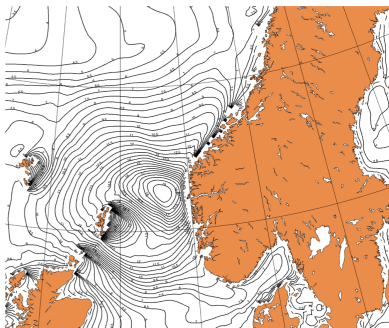


NORA10EI: Toward a very high-resolution atmospheric and wave hindcast archive for the Nordic Seas

Øyvind Breivik, Hilde Haakenstad and Magnar Reistad



Outline of presentation

- Previous hindcast archives for Norwegian waters
- The NORA10EI hindcast
- Comparison with NORA10
- The New Year's storm 1992
- Toward very high resolution hindcasts and reanalyses for the Arctic and the Nordic Seas
- Conclusions and further work

The NORA10 hindcast archive

- **The problem:** NORA10 (Reistad *et al*, 2011) has the disadvantage of being forced by the analyses from the frequently updating ECMWF-operational model after August 2002. While ERA-40 (Uppala *et al*, 2005) was produced with Cy23r4 T159L60 (~ 125 km), the ECMWF operational analyses have undergone steady resolution increases:

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 - ▶ 2002-09 Cy25r1 T511L60 (~ 40 km)
 - ▶ 2006-01 Cy32r3 T799L91 (~ 25 km)
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- **Does this lead to spurious trends and stronger winds toward the end of the period?**

Differences between NORA10 and NORA10EI

- NORA10EI was made to investigate whether the NORA10 in the latter period is biased (perhaps high in wind and waves) compared to the period before 2002

Differences between NORA10 and NORA10EI

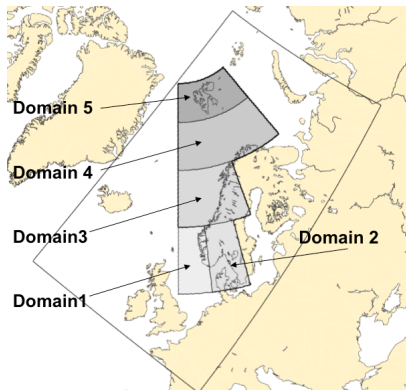
- NORA10EI was made to investigate whether the NORA10 in the latter period is biased (perhaps high in wind and waves) compared to the period before 2002
- Boundary values are taken from ERA-Interim (Dee *et al*, 2011) only, and the period is 1979 to present, cycle Cy31r2 T255 (~ 79 km horizontal resolution).
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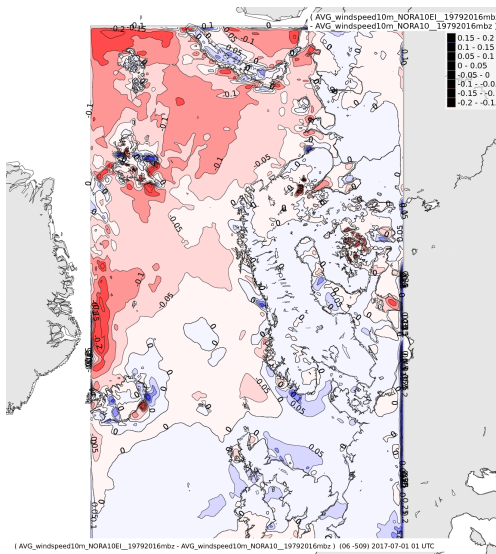
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- The data will be made publicly available

NORA10EI setup

- HIRLAM atmospheric model set up on 10-11 km resolution with boundaries and initial fields from ERA-Interim (Dee *et al*, 2011)
- The WAM wave model was set up on the same domain. Integrated parameters and spectra are output with 1-hourly temporal resolution.
- Data will be made freely available from 2018

