# Baltic sea – Liepaja port – Liepaja lake model 2018-2019

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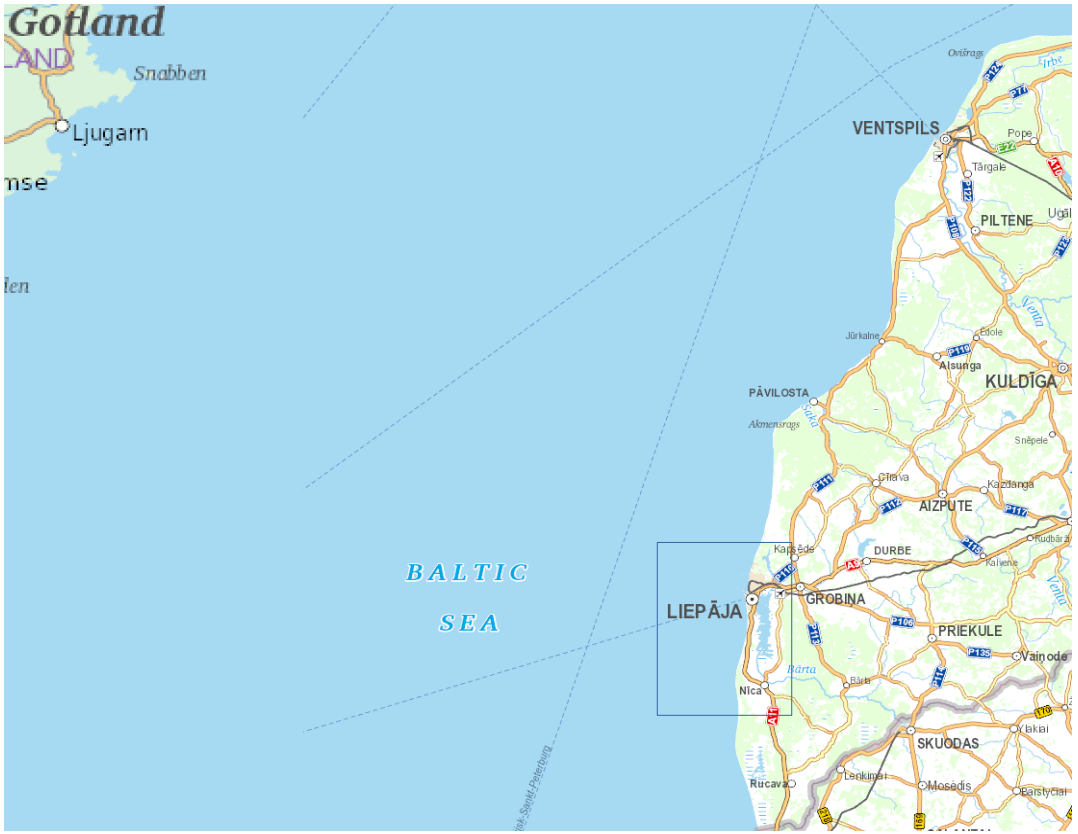
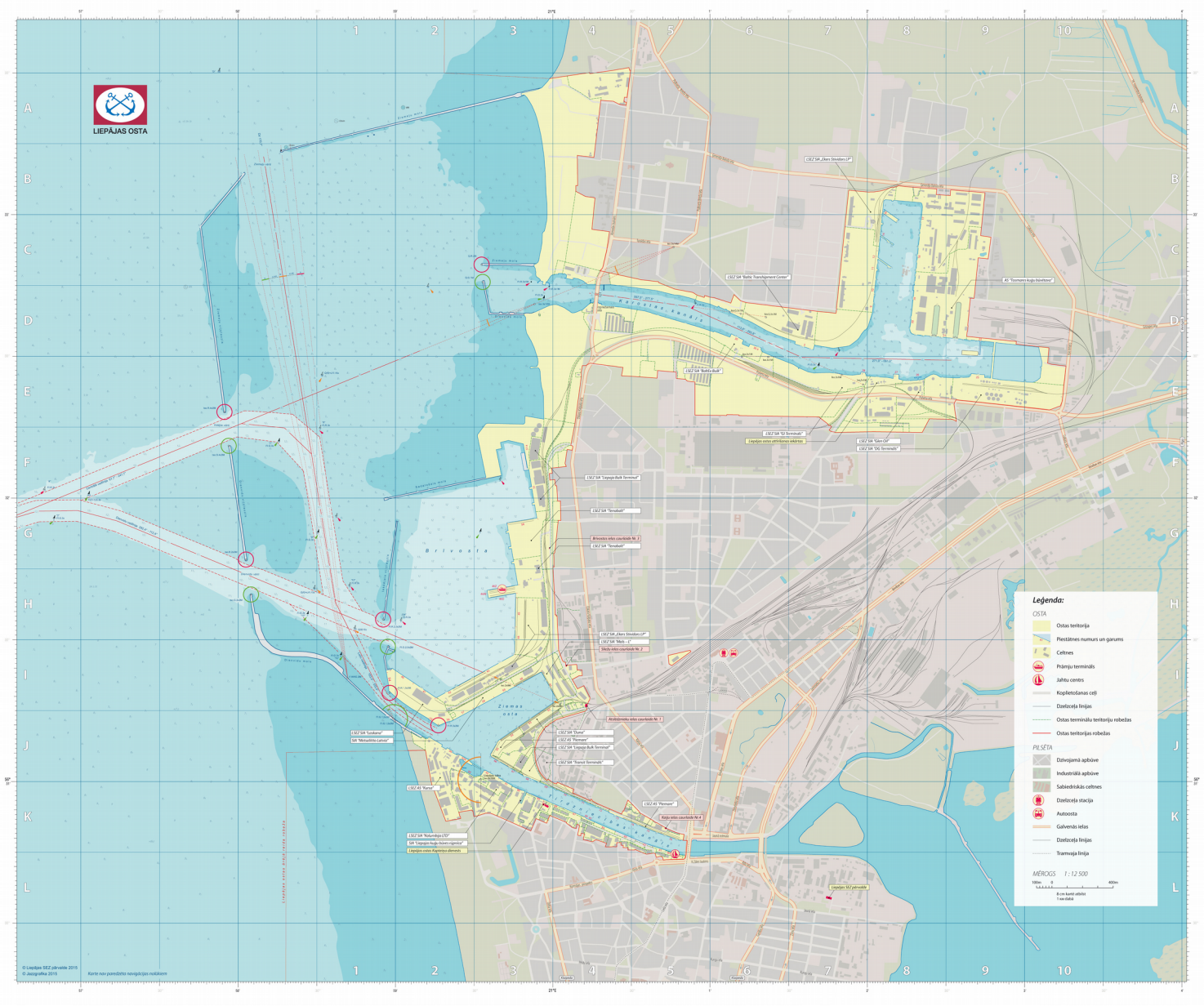


