A system for the sustainable management of Lithuanian marine resources using novel surveillance, modeling tools and an ecosystem approach"

Validation of the long-term Lithuanian local HIROMB model predictions

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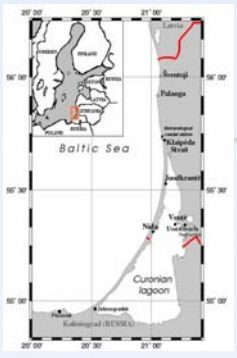
Content

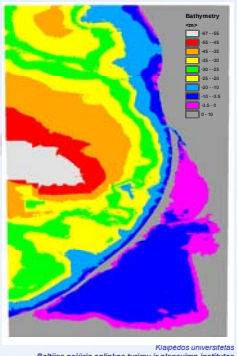
- Results of validation Lithuania local HIROMB for full year 2009.
- Validated fields:
  - Water level
  - Surface temperature
  - Surface salinity
  - Surface currents (small experiment)
  - Ice

Model characteristics

- Modelling domain: 20.431-21.319 deg E, 54.858-56.225 deg N (56x154km)
- Horizontal resolution : 492x178 cells Cell size ~300m
- Vertical resolution : 25 layers. Layer thickness 1-4m.
- Time step: 30s, 60s

Modelling area. Bathymetry



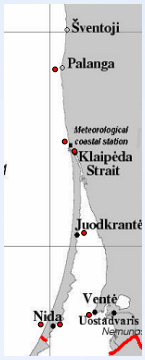


Data used for validation

Data source 1. Data from coastal permanent monitoring stations (marked by red dots on the map). Contribution of Marine Research department (EPA of Lithuania).

Data: water level, surface salinity and temperature, ice.

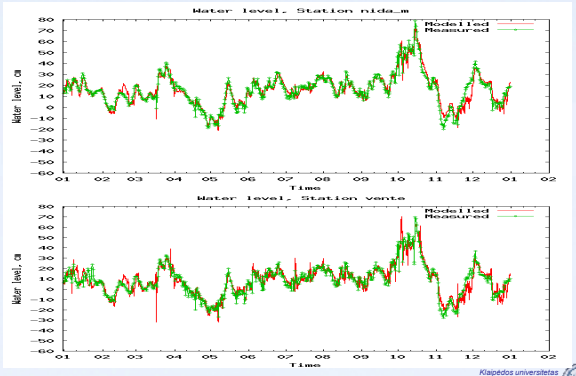
Data source 2. Small experiment with drifting buoys to test currents.



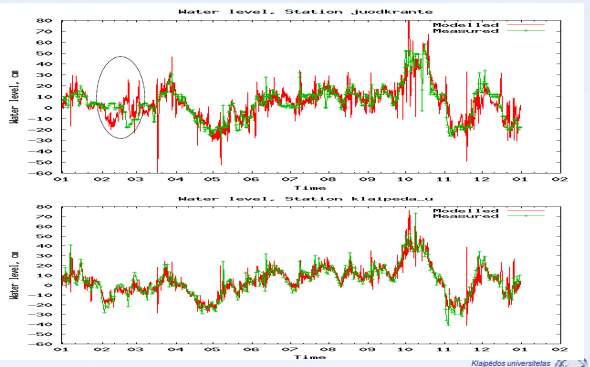
Simulation conditions

- Model version 3
- Simulation period - full year 2009.
- Initial fields for 2009-01-01 00:00 obtained from BS01 by spatial interpolation.
- Boundary conditions for temperature and salinity from BS01 (renewed every 6 hours).
- Nemunas discharge near Smalininkai from Lithuania Meteorological Service (renewed every day).
- Meteorological forcing from Lithuania Meteorological Service HIRLAM (spatial resolution 8km). Used hourly data from 3 forecasts per day with duration of 6 hours).
- No data assimilation.

