

Royal Netherlands Meteorological Institute Ministry of Infrastructure and the Environment

> **Assimilation of** scatterometer winds in **HARMONIE** for wave and surge forecasting near the coast

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Jan Kroos (SVSD) Hans de Vries (KNMI) Martin Verlaan (Deltares)







OSCAT: 20131119 11:47Z HIRLAM: 2013111906+05 IR: 11:45

OSCAT

<u>kõ</u>

That's why we needed wellies in Venice !





Progress surge forecasts

Maeslantkering requires **c** < 15 cm (1 yr¹) **Developments:** High resolution models (weather, surge). Data assimilation water levels, incl. EO (Kalman filtering) Improved interaction hydrologists and **Meteorologists** In 2007 standard deviation (RMSS) surge forecasts reached $\sigma < 15$ cm

O Lin Photo Ly





What's next

Take away remaining uncertainties:

- Mesoscale wind forcing
- > Air-sea interaction (momentum flux)
- Improving water-level representation inside estuaries and shallow seas (increased resolution)
- Data assimilation of heights and winds to increase predictive quality for the shorter lead times (<12 h)</p>
- > Steric effects (salinity, SST)

Mesoscale meteo oscillations



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Harmonie regional model



- Non-hydrostatic
- > 800x800 grid
- 2.5 km grid size
- 3D-var assimilation
 - 8 times per day
 - 48-hour forecast
- ECMWF boundaries
- Available since 1/1/2012
- Oper. cyle: cy36h1.4
- Research: cy37h1.2, soon cy38h1.1

Harmonie experiments: verification

0.6

0.4

3

- NoDA: No data assimilation 1.2
 Conv: Assimilation of conventional observations (TEMP/Aircraft/SYNOP) only 0.8
- 3. Conv + ASCAT/QSCAT (default settings)
- 4. Conv + ASCAT no thinning

- Conclusions
 - Assimilation of observations
 does not improve forecast skill
 - ECMWF outperforms Harmonie
 - Harmonie small-scale spatial structures do not verify
 - Too much weight is given to observations



AIREP_t_250hpa

- Conv+ascat+qscat
- Conv+ascat no thinn — ECMWF

Maeslantkering closure



Surface winds from HARMONIE model at 1.7 km grid

HARMONIE shows mesoscale structures

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.... zoomed in





Mesoscale DA challenges

- Default: 3D-Var with 3-hr assimilation window
 - Time mis-match between asynoptic (satellite) observations and analysis time
 - Harmonie small-scale spatial structures look realistic but are not real, i.e., they do not verify with observations
 - Harmonie exaggerates strong winds
- New developments at KNMI
 - 4D-Var is running in experimental mode
 - 3D-Var Rapid Update Cycle (1-hr window)
- Collaborative/coordinated effort on mesoscale DA within Hirlam/Harmonie consortium and at IWW workshop





Optimal use of observations in meso-scale DA



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Next steps

- Period 4 (6/12/2011 -6/1/2012)
 - ASCAT/OSCAT assimilation
 - Test error growth
 - 3D-Var Rapid Update Cycle (1-hr)

OSCAT (25-km product) assimilated in HARMONIE for the first time!

Observations_for_Harmonie_analysis_20111206_12UTC



