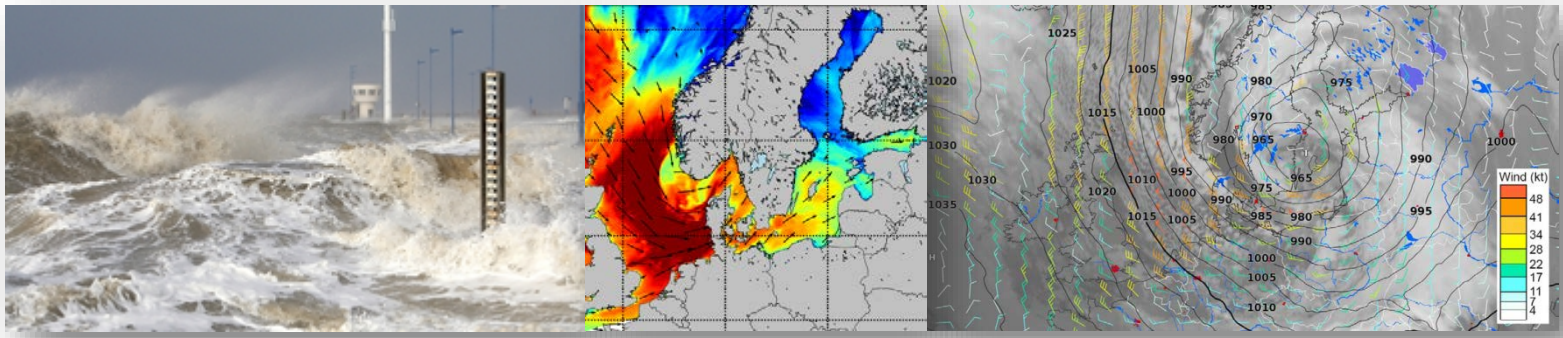

Reproduction of 10 m-wind and sea level pressure fields during extreme storms with regional and global atmospheric reanalyses in the North Sea and the Baltic

Natacha Fery[1], Birger Tinz[1], Anette Ganske[2] and Lydia Gates[1]

[1] Deutscher Wetterdienst, Hamburg, Germany
[2] Bundesamt für Seeschifffahrt und Hydrographie, Hamburg, Germany

Overview

- Context : Project EXTREMENESS
- Description of the data
  - Atmospheric reanalyses
  - Observations
- Case studies – Validation of the 10 m-wind and sea level pressure
- Conclusions

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Project EXTREMENESS

- „EXTREME North sEa Storm Surges and their consequences“
- Analysis of wind fields inducing storm surges in atmospheric data [EXTREMENESS-B]
- More details about this project in the presentation of Ralf Weisse:

‚***Identification of extreme storm tides with high potential for the German North Sea coast‘ – Topic D***

https://www.hzg.de/ms/extremeness/index.php.de

Overview

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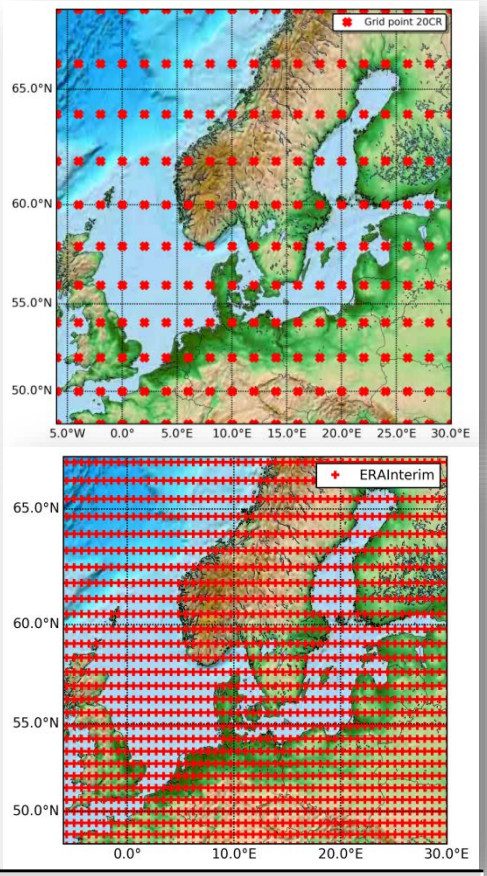
Global atmospheric reanalyses

- Twentieth Century Reanalysis 20CRv2c *(Compo et al., 2011)*
- ERAInterim *(Dee et al., 2011)*