# Bathimetry at port



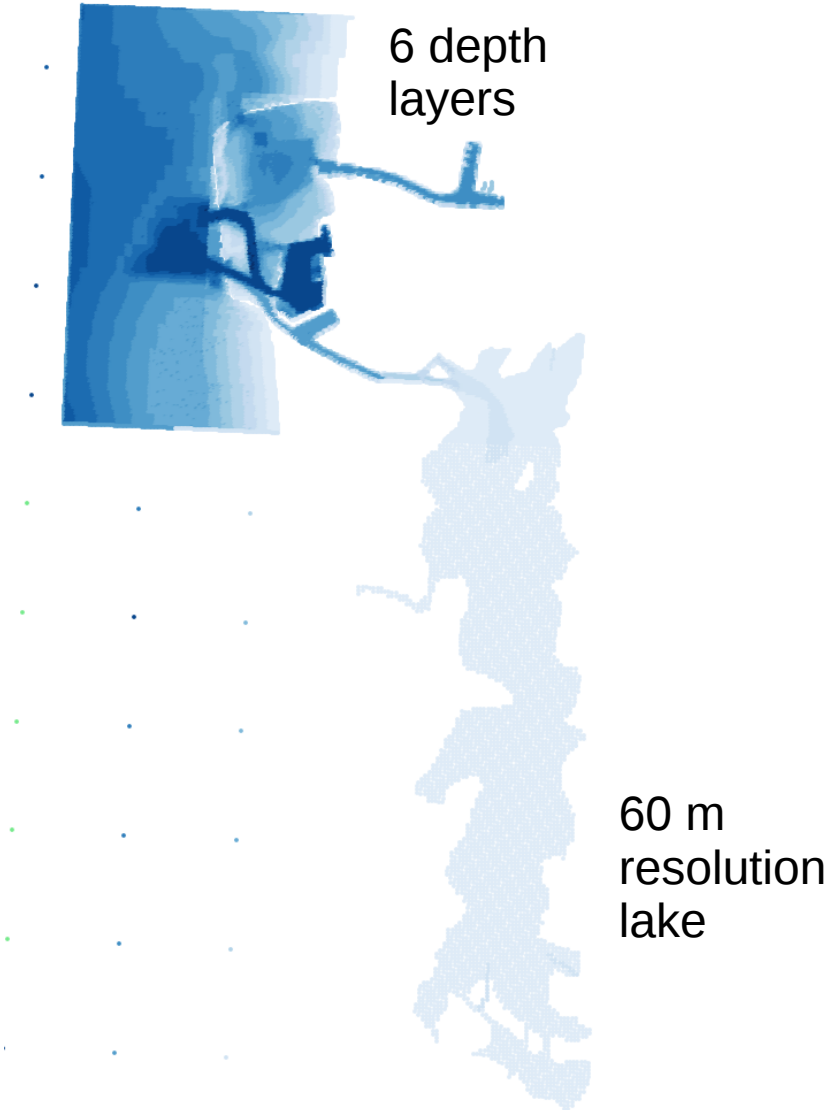
# Nested HBM setup

1 nm resolution Baltic proper

Weather forcing: DMI HARMONIE

30 m resolution port and channels

6 depth layers



60 m resolution lake

# Observations

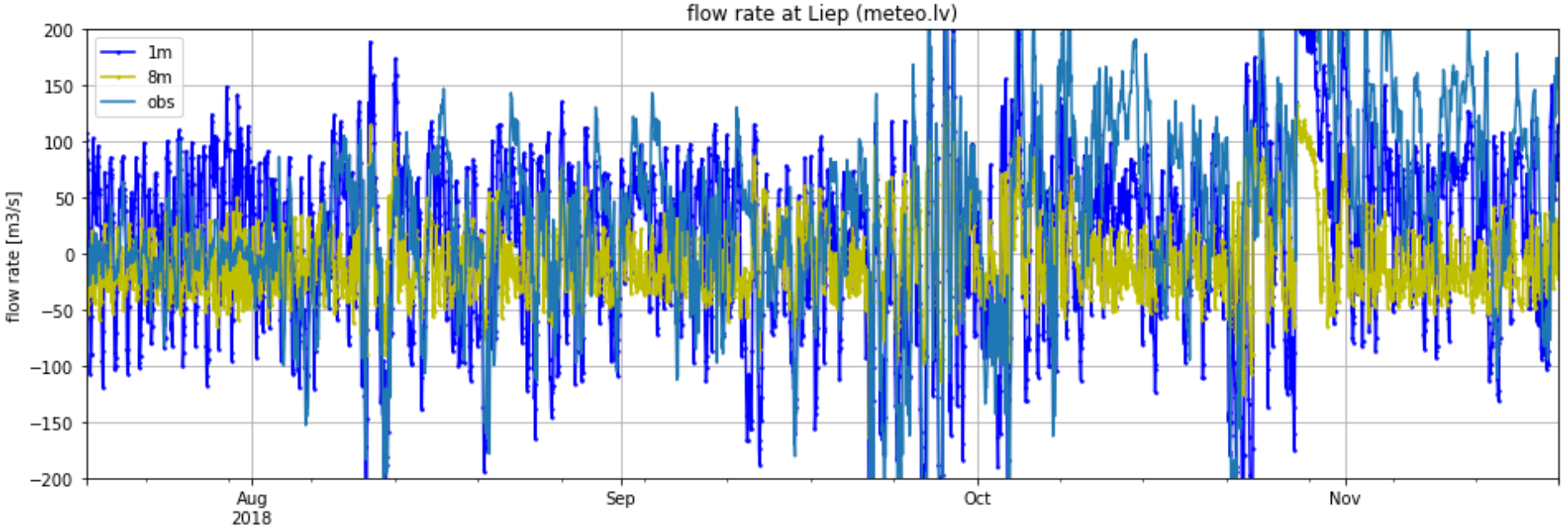
Automatic, hourly: water level, run-off, temperature