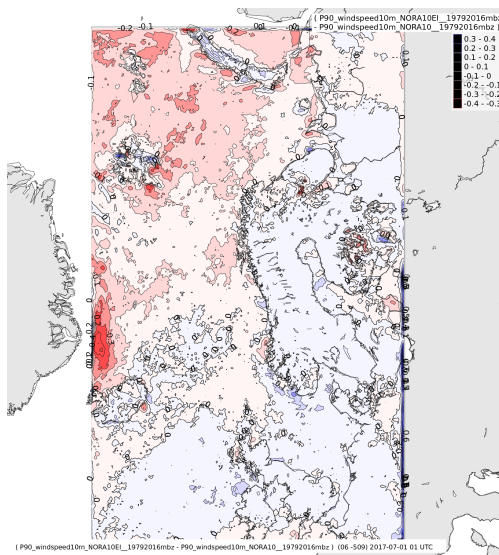


Mean wind difference NORA10EI-NORA10



Note: Blue = NORA10EI stronger

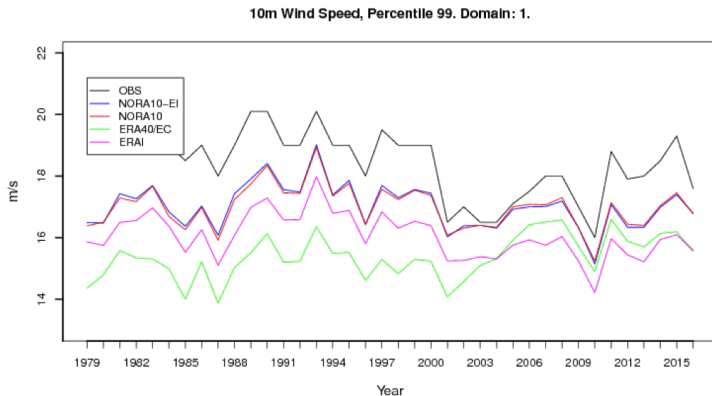
P90 U_{10} difference NORA10EI-NORA10



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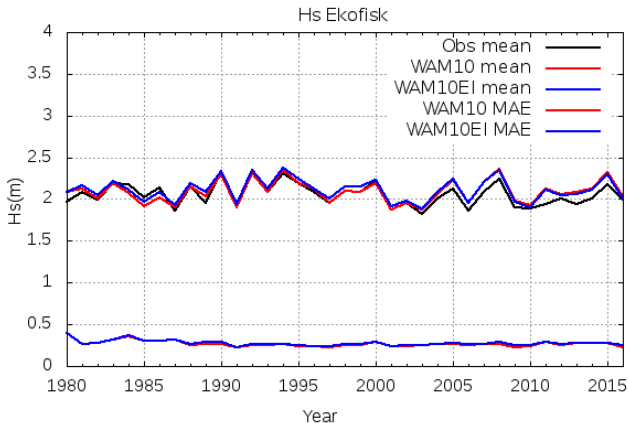
U_{10} trends NORA10EI vs NORA10 - P_{99}

NORA10EI has slightly weaker winds after 2002



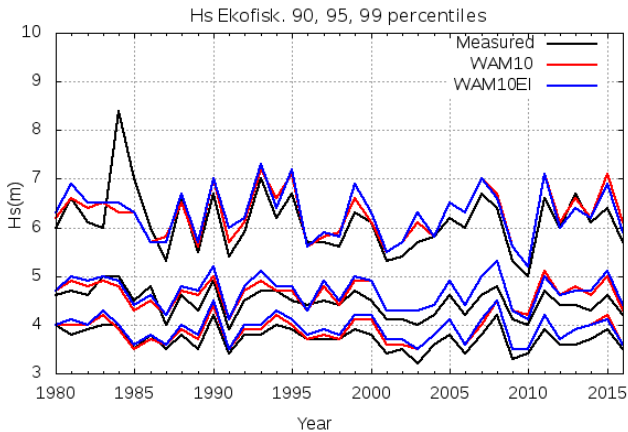
H_s NORA10EI vs NORA10 - Ekofisk, mean values

NORA10EI has slightly higher RMS but lower waves after 2006 when ECMWF analyses surpassed the ERA-Interim resolution



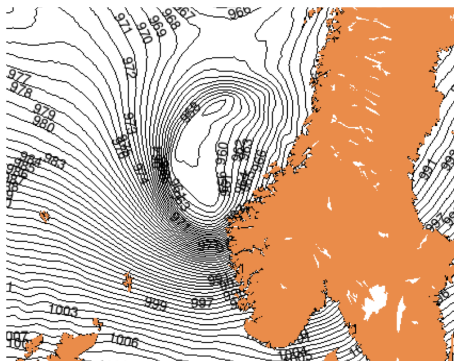
H_s NORA10EI vs NORA10 - Ekofisk, upper percentiles

NORA10EI also shows slightly lower upper percentiles after 2006 when ECMWF analyses surpassed the ERA-Interim resolution