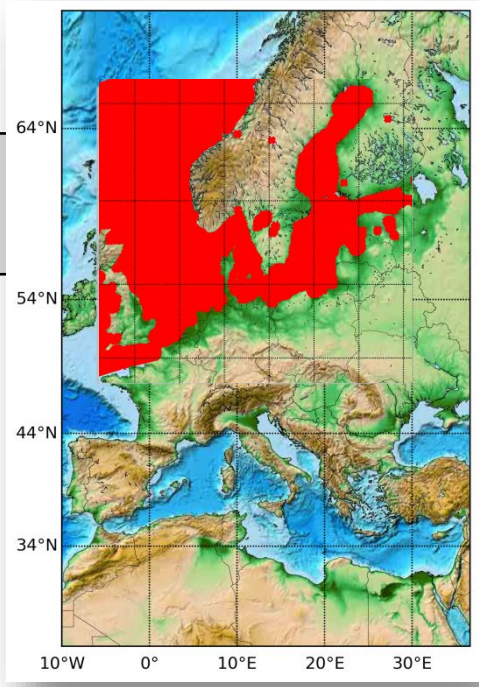


20CRv2c	1851-2016	6 h	2°	FF10M, DD, PS	Gobal, NOAA 2D, 56 Ensembles
ERA-Interim	1979-today	6 h	0.75°	FF10M, DD, PS	Global, ECMWF 2D

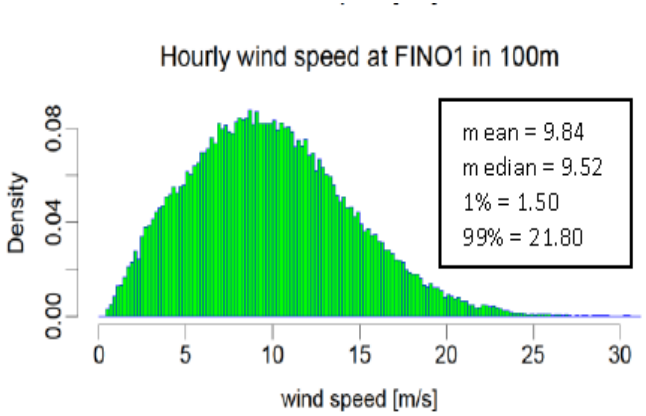
The regional atmospheric reanalysis COSMO-REA6

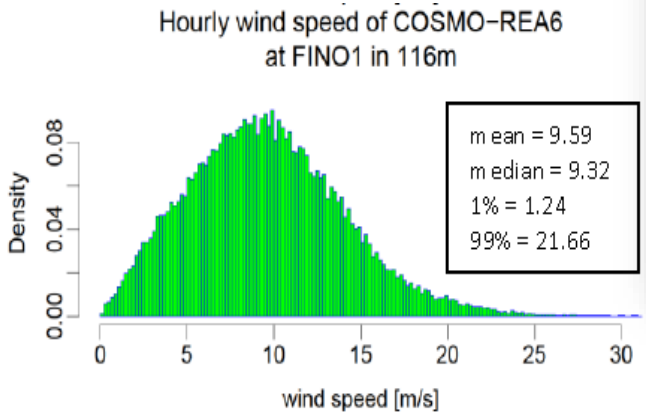
➔ Product of the Deutscher Wetterdienst/University of Bonn (Bollmeyer *et al.*, 2012)

COSMO-REA6	1995-2015	1 h	0.055° 6x6 km	FF, DD, PS	Regional EURO-Cordex domain 2D and 3D information



➔ Validation (Borsche *et al.*, 2016)





➔ Here, applications for extreme events (storms)

Overview

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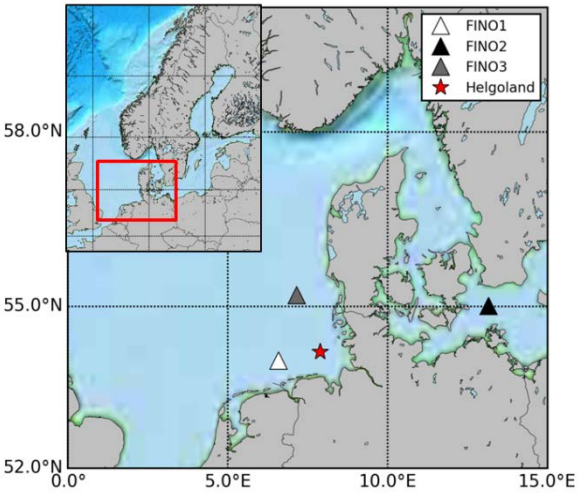
Overview of the measurement network

- Parameters: wind speed / wind direction / pressure
- FINO research platforms
- German Naval Observatory
- DWD Climate Data Centre [CDC ftp://ftp-cdc.dwd.de/]



FINO1 [North Sea]	2004-2015	10 min
FINO2 [Baltic Sea]	2007-2015	10 min
FINO3 [North Sea]	2009-2015	10 min
German Naval Observatory	Borkum (1883-1991) Cuxhaven Heligoland	6 h
DWD Climate Data Centre (CDC)	Borkum (1967-2016) Cuxhaven (1969-2016) Heligoland (1959-2016)	1 h

