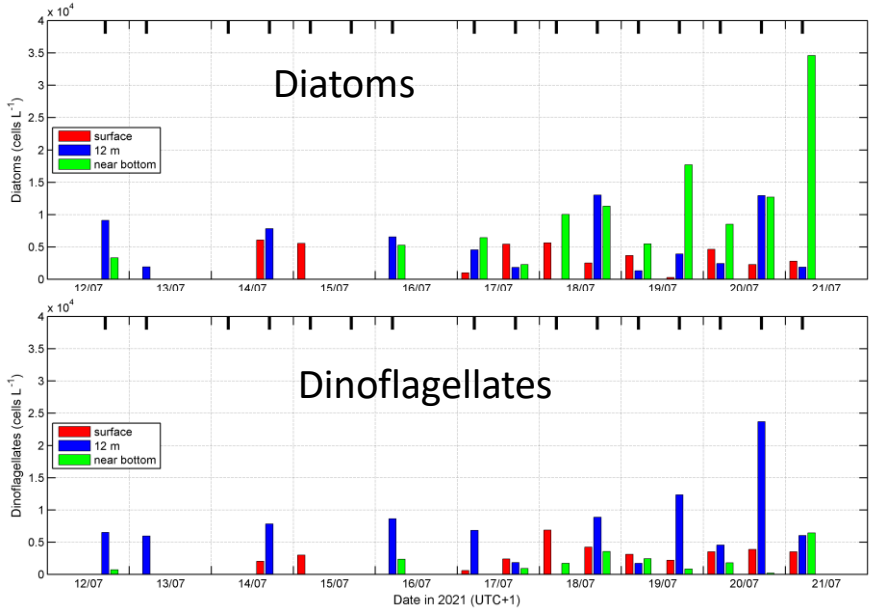
- CTD temperature measurements showed that the ITW range was decaying away from the coast.

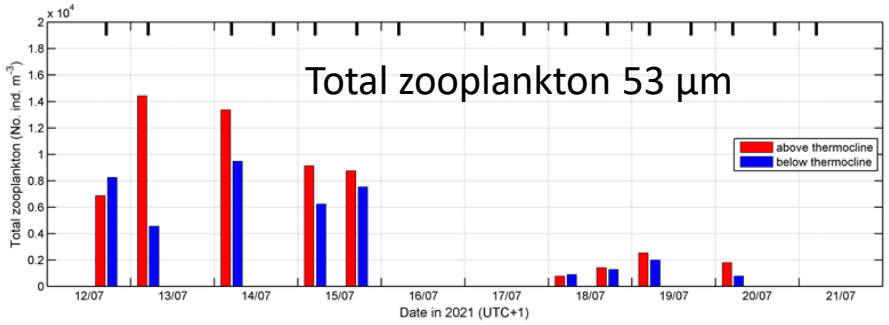
- Complementary to the CTD measurements, discreet water nutrient and plankton (bacterio-, phyto- and zooplankton) samples were taken for further analysis

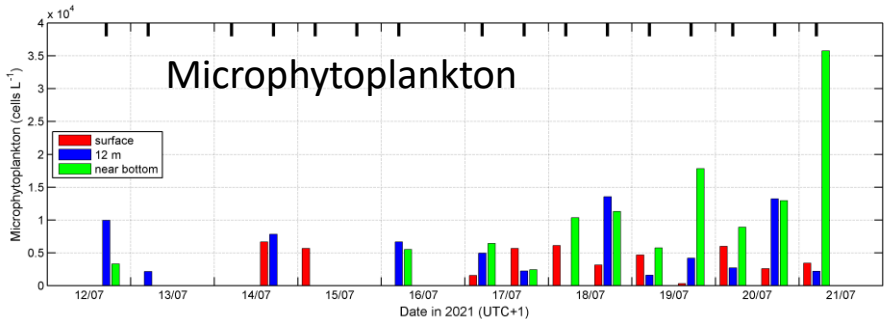


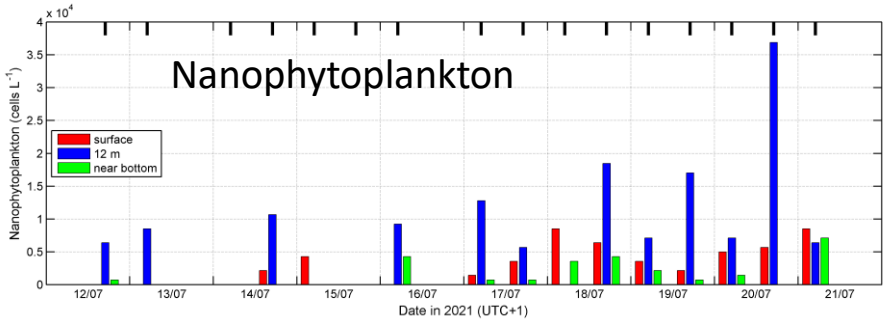
CTD temperature and chl-a (July 2021)











First observations:

- Change of phytoplankton community dinoflagellates/diatoms
- regime shift in phytoplankton and zooplankton abundance
- Strong microbiological activity in the thermocline – nanoplanktonic dinoflagellates

Questions to be answered in next 3 years:

1. Diurnal thermocline dynamics under stratified conditions supply nutrients which fuel primary production?

2. Application of novel in situ platforms and sensors allow us to develop a mechanistic and quantitative understanding of the physical oceanographic processes that support primary productivity through nutrient transport ?

3. ITWs make an important contribution to primary productivity in Lastovo archipelago?