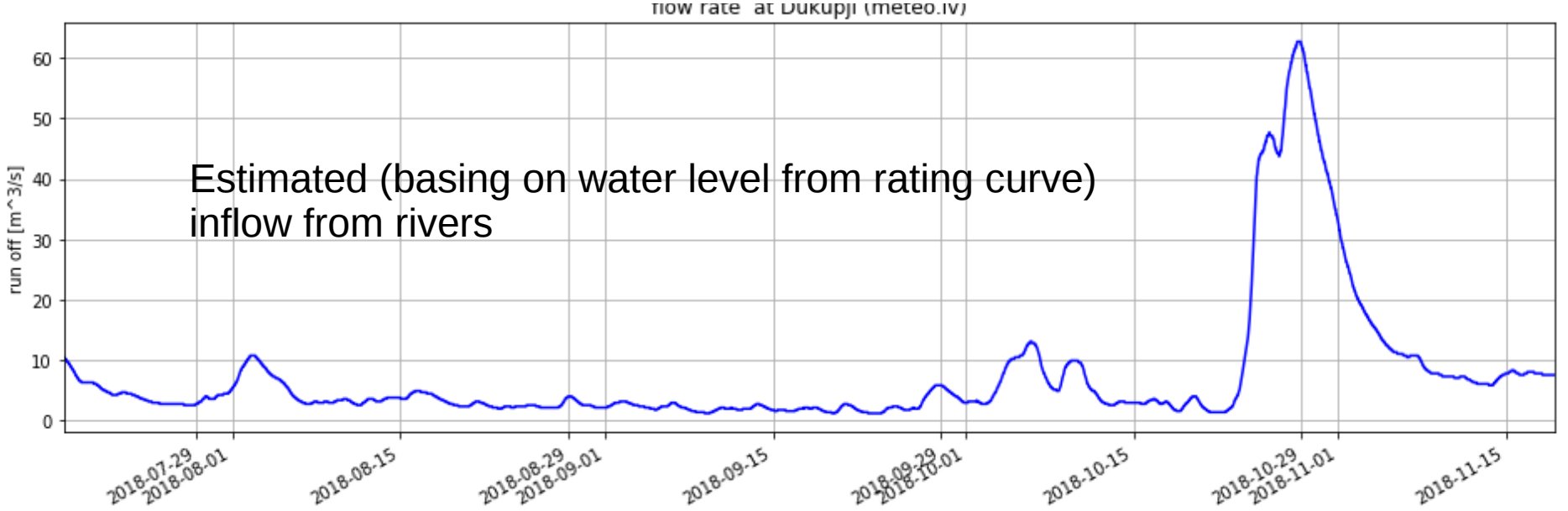

Manual, daily: sea surface temperature, salinity

Automatic, hourly: water level, temperature

Automatic, hourly: water level, temperature. Occasionally: run-off

# Flow rate through channel

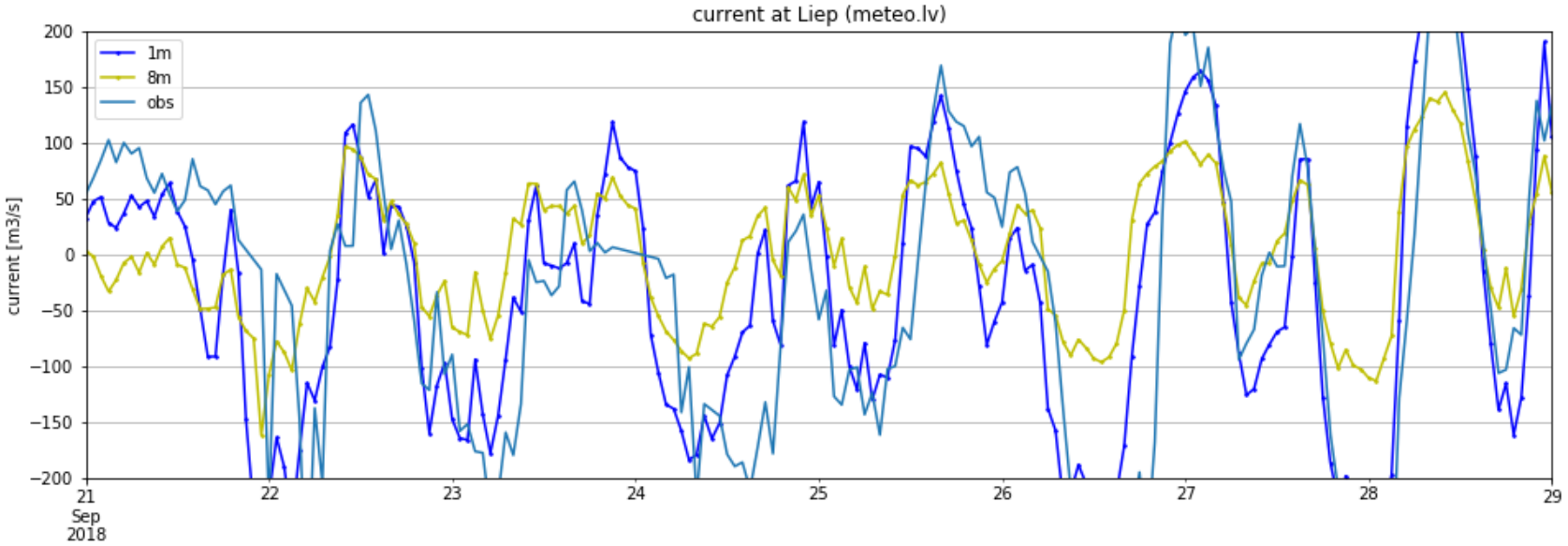


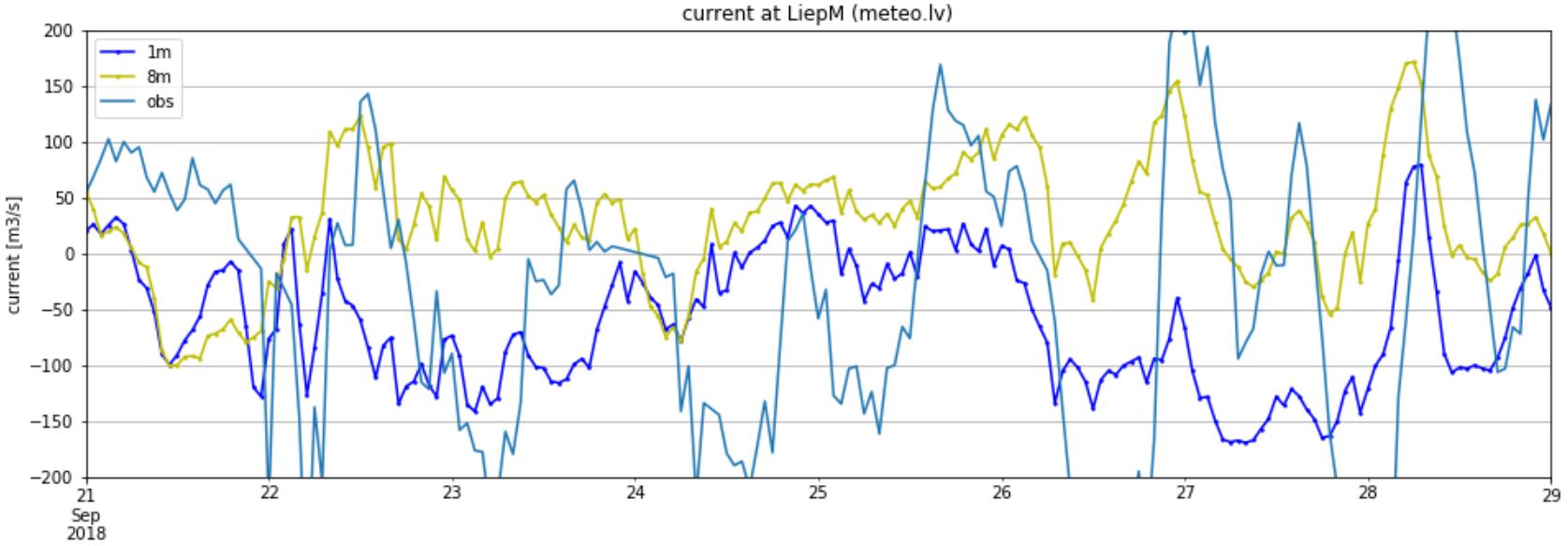

Estimated (basing on water level from rating curve) inflow from rivers

