F998dcs13001: North Sea SWAN-DCSM 2013

Purpose

In the Dutch waters wave forecasts are essential for early warning and navigation. Thus, the SWAN North Sea models have been developed, validated and improved to produce wave forecasts for the North Sea and in particular the Dutch Coast.

The SWAN North Sea models consist of two models, a larger model covering the whole North Sea and a smaller model focusing on the Dutch coast, see Figure 1. For SWIVT the larger model was selected: the SWAN-DCSM model. Due to the large size of the computational area, temporal variations in wind, water levels and waves cannot be neglected. Therefore, the computations are carried out in non-stationary mode.

A hindcast has been done for the SWAN-DCSM model to assess the performance and numerical settings of SWAN on the grid for a selected storm during the storm season of 2013/2014 by comparing the SWAN results against observed data.

Case selection

As mentioned above, the storm season of 2013/2014 was used to perform a sensitivity analysis of the numerical settings of the non-stationary SWAN-DCSM model. Five periods were selected with severe waves for the Dutch coast during the storm season 2013/2014 for a sensitivity analysis. For SWIVT only the period from 2013 Nov 26 - 2013 Dec 09 (very strong NW waves) has been chosen.

Different settings of the whitecapping dissipation were tested to find the most suitable parameters. The whitecapping formulation has been proven to have the largest effect on the results, mainly on the low frequency wave height HE10 and the wave period.

Model settings

The large computational grid SWAN-DCSM and its bathymetry are based on the rectangular DCSMv6 grid (of the operational Dutch North Sea flow model), but are covering a slightly smaller area, see Figure 1.

The model receives at 22 locations (with 2° distance between them) along its northern, western and southern boundary, 2d spectral wave boundary conditions that come from forecasts of the operational European shelf wave model WAM of ECMWF (ECMWF-WAM). The water level fields come in this model version from the operational flow model WAQUA. Since the SWAN-DCSM grid covers mainly the deeper waters, no currents are applied in the model. Finally, the wind fields come in this model version from KNMI's HIRLAM11-v7.2 model.

The following physical model settings are applied.

```
GEN3 KOMEN

WCAP KOMEN delta=0

FRIC JONSWAP cfjon=0.02

BREA CONST alpha=1.0 gamma=0.73
```

Quadruplets (deep water non-linear wave interactions) are activated by default and triads (non-linear wave interactions; active on shallow water) are off.

The numerical settings are as follows:

```
PROP BSBT

NUM ACCUR NONSTAT mxitns=20
```

Which means that the first order upwind scheme BSBT (backward space, backward time) is used, and that the maximum number of iterations is 20.

The time step of the non-stationary computations is one hour.

It should be noted that the actual operational version of the SWAN-DCSM model may differ from this model version, as updates have been performed on the model since Deltares (2015).

References

Deltares (2015). SWAN North Sea 2014. Deltares report 1209448-004-ZKS-0004, March 2015.