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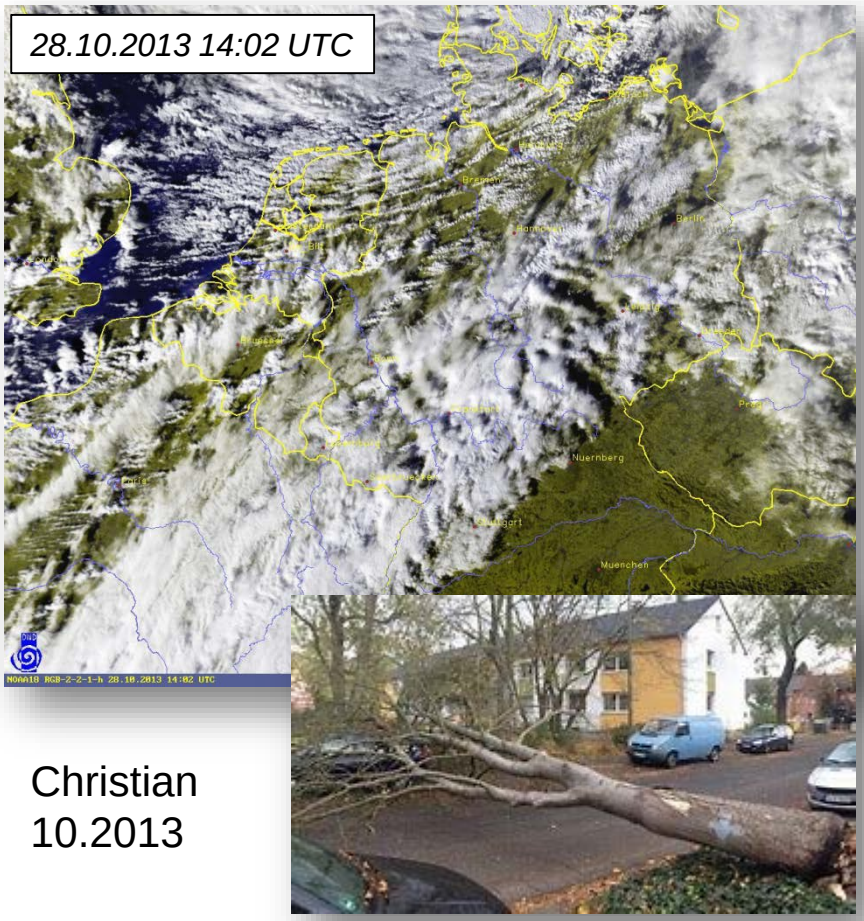
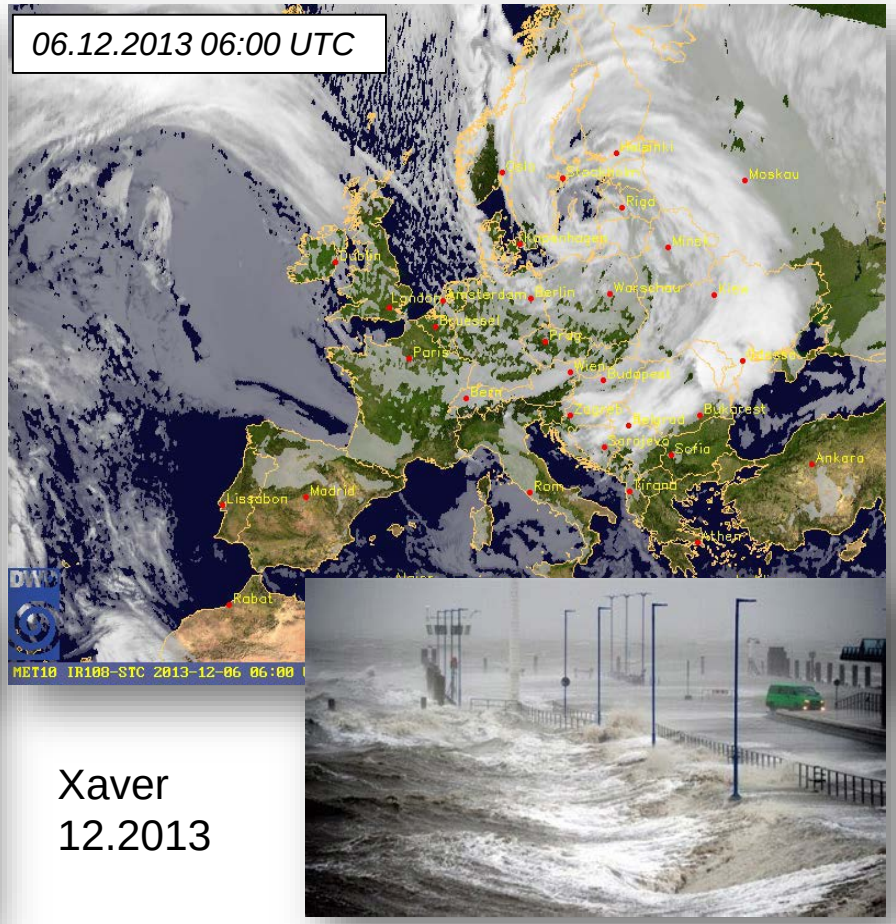
Validation for case studies – Storms in 2013