# Port-lake flow oscillations

Channel between port and lake

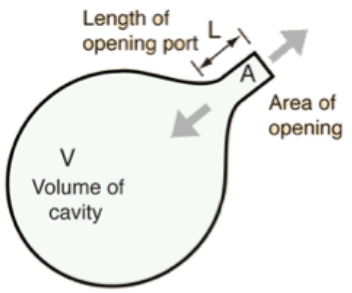



Middle port gate. Observations for the channel.



# Port-lake seiches

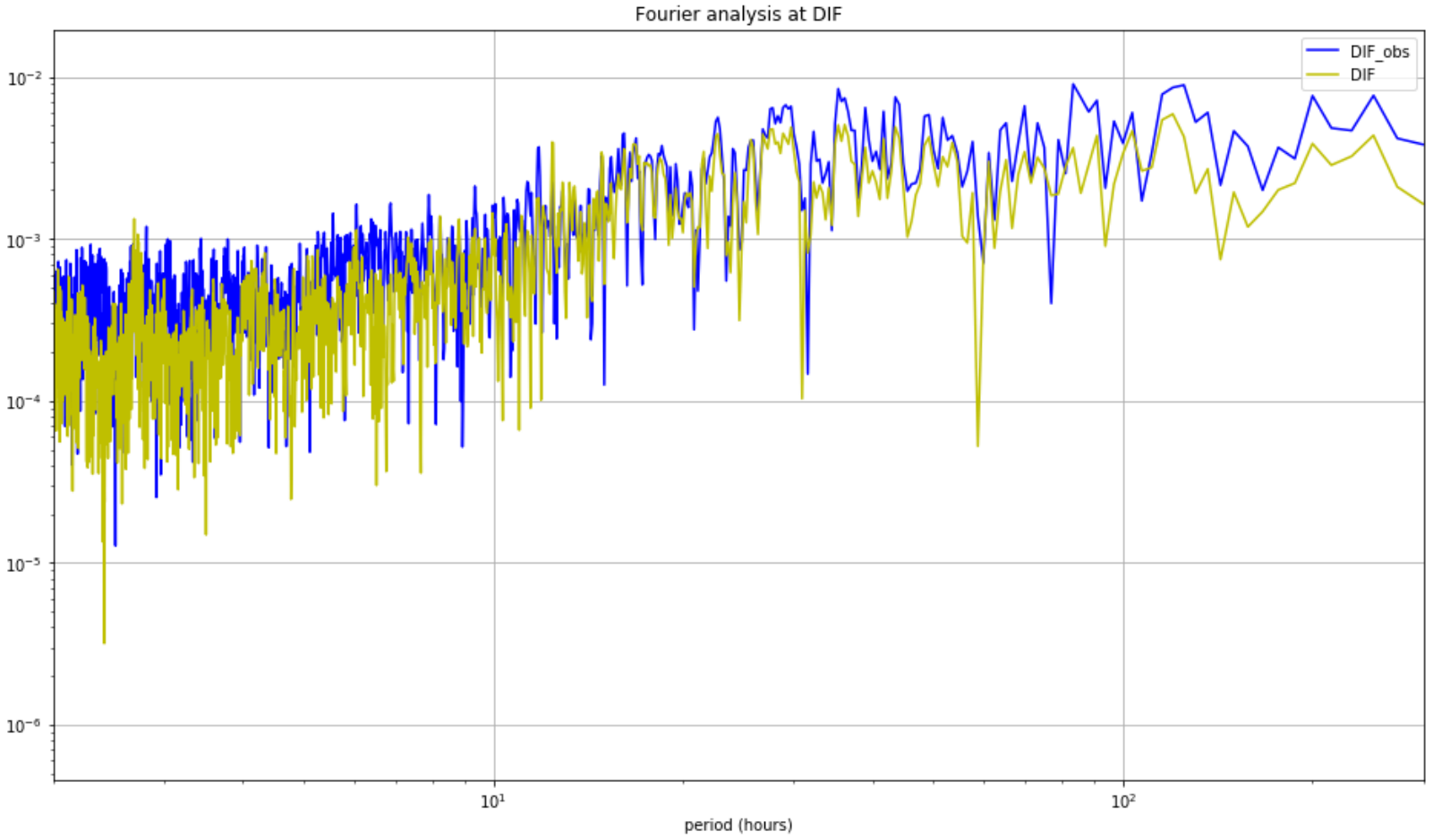
$$f_{resonance} = \frac{v}{2\pi}\sqrt{\frac{A}{VL}}$$




Otsmann, Suursaar,Kulla

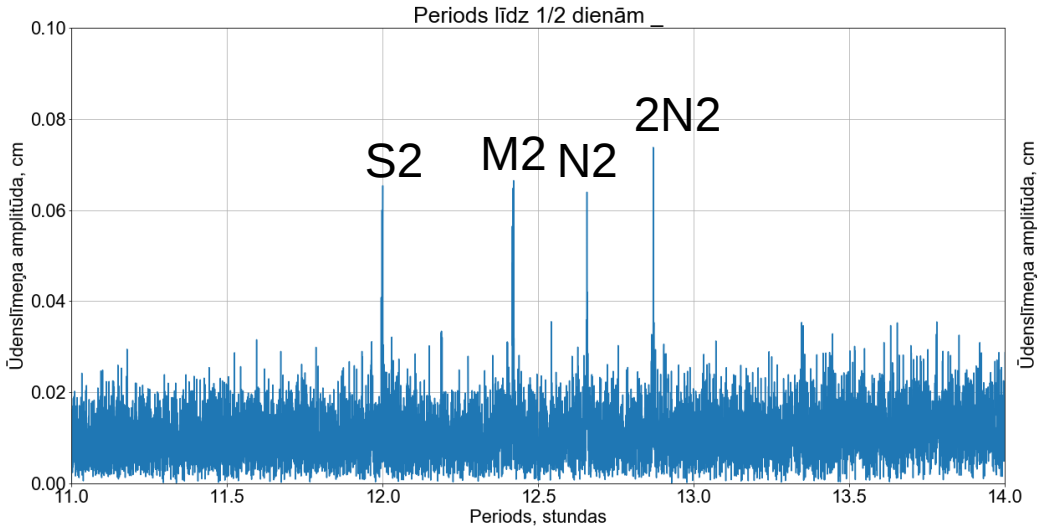
$$Period = 2 * \pi \sqrt{\frac{L_{ch} A_{lake}}{g A_{ch}}} \approx 10\,h$$