Acknowledgments

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Figures

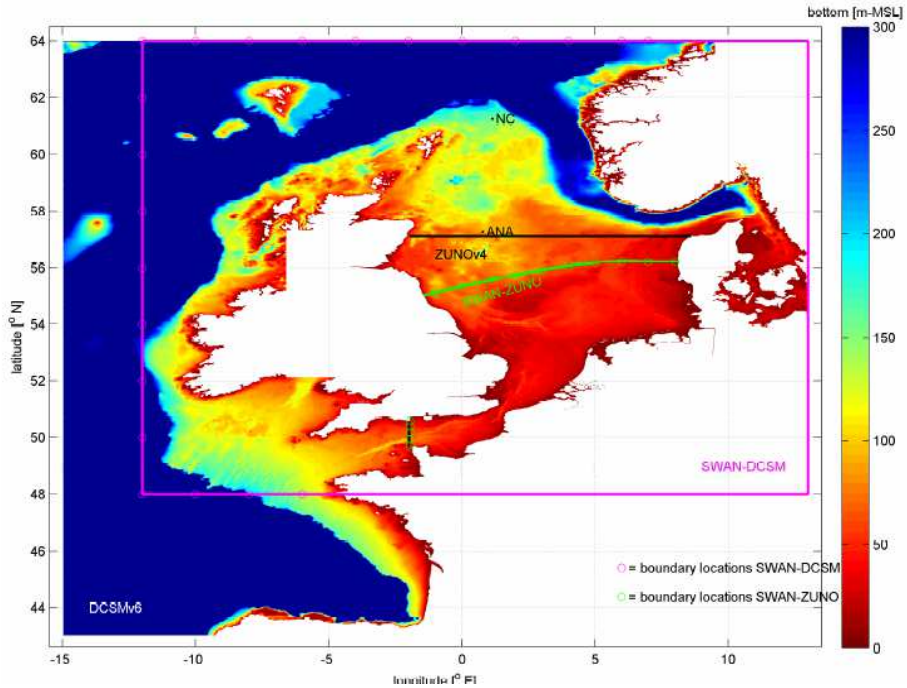

Figure 1. Computational grids: SWAN-DCSM (magenta line) and SWAN-ZUNO (green line) and original DCSM and ZUNO grids

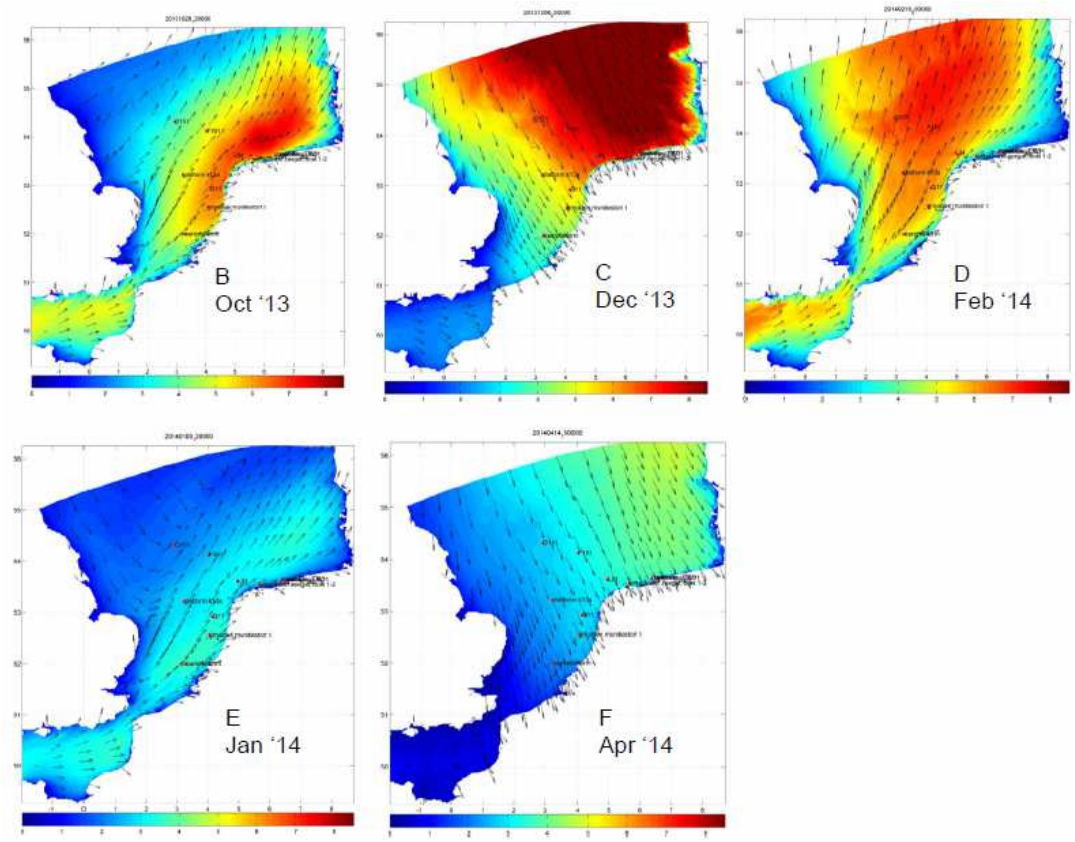

Figure 2. Five storms during storm season 2013/2014