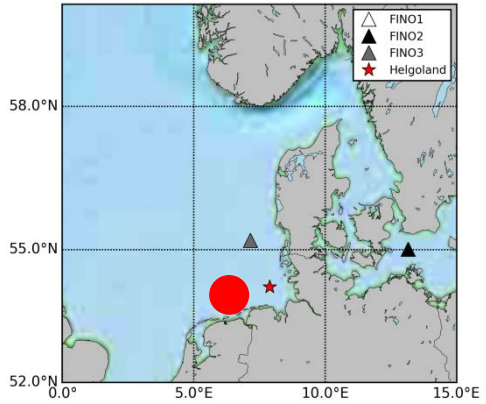


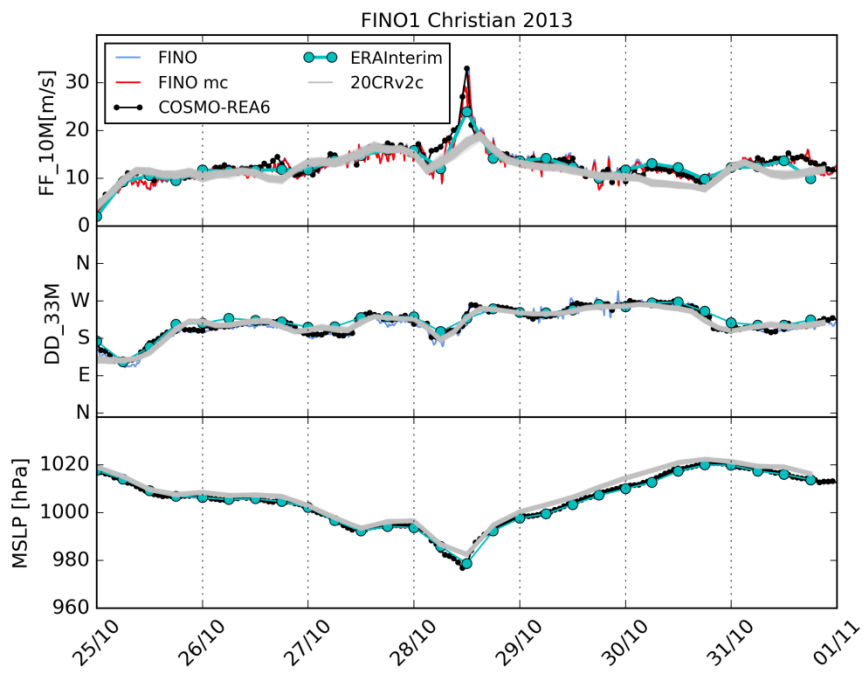
Christian
10.2013

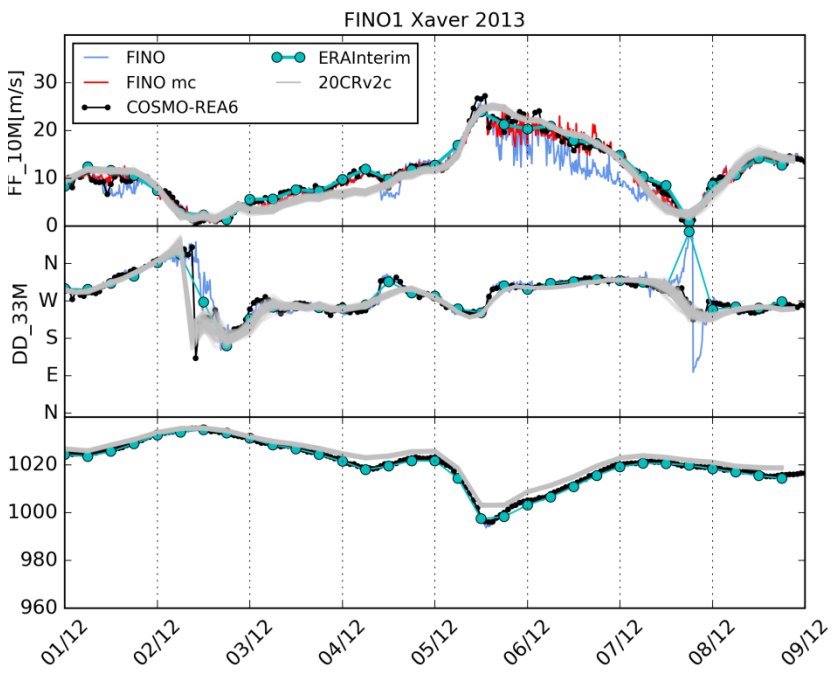


Xaver
12.2013

