

BALTIC S

# New coupled forecasting system for the Baltic Sea area

Adam Nord, Tuomas Kärnä, Anja Lindenthal, Patrik Ljungemyr, Ilja Maljutenko, Saeed Falahat, Ida M. Ringgaard, Vasily Korabel, Hedi Kanarik, Svetlana Verjovkina, Simon Jandt. With support of the whole BAL MFC team

### **BAL MFC**



#### Consortium of five Baltic Sea Institutes:

Danish Meteorological Institute (DMI) Swedish Meteorological and Hydrological Institute (SMHI) Finnish Meteorological Institute (FMI) Federal Maritime and Hydrographic Agency (BSH), Germany Marine System Institute (MSI), TalTech, Estonia



### **BAL MFC Model-system**

#### Baltic Sea Model System consists of four parts,

physical state (NEMO): *sea level, sea current, temperature, salinity, sea ice* wave dynamics of the ocean (WAM): *wave height, wave period, wave direction* marine ecosystem (ERGOM): *dissolved oxygen, nutrients, chl-a, carbon cycle* 

CMEMS BALTIC SE

MFC

#### **Data assimilation system: PDAF**

The system will be used both for forecasts (up to 6 days) and reanalysis from 1993 up to close to present.

## Model and product grid



COPERNICUS CMEMS BALTIC SEA MFC OFFICE OFFIC



### WAM to NEMO





- Coupling to the wave model effects sea level
- For storm situations the effect of coupling increases

| Frederikshavn r                            | - <del>* 9</del> n | <b>┌────</b> ──────────────────────────────── |   |  |
|--|--------------------|---|---|--|
| Goteborg Torshamnen                        | - × o              | - 0× -  | <b>₽</b> ≫  |  |
| Grena                                      | - × 0              |   |   |  |
| Skagen                                     |                    |   |   |  |
| Dragor                                     |                    |   | La Salation |  |
| Fredericia                                 | - × 0              |   | e 8-  |  |
| Fynshav                                    | - × 0              | - o × -                                       | -o ×o   |  |
| Hornbaek                                   | - × O              | - × 0 -                                       | e O+  |  |
| Kobenhavn                                  | - × 0 -            | - × O -                                       | -E O × -  |  |
| Korsor                                     | - × 0 -            | - × 0 -                                       | Ð   |  |
| Slipshavn                                  | - × 0              |   | 면 생   |  |
| Viken                                      |                    |   |   |  |
| Barboeft                                   |                    |   | Ľ n 💑   |  |
| Koserow                                    | - × ŏ -            |   | - 0 0   |  |
| Landsort Norra                             | - × o -            | -×0   | <b>⊕</b> ⊗  |  |
| Marviken                                   | - × C -            | × 0   | ф 🔗   |  |
| Rodvig                                     | - × O -            |   | 8   |  |
| Skanor                                     | - × 0              |   | 면 🦉   |  |
| Daugavgriva                                | ×vo                |   |   |  |
| Lehtma                                     |                    |   |   |  |
| Parnu                                      | x^o~               | - »~  | i o e   |  |
| Sillamae                                   | - × •              | - × -   | - 0 🔗   |  |
| Degerby                                    | - × o -            | × 0 -   | ¢ 0   |  |
| Forsmark                                   | - × o -            | -× O  | ф   |  |
| Kalix                                      | - × o -            | - ×0 -  | ₽ <u></u>   |  |
| Kaskinen                                   | - <u> </u>         |   | P O   |  |
| Pietarsaari                                |                    |   | B 0   |  |
| Skagsudde                                  | - Î                |   | ф <sub>A</sub>  |  |
| Spikarna                                   | - ×ŏ-              | -× 0  | Ē. õ  |  |
| Aarhus                                     | - × O              | - × • -                                       |   |  |
| Bagenkop                                   | - × O              | - O × -                                       | - 0 ×>  |  |
| Ballen                                     | - × O              | - ×0 -  |   |  |
| Furuogrund                                 | - × 0              | - × 0   | P O   |  |
| Geaser                                     |                    |   |   |  |
| Kemi                                       |                    |   | e a   |  |
| Kiel Holtenau                              | - x o              | - 0 ×   | Te X  |  |
| Kungsholmsfort                             | - × o -            | × 0 -   | <b>₽</b>  |  |
| Kungsvik                                   | - × O -            | - o× -  | ф   |  |
| Ringhals                                   | - × 0 -            | - ×o -  | ₽ <u></u> >   |  |
| Rodby                                      | - × 0              | - OX  |   |  |
| Sassnitz<br>St Potorsburg                  |                    |   |   |  |
| Tallinn                                    | - X A              |   |   |  |
| Tein                                       | - × 0              | - × 0   | Fo A  |  |
| Visby                                      | - × o              | * 0 -   | <b>₽</b> →  |  |
| Warnemuende                                | <u>× b</u> U       |   |   |  |
| -0   | .2 0 0.2 0.4       | 0.05 0.1                                      | 0 20 40 60 80 100   |  |
|  | Bias [m]           | cRMSD [m]                                     | Correlation   |  |
| Missing observations [%]                   |                    |   |   |  |
| □ missing observations ○ V201804 × V202012 |                    |   |   |  |

### **NEMO to WAM**





- The storm Toini on 12 Jan 2017
- Effect of wave-current interaction to the significant wave height.







# **Conclusion and outlook**

BALTIC SE

MFC

- The coupled system works good in general
- Improvements by the coupling of wave to ocean circulation can be situational
- More work possible!