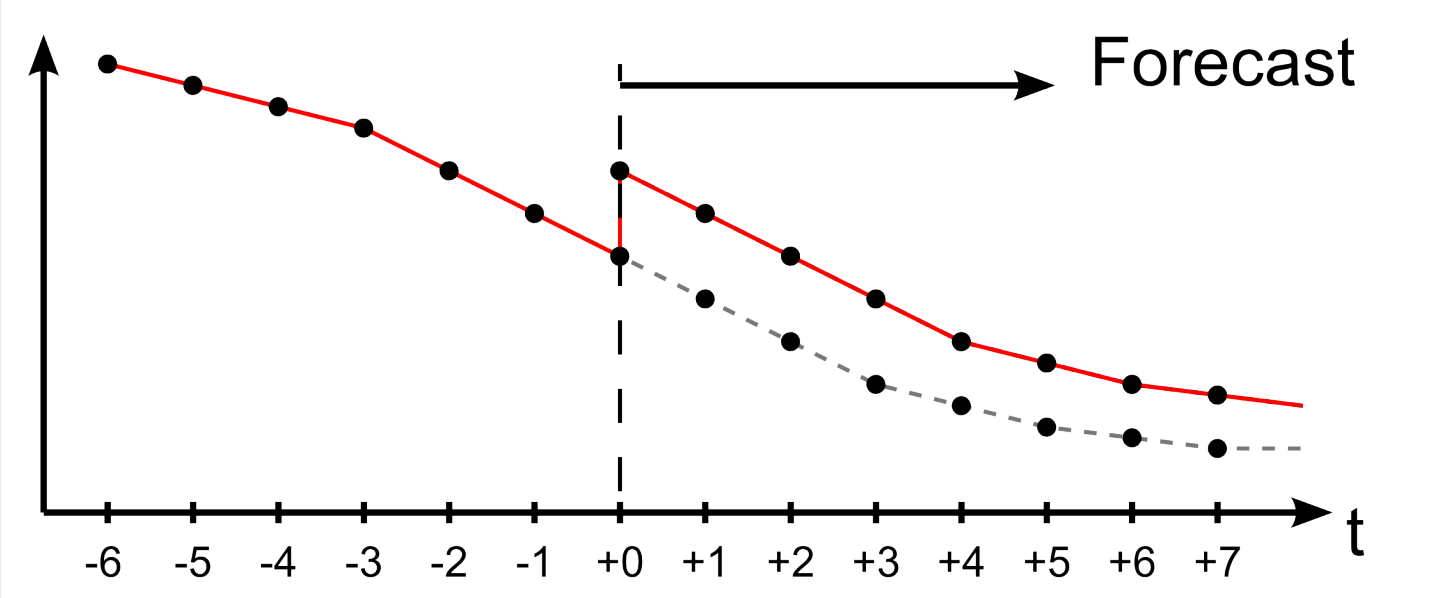
On Meteorological Forcing in Ocean Modelling



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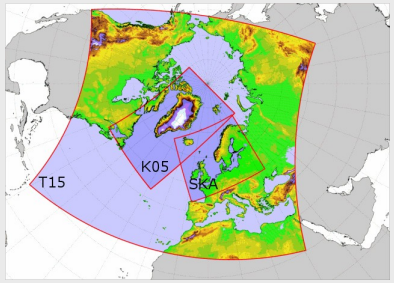
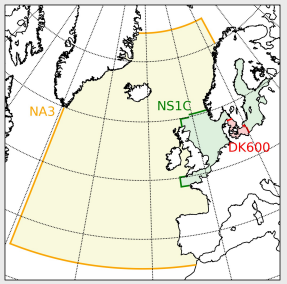
Outline