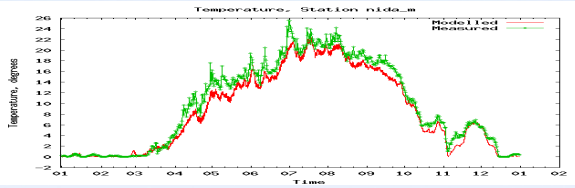
Results. Water level: Nida (lagoon), Vente

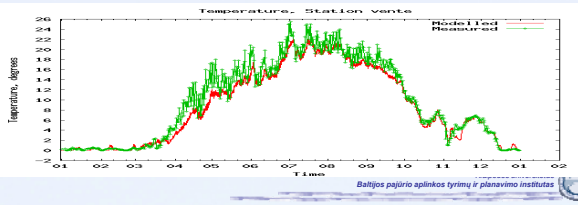


Water level: Juodkrantė, Klaipėda harbour

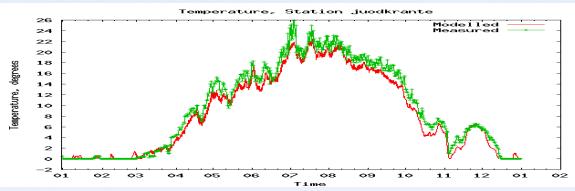


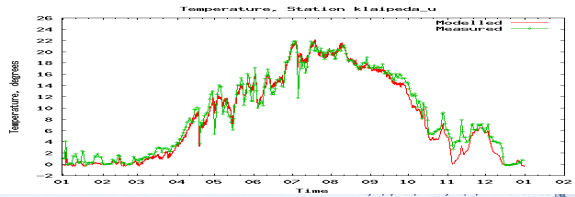
Temperature (lagoon): Nida, Ventė



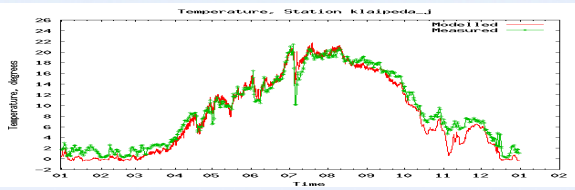


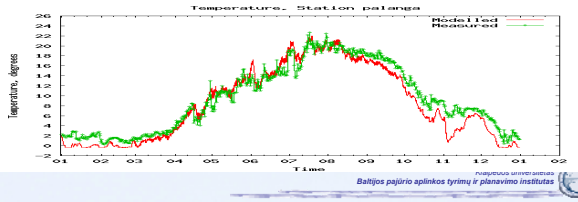
Temperature (lagoon): Juodkrantė, Klaipėda harbour



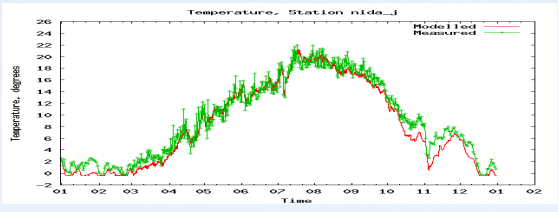


Temperature (sea): Klaipėda, Palanga

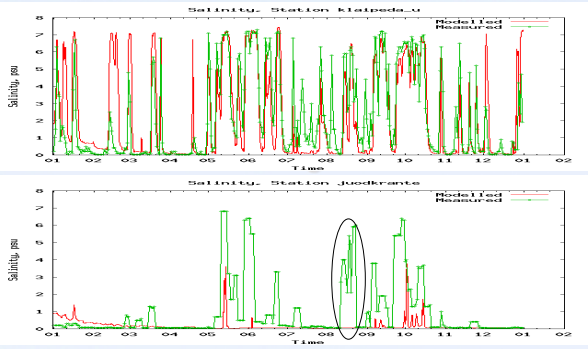




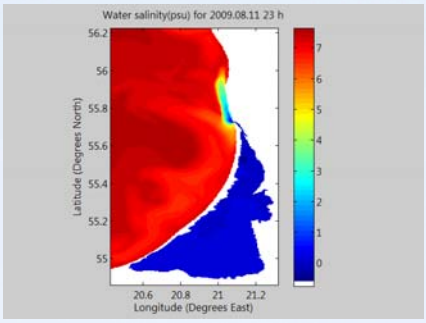
Temperature (sea): Nida



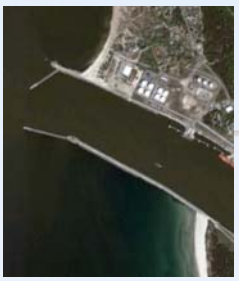
Salinity (lagoon): Juodkrantė, Klaipėda harbour