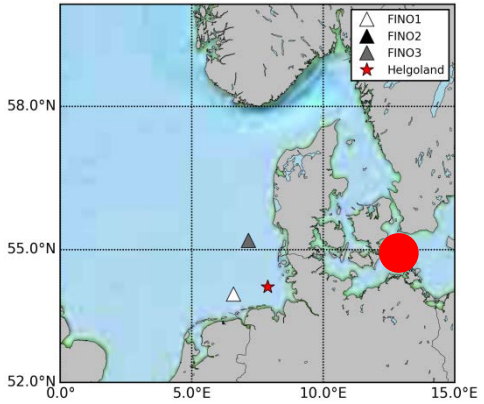
Validation for case studies – FINO1

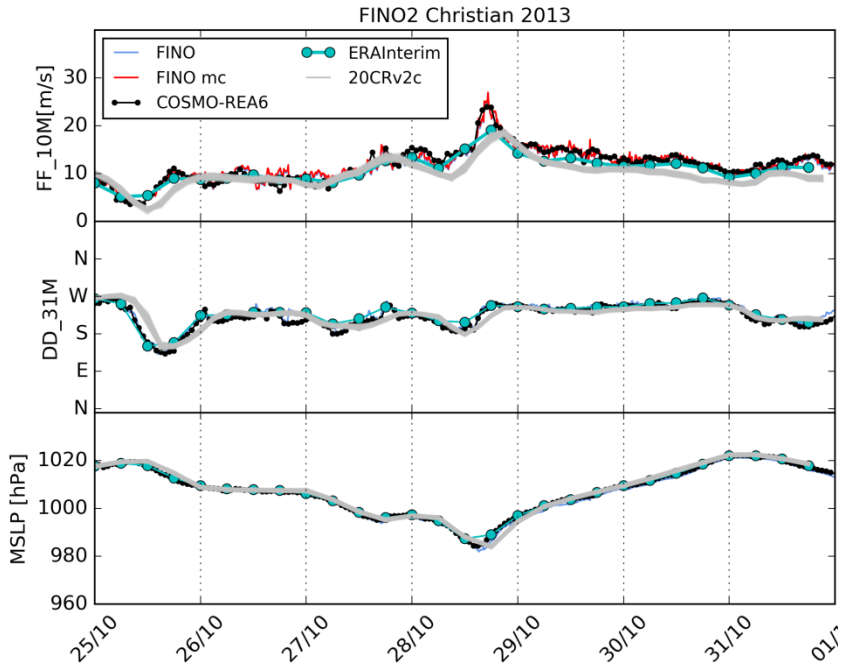


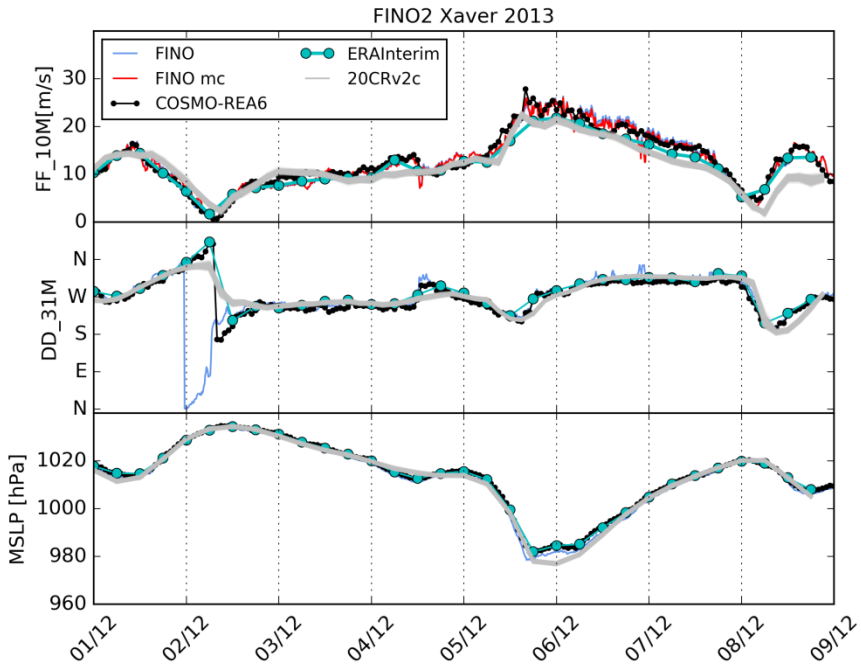




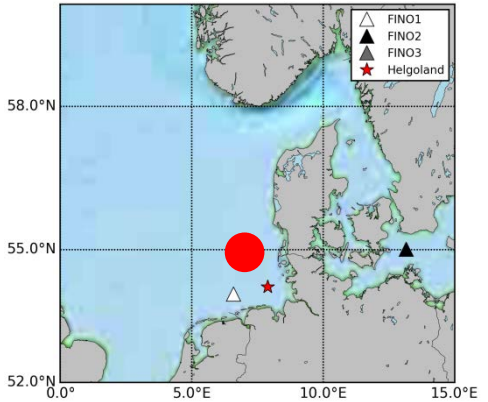