Meteorological forcing

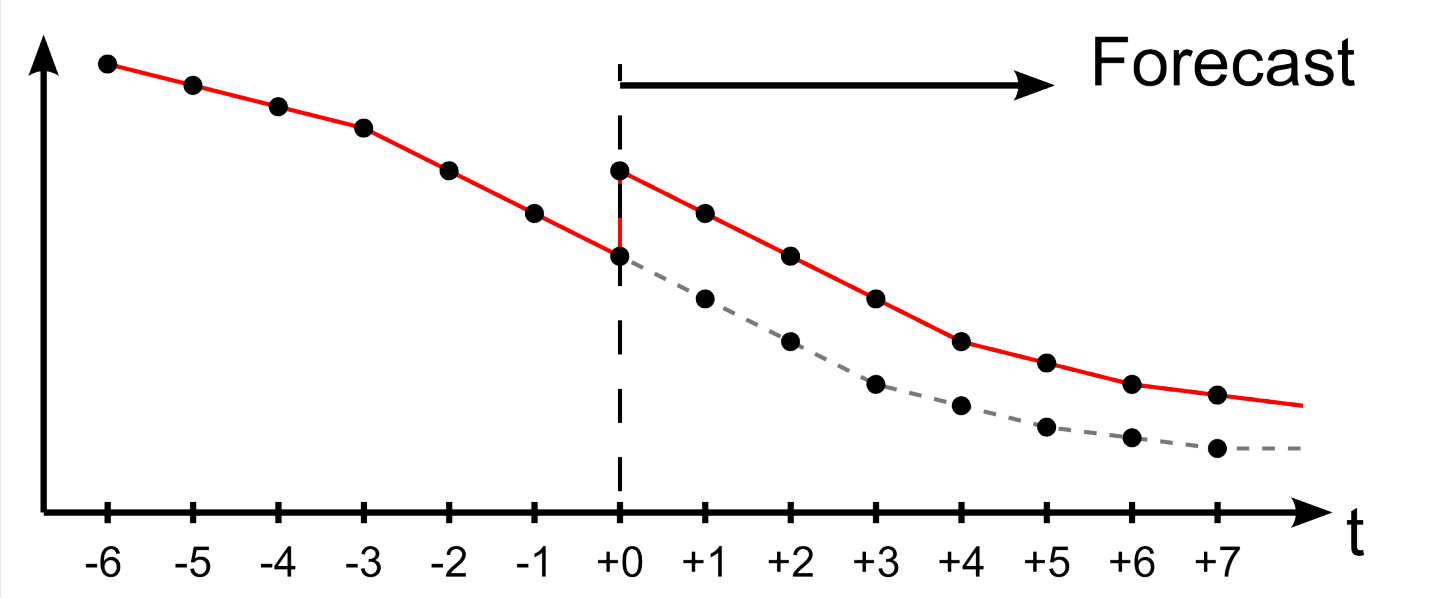


Ocean model



Conclusions

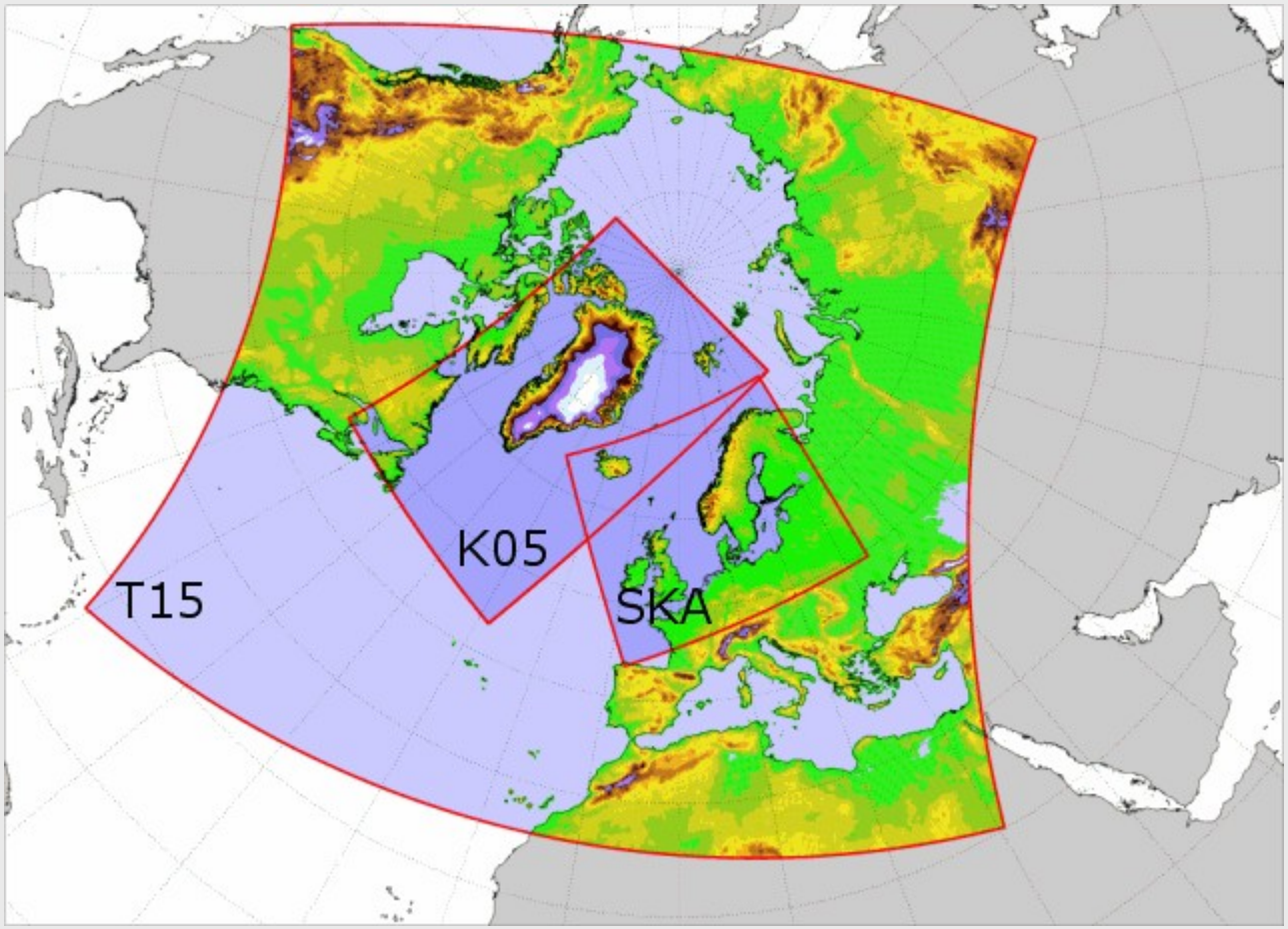
Meteorological forcing in operational ocean modelling



Operational ocean modelling: Switch directly to a new meteorological forecast at the start of each forecast cycle.