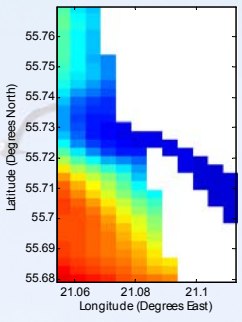


Salinity distribution Near Juodkrantė 2009-08-12 – 2009-08-24

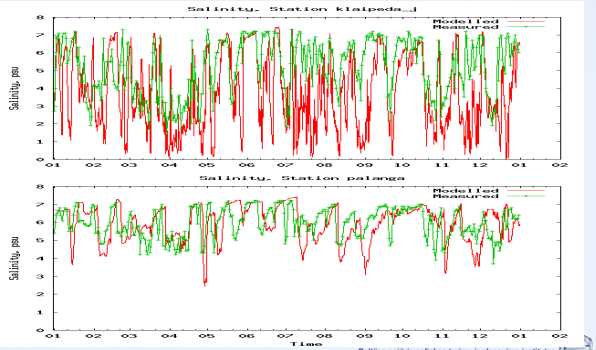


Configuration of the harbour gates and their representation in the model

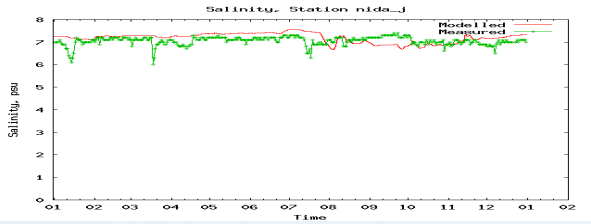




Salinity (sea): Klaipėda (reduced salinity), Palanga



Salinity(sea): Nida



Hypothesis about salinity discrepancies

- Inadequate harbour gates representation by the model grid.
- Not enough precise wind speed and direction?
- To be tested.

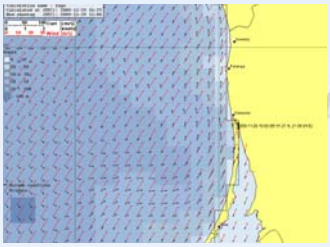
Testing surface currents using drifting buoy

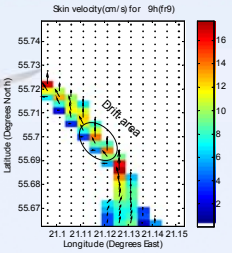
- Short experiment 2009-11-29 in Klaipėda strait:
  - Drifting distance 1095m.
  - Drifting time 08:17 – 10:17 UTC (2h 14m)

Surface currents 2009-11-29 09:00 UTC

Seatrack Web

HIROMB_LT



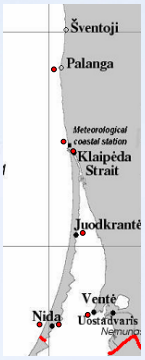


Average buoy drift speed – 14 cm/s

Comparison of drifting trajectory with predicted by Seatrack Web

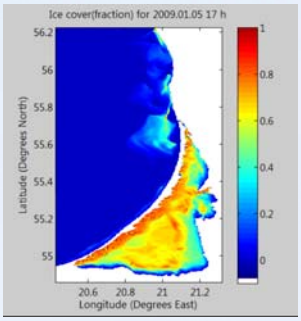
Ice validation

- Observations:
  - Nida, Vente, Juodkrante Curonian lagoon continuous ice cover 2009-01-05 – 2009-03-01
  - Klaipeda strait free of ice (drifting ice)
- Model was not able to reproduce continuous ice cover.