Validation for case studies – FINO2

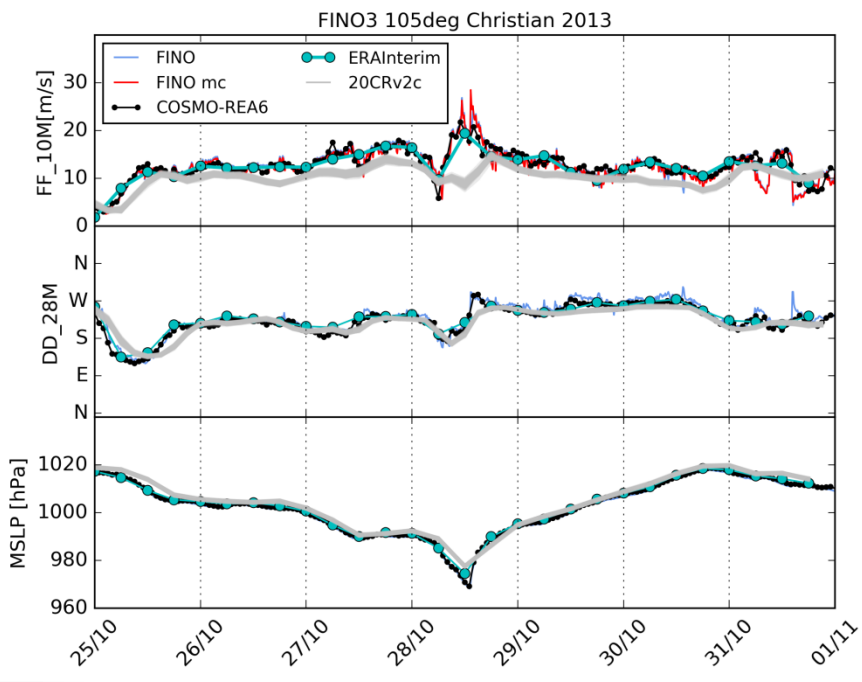


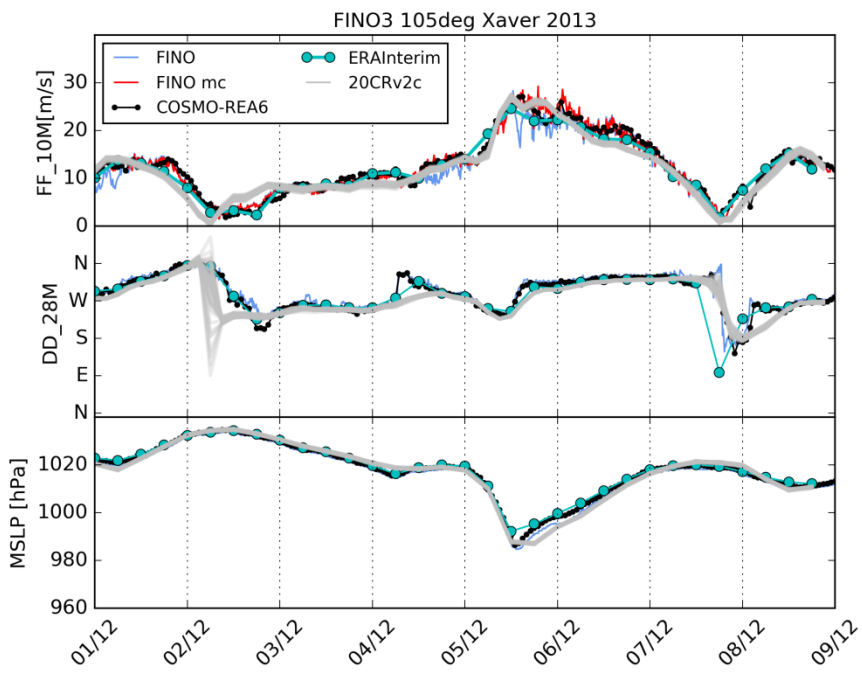




Validation for case studies – FINO3 [105°]