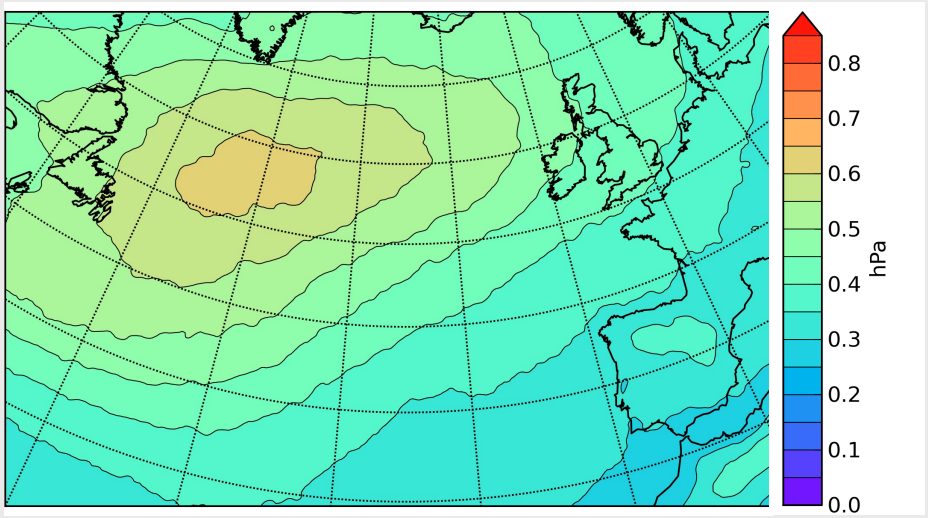
Introduces discontinuities in the forcing fields.

Meteorological forcing
DMI HIRLAM T15 and SKA

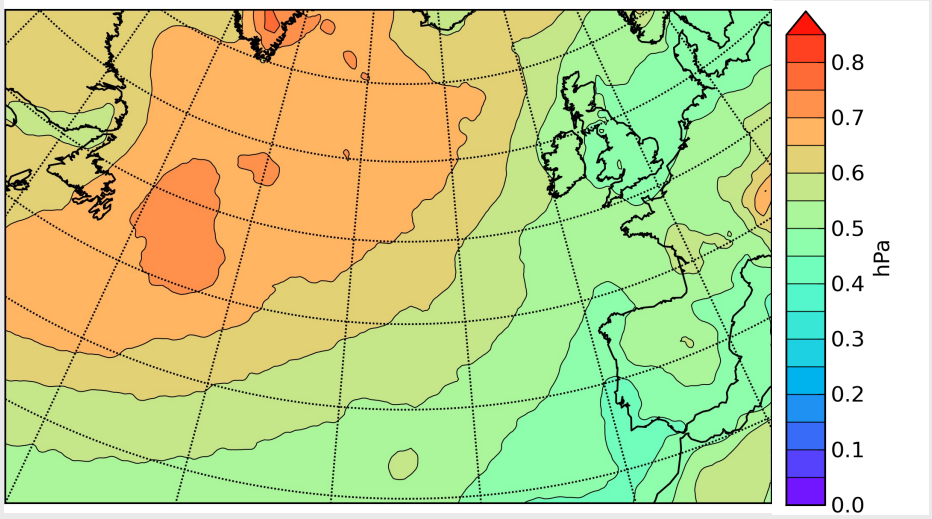


Study period 2010-2012 (4 forecast cycles per day)

Sea level pressure discontinuity magnitude



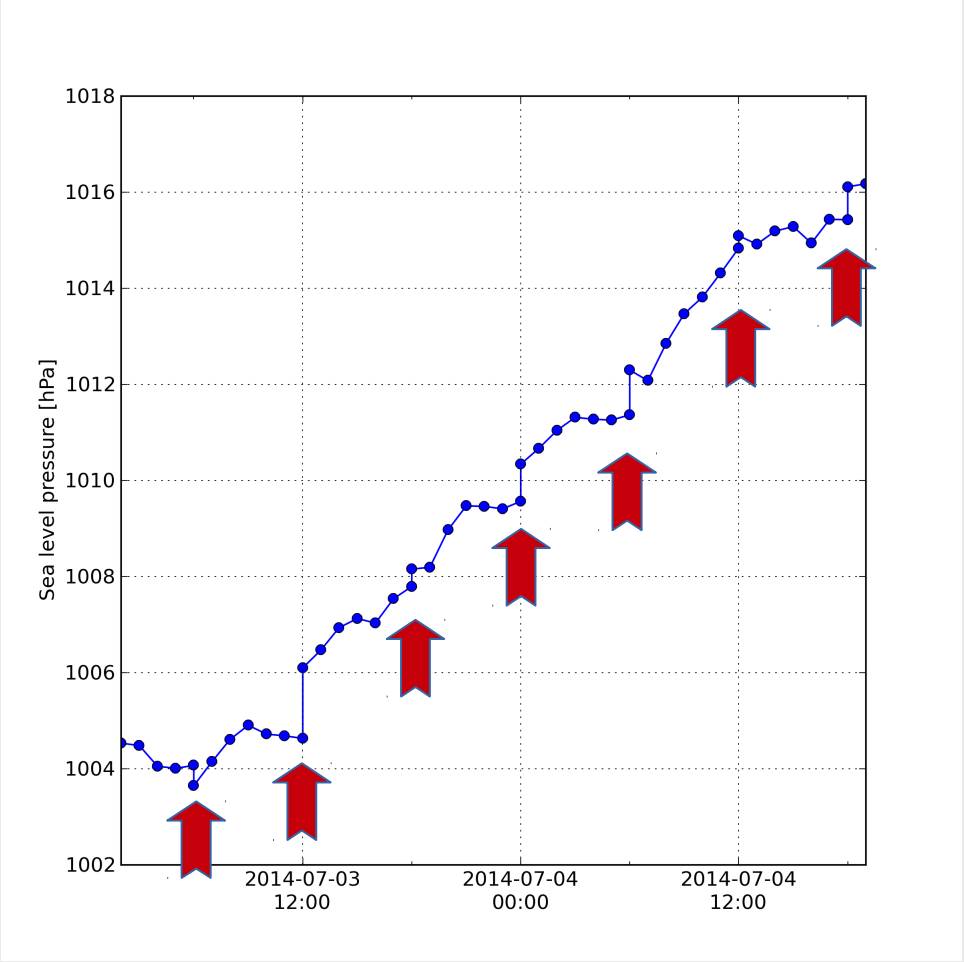
Mean absolute sea level pressure difference during 1 hour of forecast.