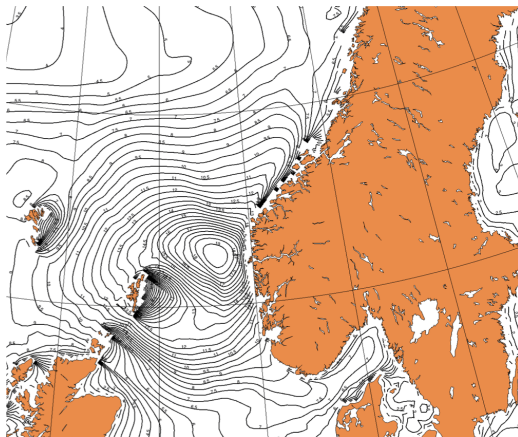
The New Year Storm 1992

- The New Year's Day Storm hit the western coast of Norway on 1 January 1992 and became the most devastating storm in modern Norwegian history
- The storm caused three fatalities (one in Norway and two on the Shetland Isles) and huge material damage
- The Statfjord-B platform recorded wind gusts of 75 m/s while further south sustained winds (10 min average) of 46 m/s were recorded



The New Year Storm 1992

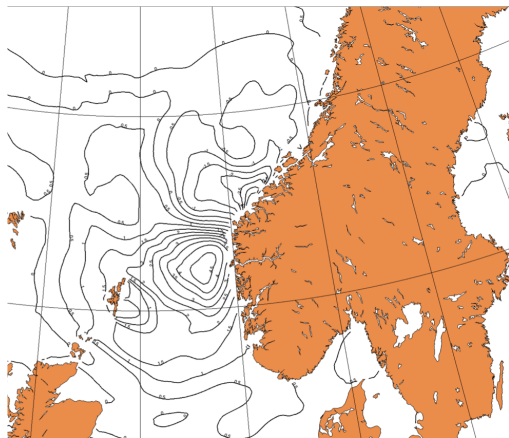
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NORA10EI has waves around 19 m west of Bergen.

The New Year Storm 1992

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NORA10EI probably exaggerates the wave height somewhat, while the winds are probably better than in NORA10.

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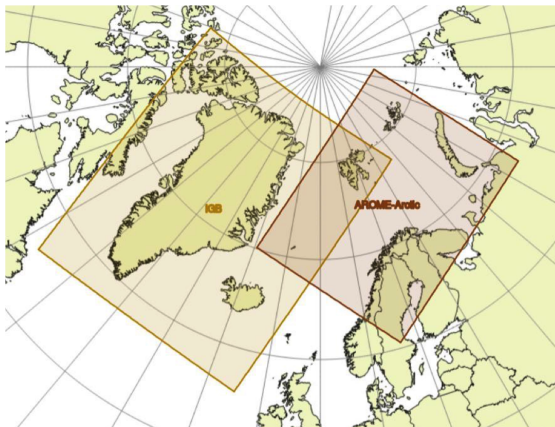
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- ④ No discernible impact on the trends in U_{10} and H_s
- ⑤ It seems safe to use NORA10 for the period after 2006, but switching to NORA10EI might be recommended for extreme value analysis

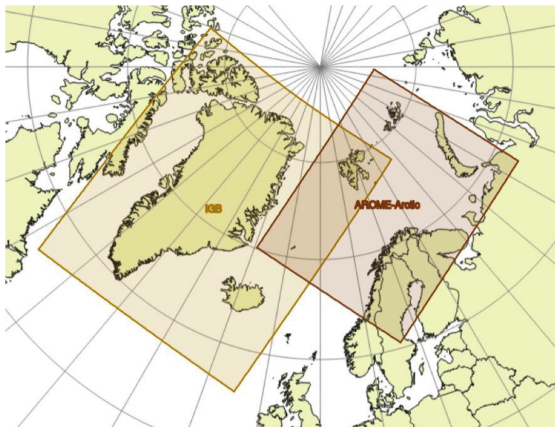
Future work: The CARRA reanalysis

- CARRA: A new 2.5 km resolution atmospheric reanalysis (1997-) of the Arctic with boundary conditions from ERA5 (available from 2019 in the ECMWF MARS archive)



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- On this resolution polar lows should be well resolved

Future work: The WINDSURFER hindcast archive

WINDSURFER: A new wave hindcast archive based on the ERA5 reanalysis on at least 5 km resolution (1979-) will be made freely available (from 2019)