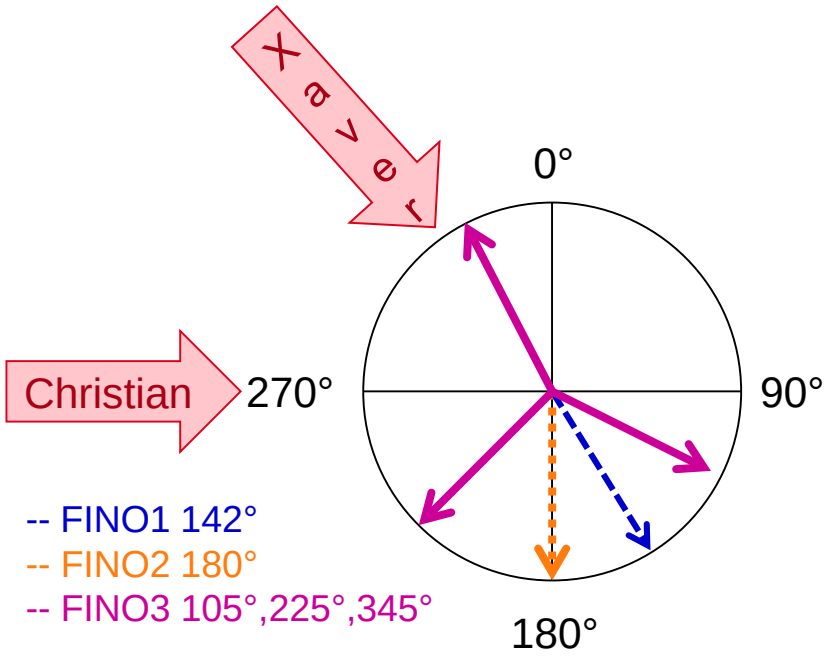


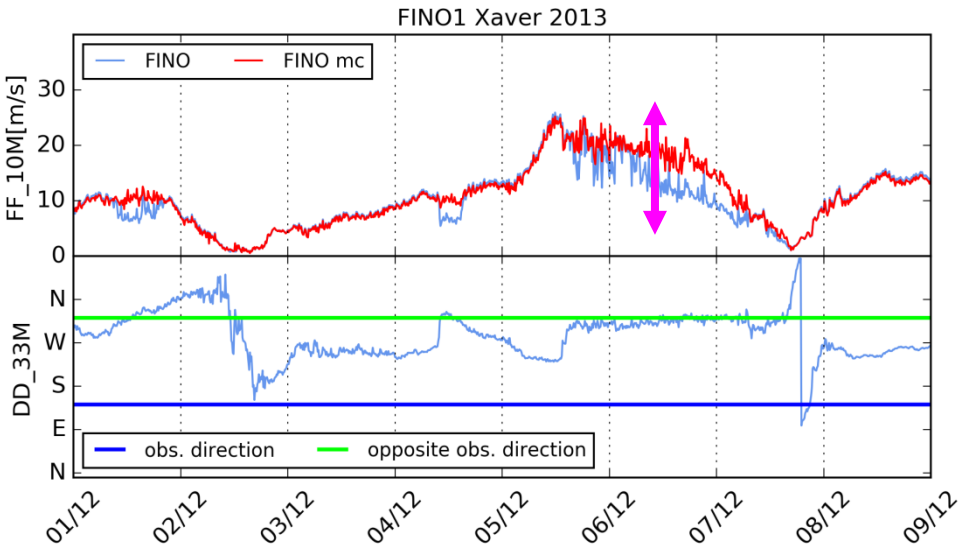




Mast corrections at the FINO platforms

➔ Algorithm developed during the project FINO Wind to correct the mast effect