Mean absolute sea level pressure difference at same timestep for two subsequent forecasts.

Based on data from > 1000 forecast cycles

Sea level pressure discontinuity example



Sea level pressure during passage of Atlantic low pressure system.

Red arrows show discontinuity at analysis time.

Mitigation strategies

Get smooth meteorological forecasts

Smooth/ramp the meteorological forecasts

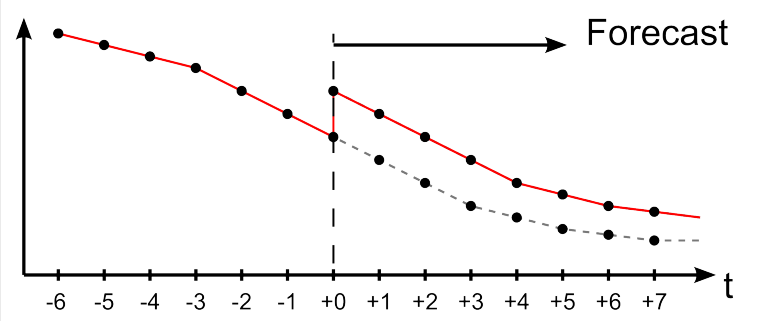
Mitigation strategies

Get smooth meteorological forecasts

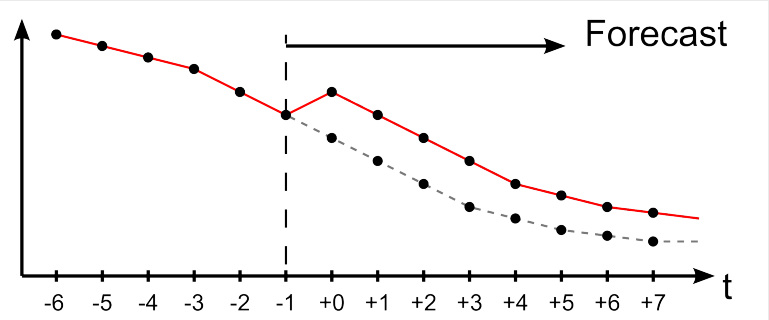
Smooth/ramp the meteorological forecasts