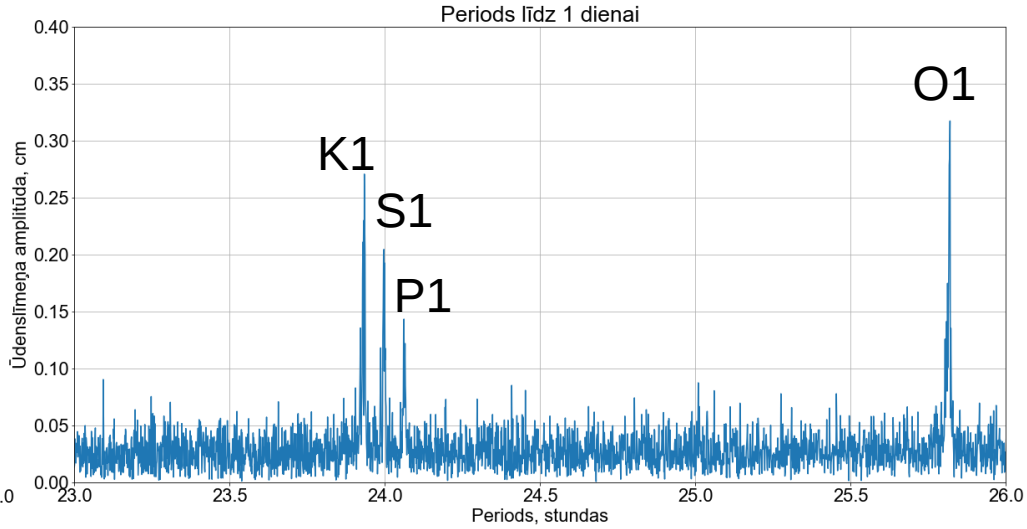
Difference of water level between port and lake