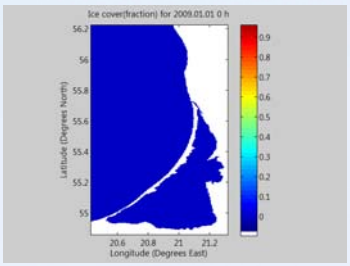


Modelled ice cover on 2009-01-05

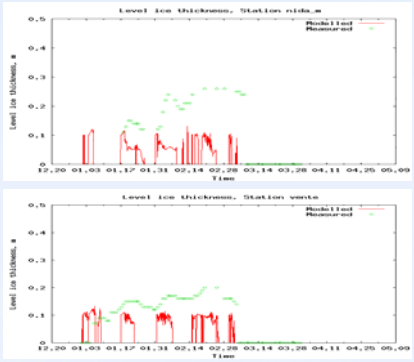
Curonian Lagoon is fully covered by ice on 2009-01-05 according to the monitoring data!



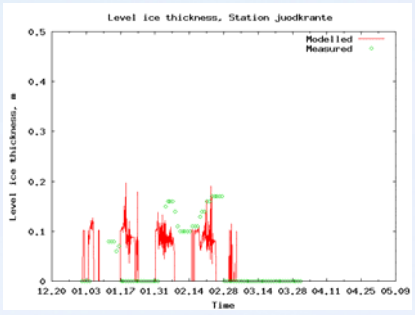
Ice cover dynamics 2009-01-01 – 2009-01-015



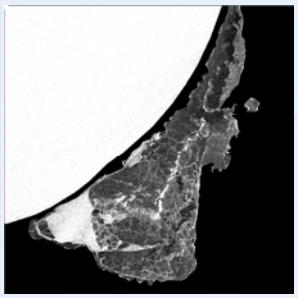
Ice thickness: Nida, Ventė

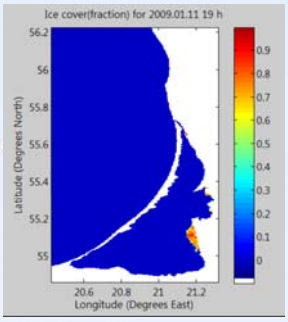


Ice thickness: Juodkrantė

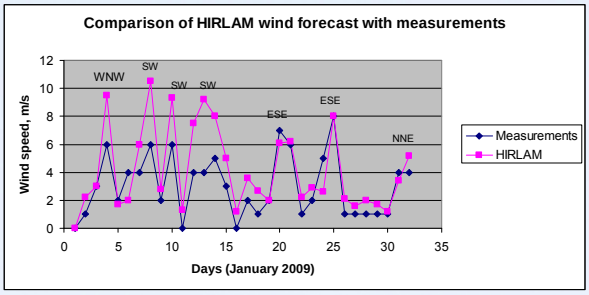


Comparison of radar image at 2009-01-11 with ice cover modelled with HIROMB_LT

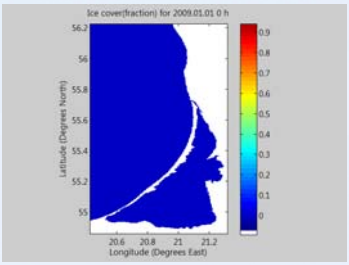




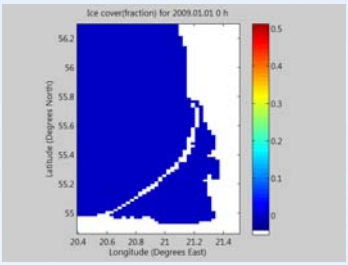
Absence of the Curonian spit in Lithuanian HIRLAM. Comparison of modelled and measured wind in Nida



Numerical experiment: Wind speed multiplied by 0.6



Ice cover 2009-01-01 – 2009-01-15 by HIROMB V3 BS01



- HIRLAM air temperatures were not checked yet.
- What about HIROMB V4?
- Any advices are welcomed!

Conclusions

- Model gives satisfactory results for water level and temperature.
- Salinity validation results indicates that lagoon-sea exchange could be better. Grid corrections seems are necessary.
- Ice validation gives unsatisfactory results. Further analysis is necessary.

This work was supported by Norwegian Financial Mechanism, project "A system for the sustainable management of Lithuanian marine resources using novel surveillance, modeling tools and an ecosystem approach" (project nr. LT0047)