Meteo Ramping

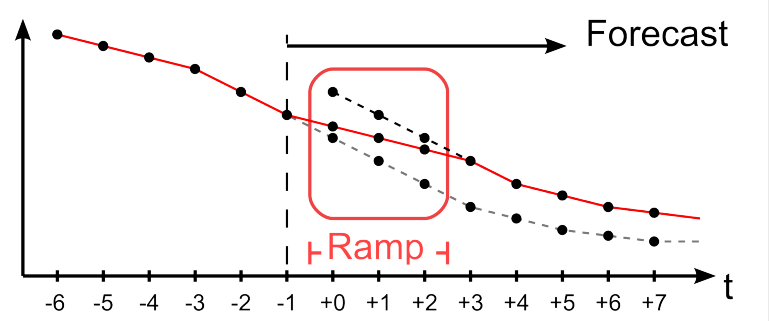
No ramping



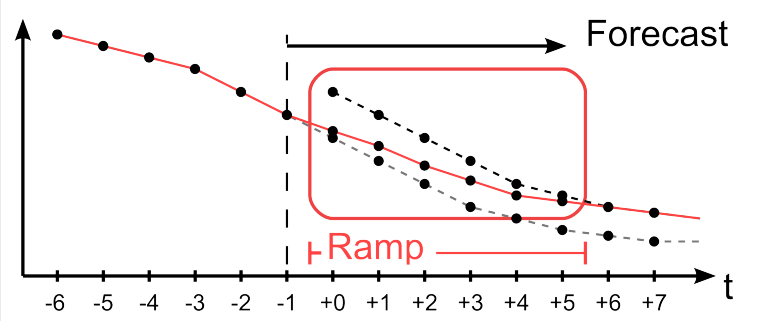
Ramp 0



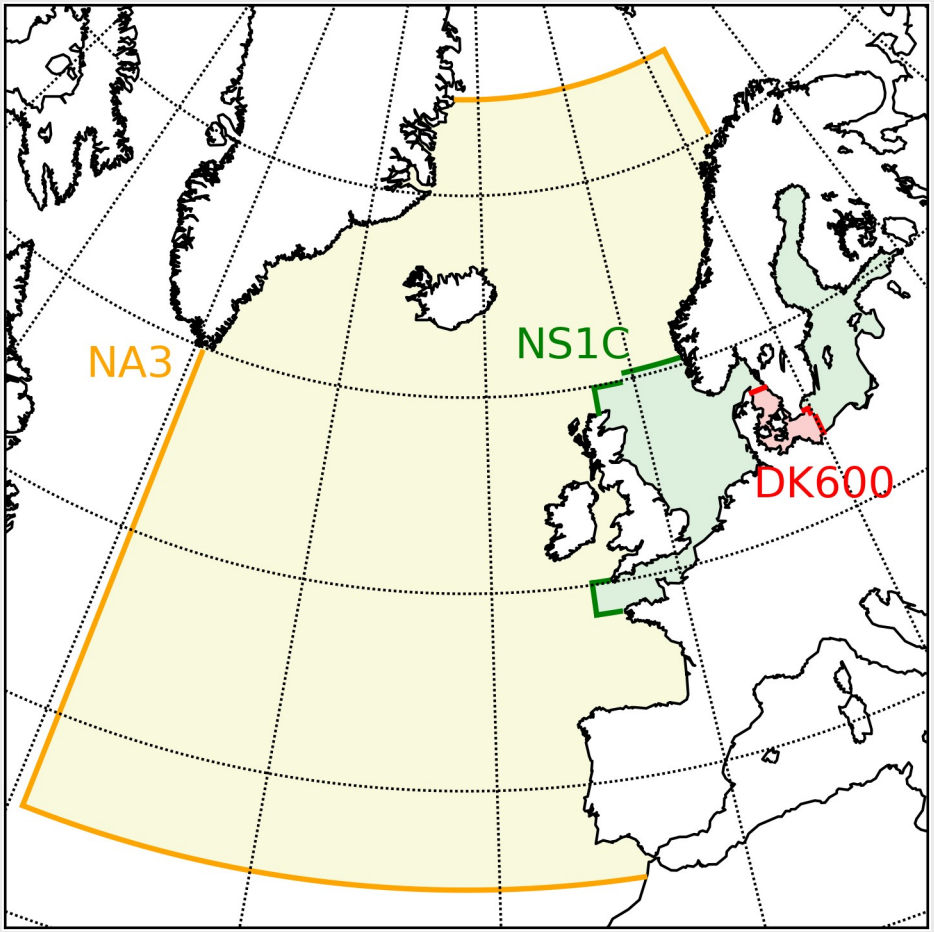
Ramp 3



Ramp 6



Operational ocean model setup



GETM (www.getm.eu)

NA3
- Barotropic (2D) model
- Surge only
- 3 nm hor. resolution

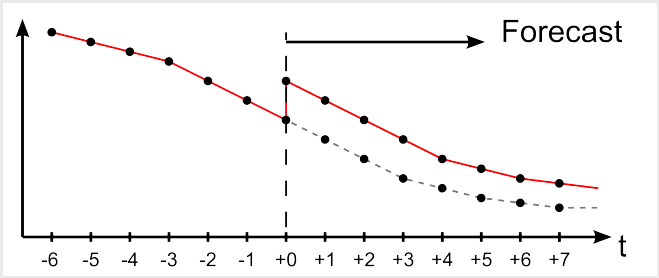
NS1C
- Baroclinic (3D) model
- 1 nm hor. resolution
- 60 vertical layers

DK600
- Baroclinic (3D) model
- 600 m hor. resolution
- 60 vertical layers

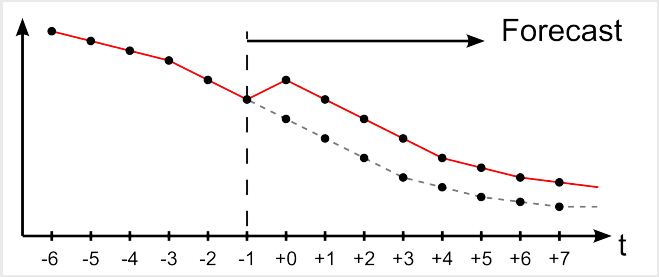
Ocean model experiments

- Only results from NA3 are used
- Study period: 2010-2012
- Rampings: none, 0h, 1h, 2h, 3h, 6h, 9h, 12h, 18h