No periodic forcing except tides and sea breeze

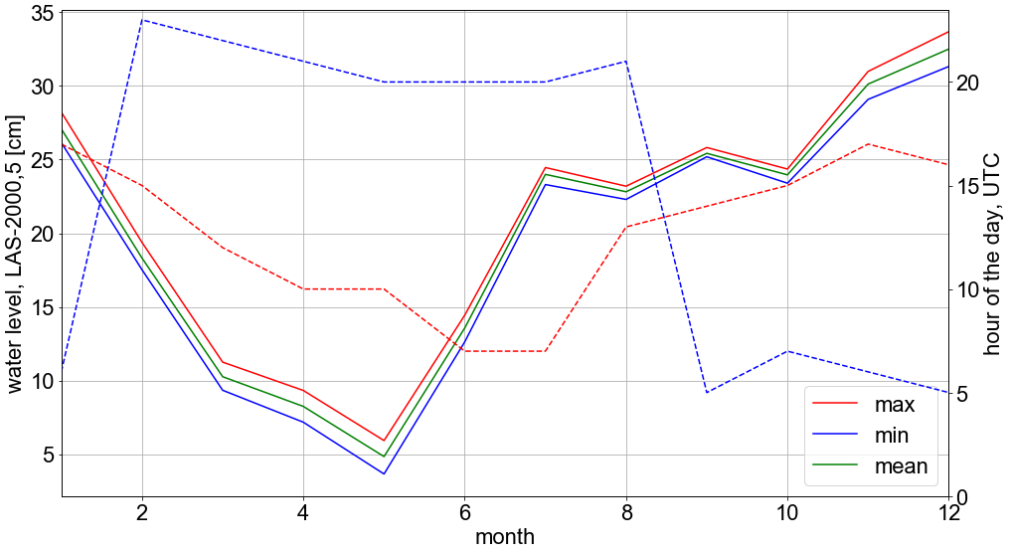
# Tidal oscillations in Liepaja



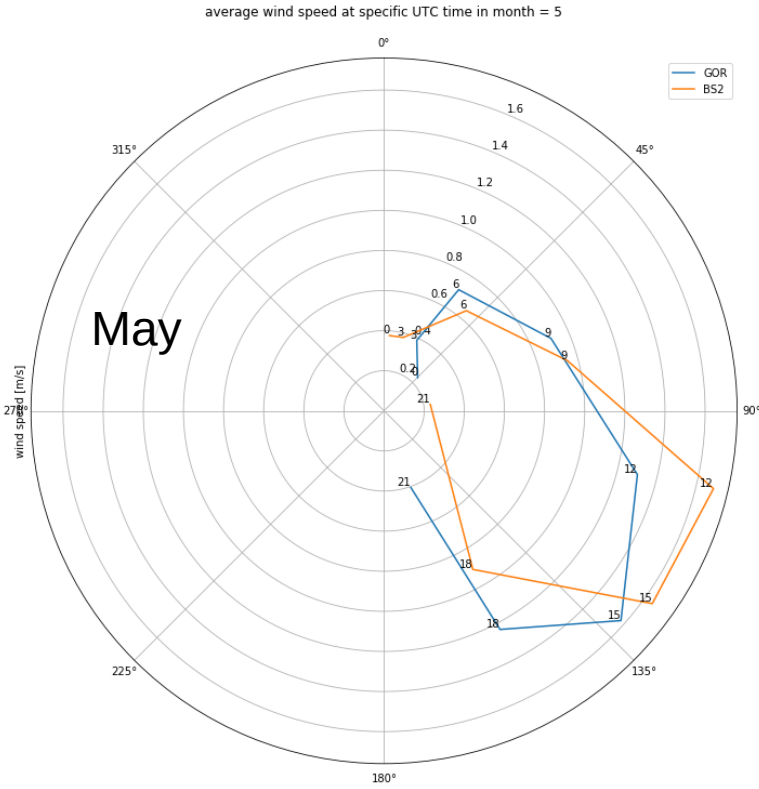



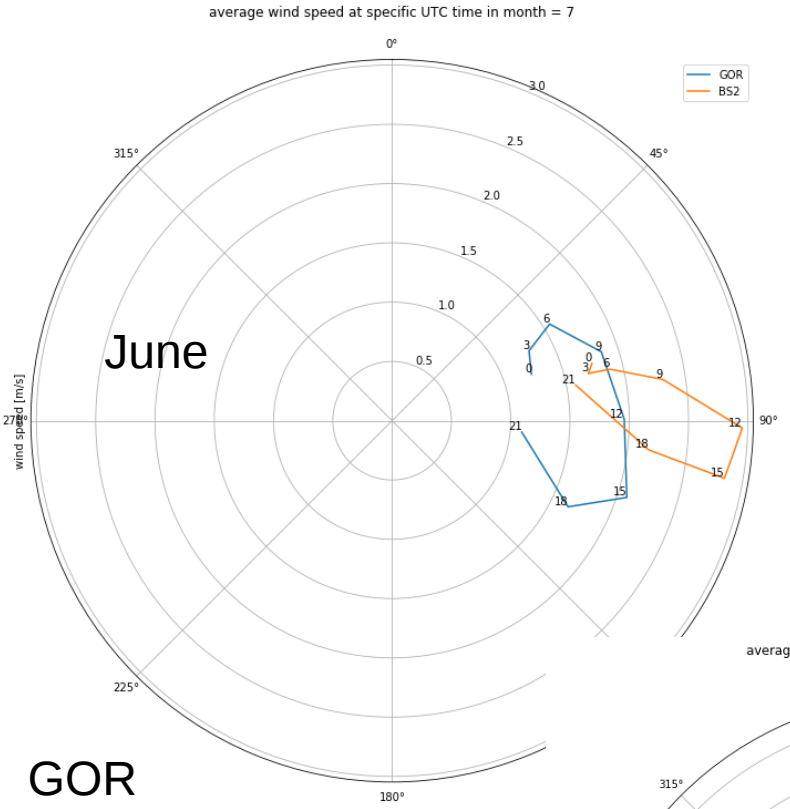

Observations from 1961

S1 (24 h) is sea breeze effect



# Wind hodograms

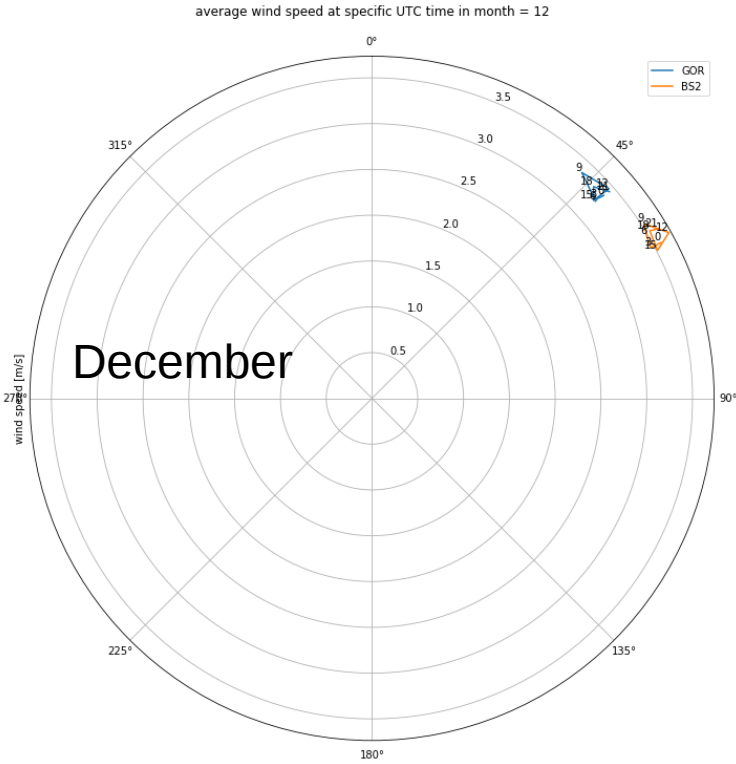



ECMWF MARS reanalysis, 1979-2018

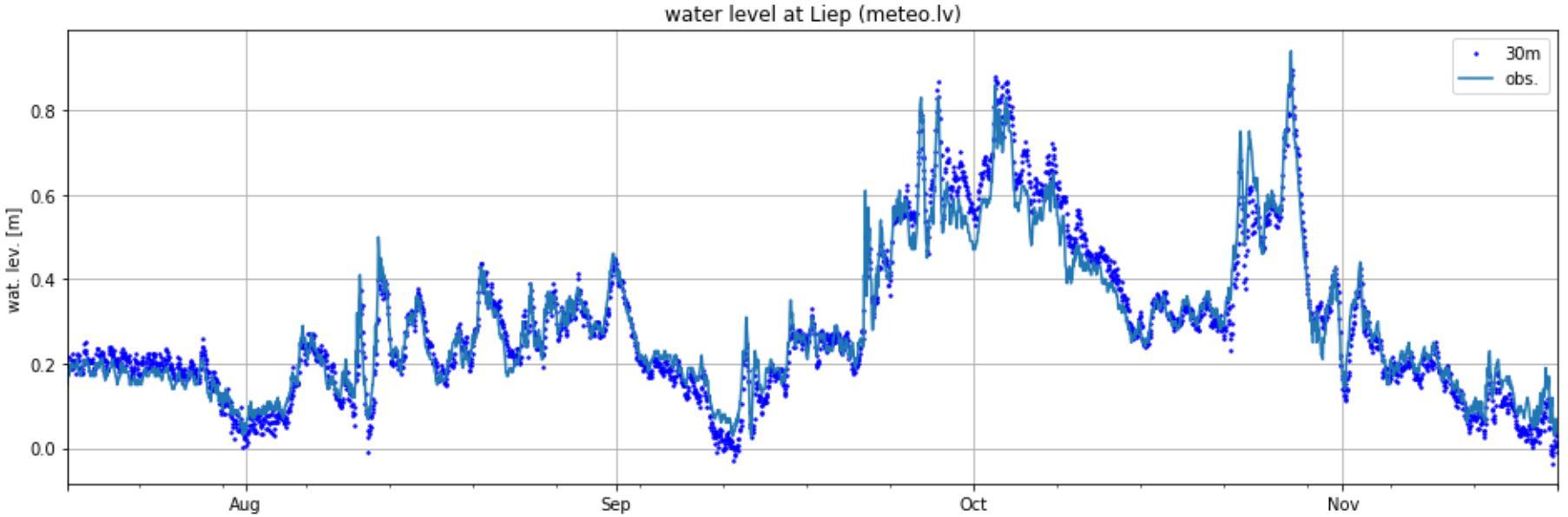
GOR

BS2

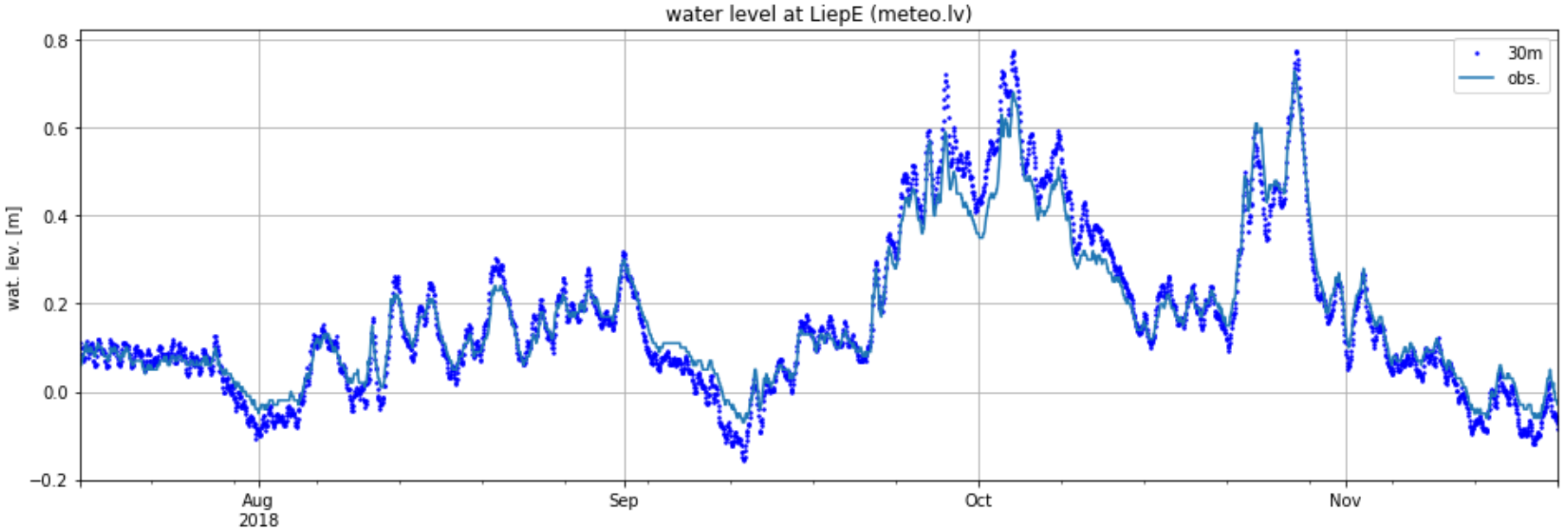



# Water level

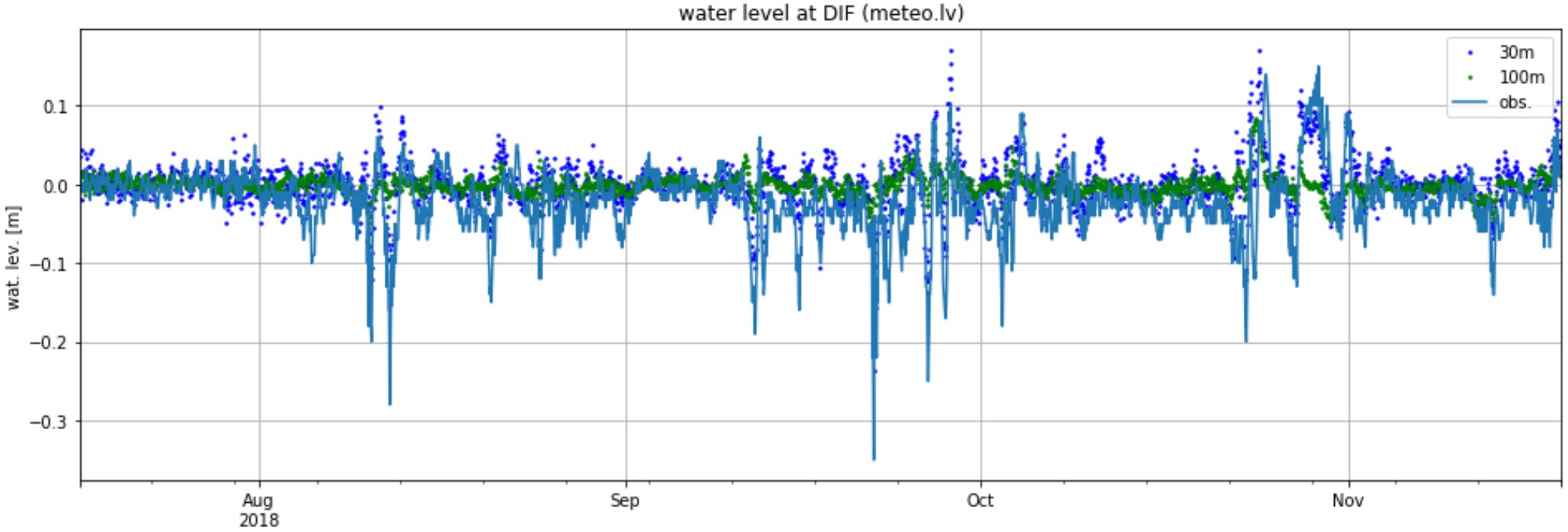
Channel between port and lake




Lake



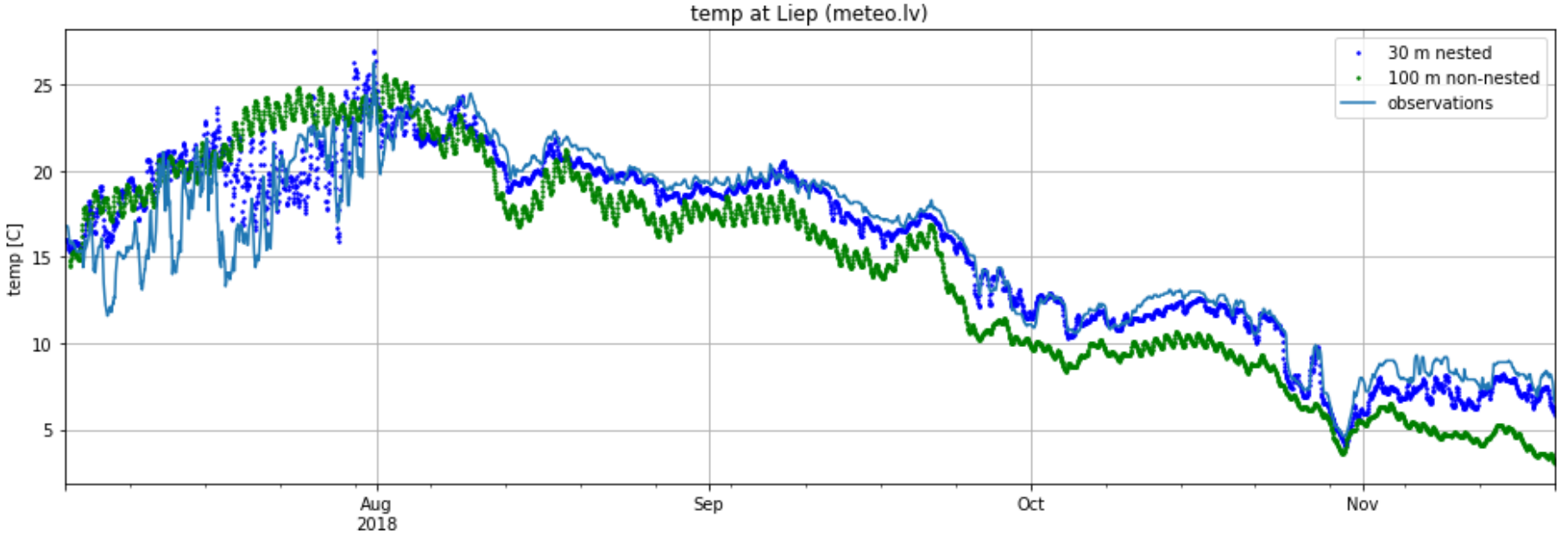
# Water level difference between channel and lake