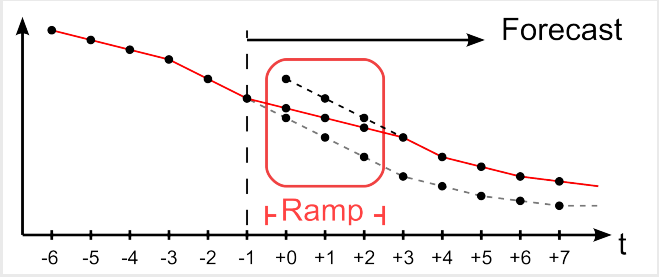
No ramping



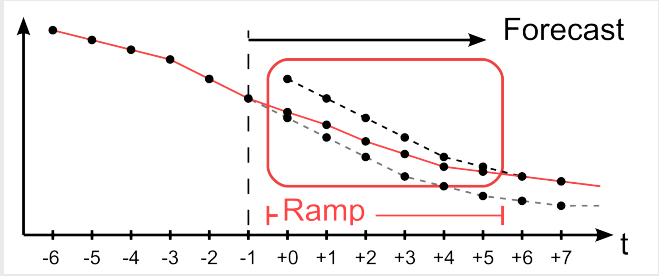
Ramp 0



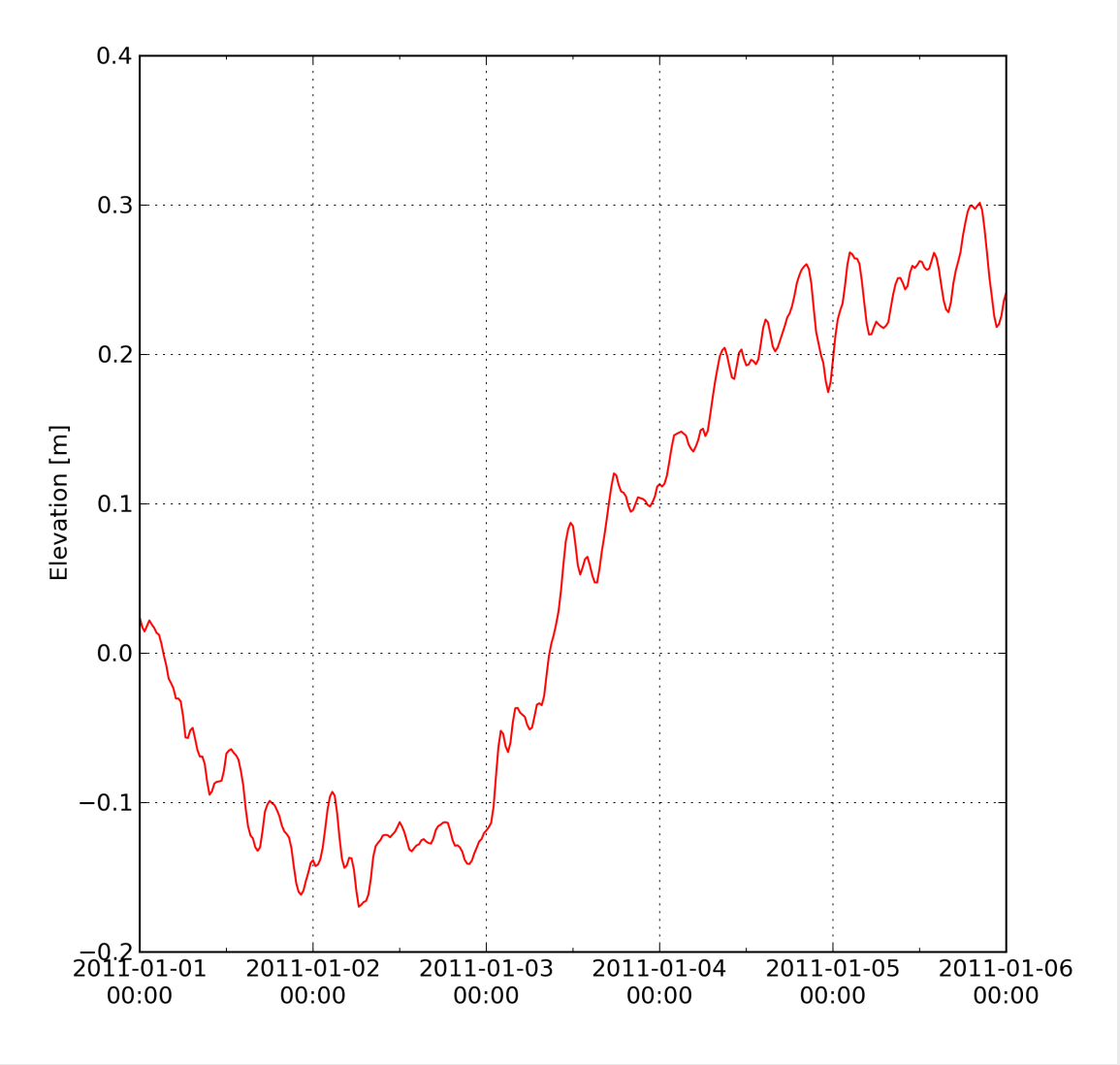
Ramp 3



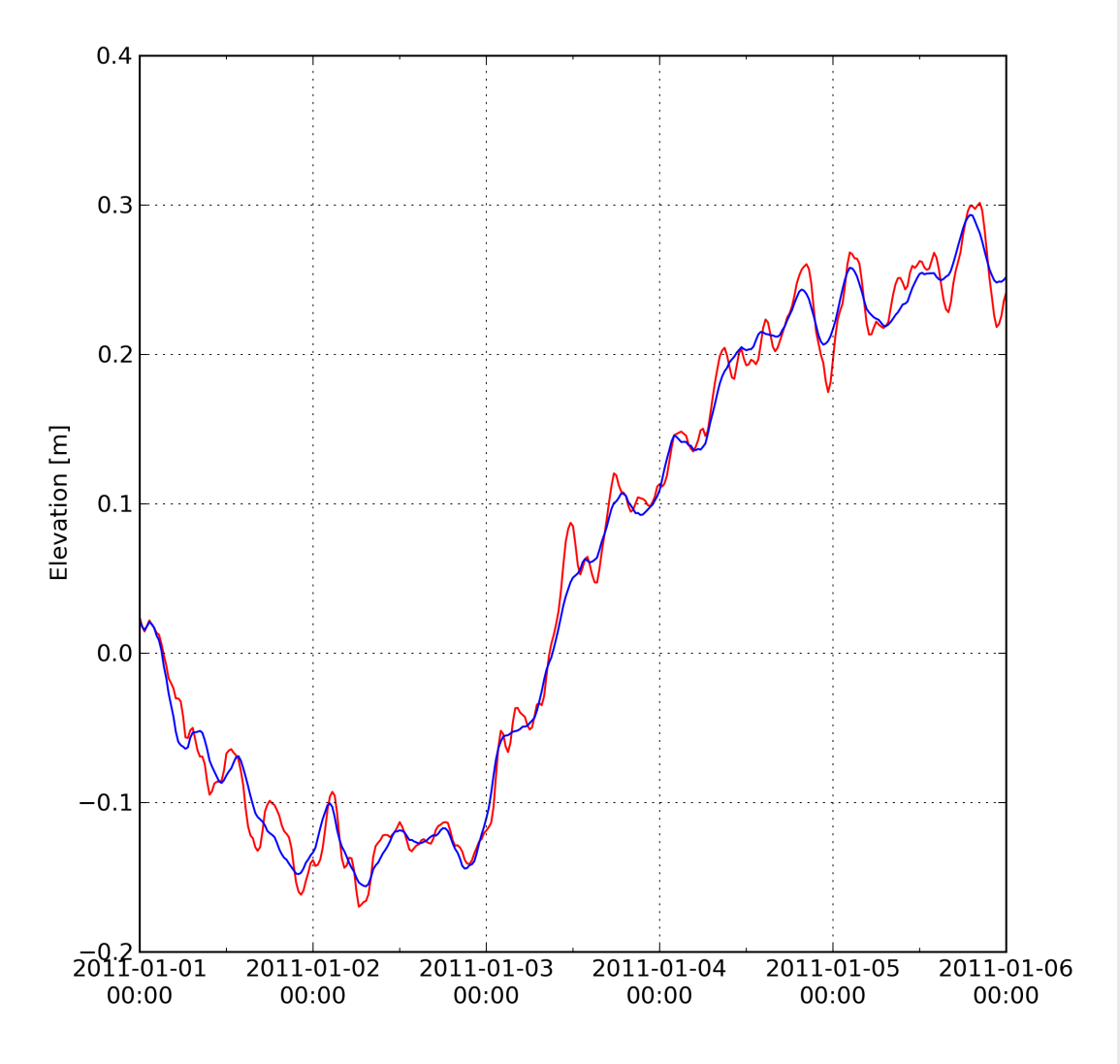
Ramp 6



Sea level timeseries example no ramping

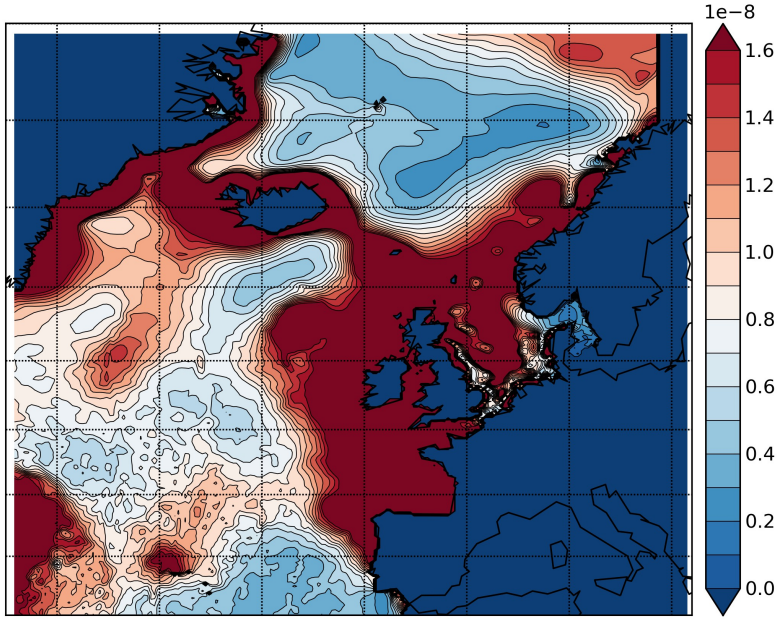


Sea level timeseries example ramp 9h