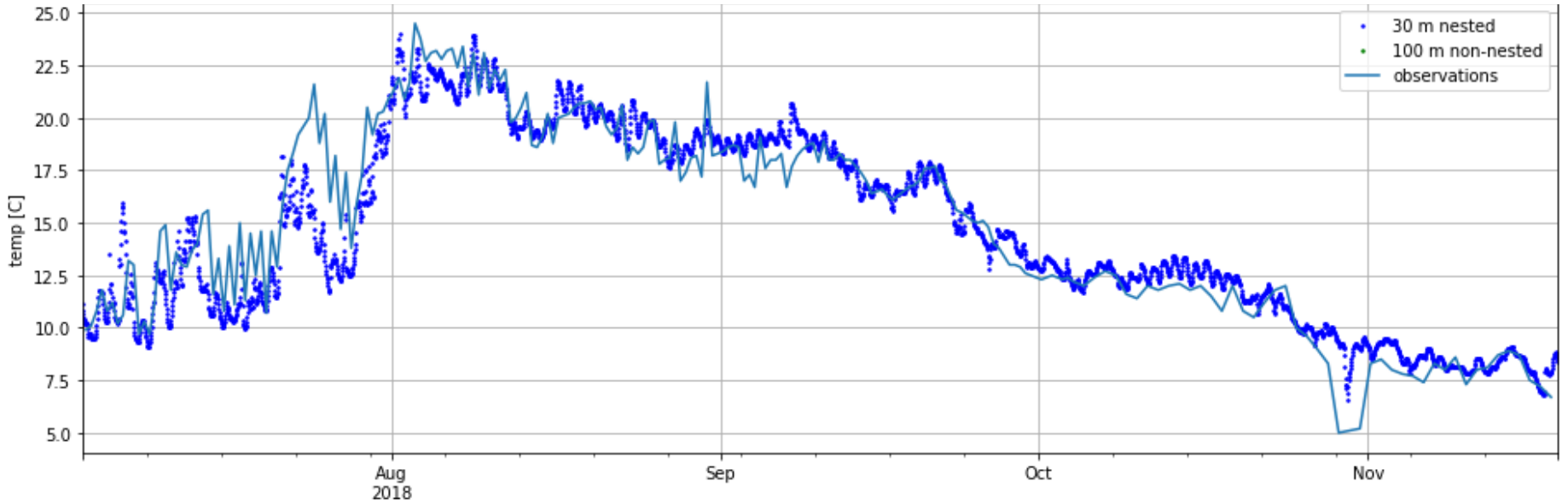

Different sensors are used channel (15 min average) and lake (last hour)

# Temperature

Channel between port and lake



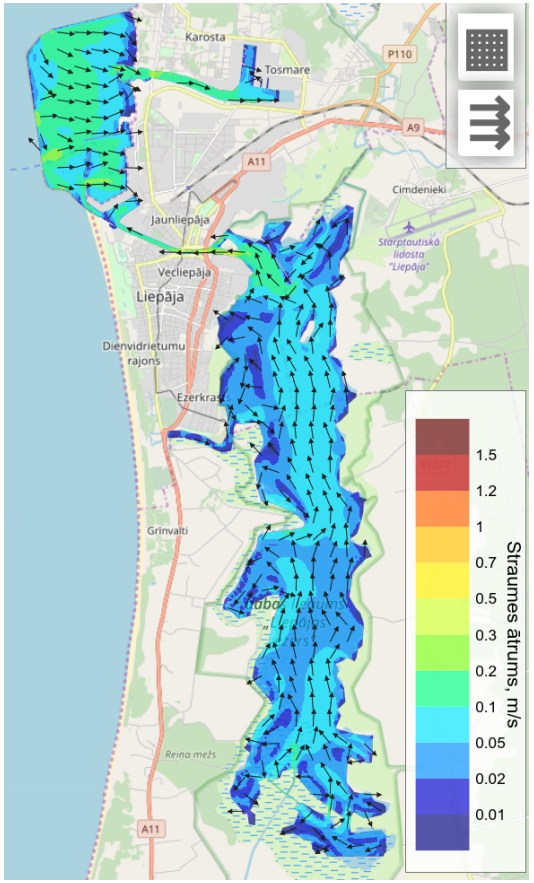

Baltic sea at Liepaja

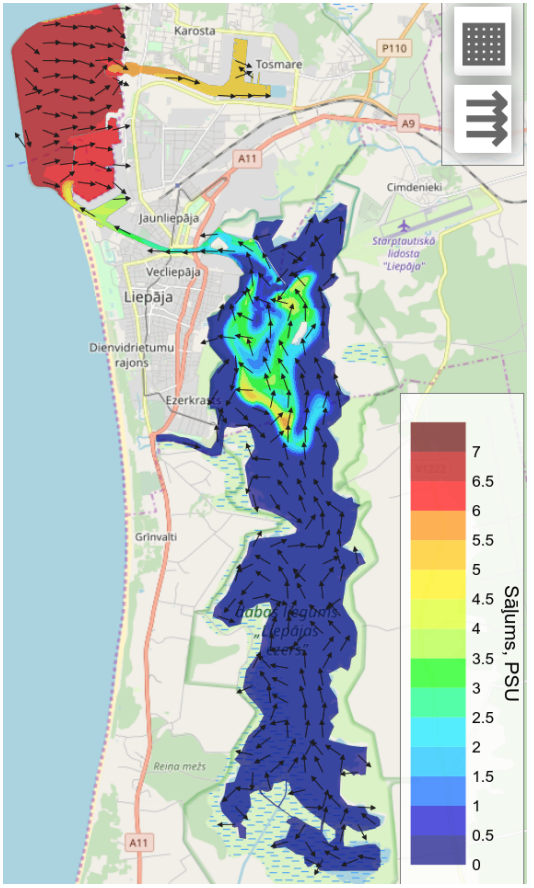



Lake temperature sensor not working for this period

# Interactive coastal visualisations

Currently testing in
http://www.modlab.lv/meteo/FimarWeb/LiepajaStraumes/Aprekins_2017/aprekins_2017_07_09.html
but will be under http://www.water.lv




Surface currents and salinity in Liepaja port in September 15, 2017 after the storm

# Conclusions

- Flows in port gates are largely influenced by currents in Baltic sea. Therefore, closed port model may not work.
- Longshore currents are important for coastal areas. Not accounted yet.
- Wetlands have to be accounted in case of high water level in large and shallow lake
- Better thermodynamics is required for shallow locations of the lake with strong seasonal vegetation.
- Both model and observations show that there are port-lake oscillations
- Both single level and two-level flows are characteristic in port gates and the channel connecting port with the lake