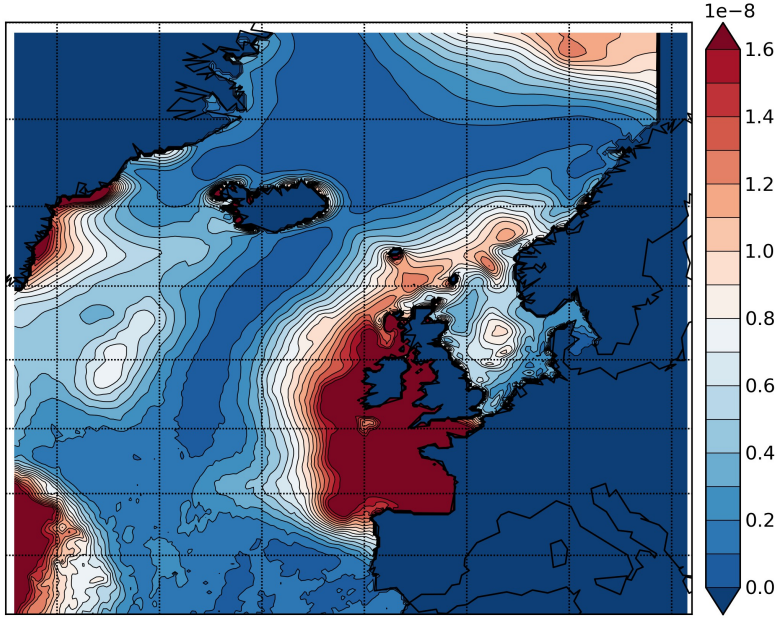


Sea level power spectra – spatial distribution

No ramping

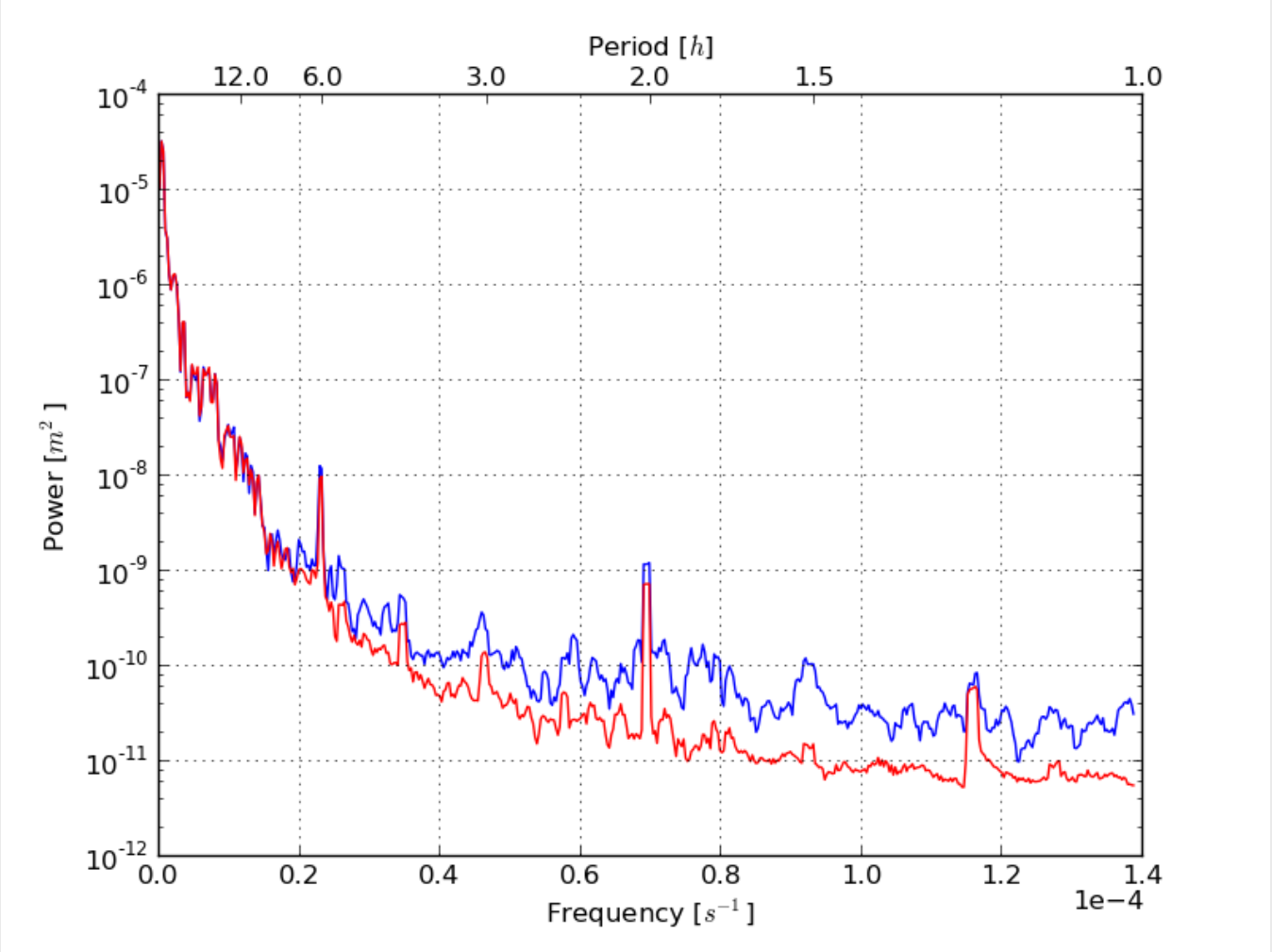


Ramp: 12h



- Power spectrum sum of frequency bins higher than the equivalent of a period of 3 hours.
- Note: Power spectrum is not normalized.

Example sea level power spectra



Blue: no ramping; Red: ramp 12h

Conclusions

- Ramping effectively removes discontinuities in meteo forcing
- Ramping is easily implemented
- Use the same ramping for validation runs as for operational runs
- We use a ramping window of 9 hours

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