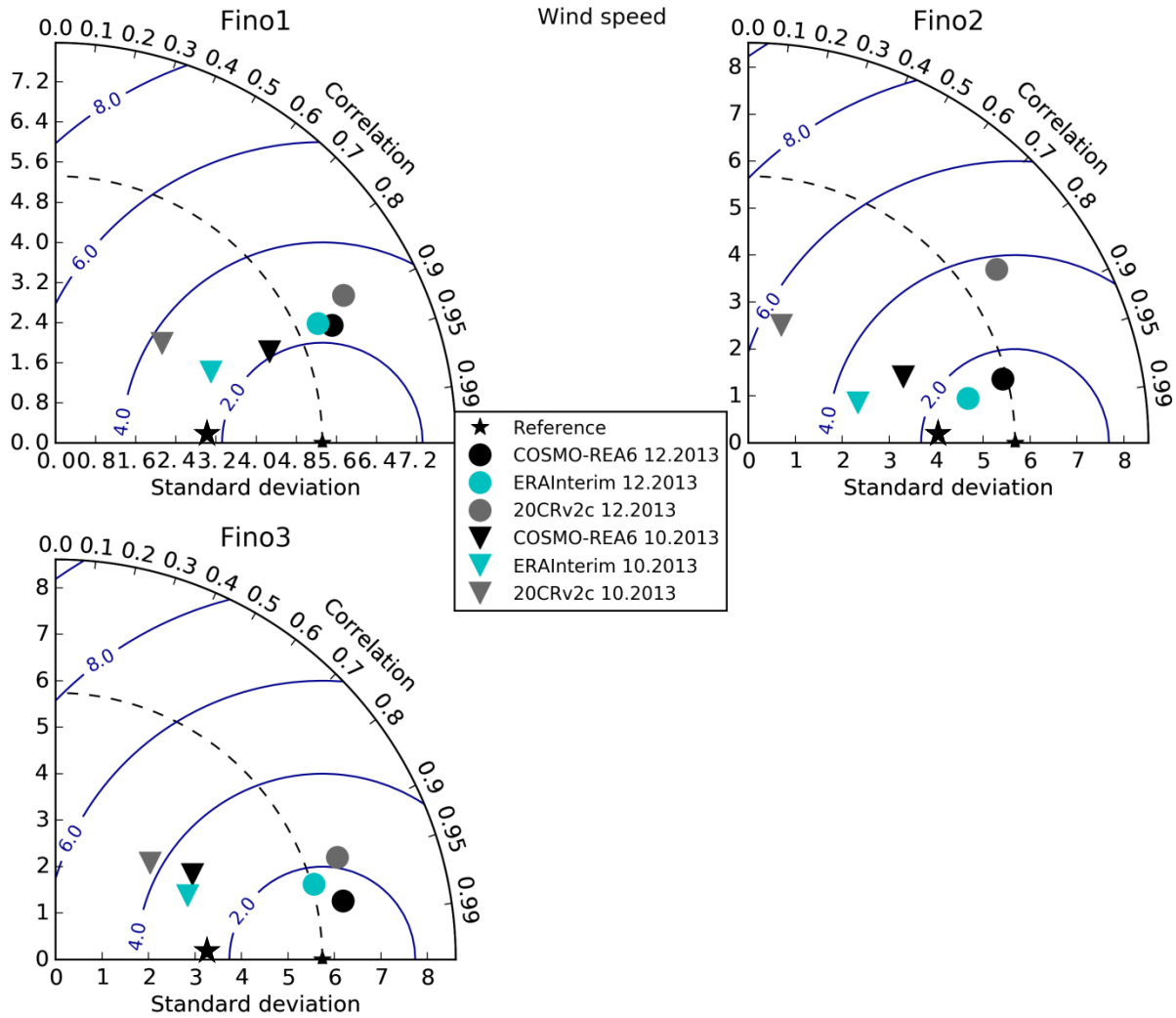




- Example of correction at FINO1 during Xaver

Statistics

➔ Wind speed

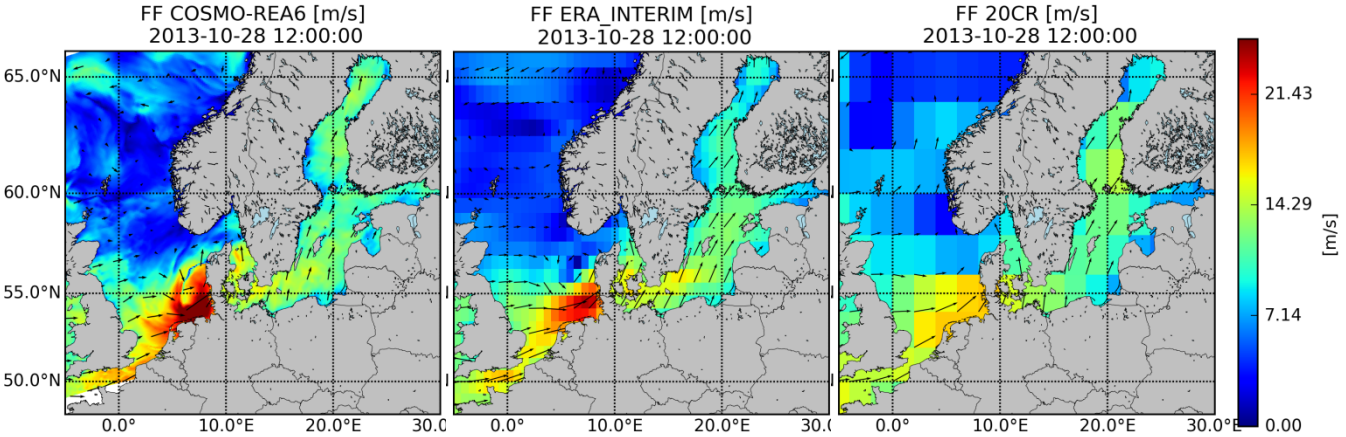


Spatial distribution

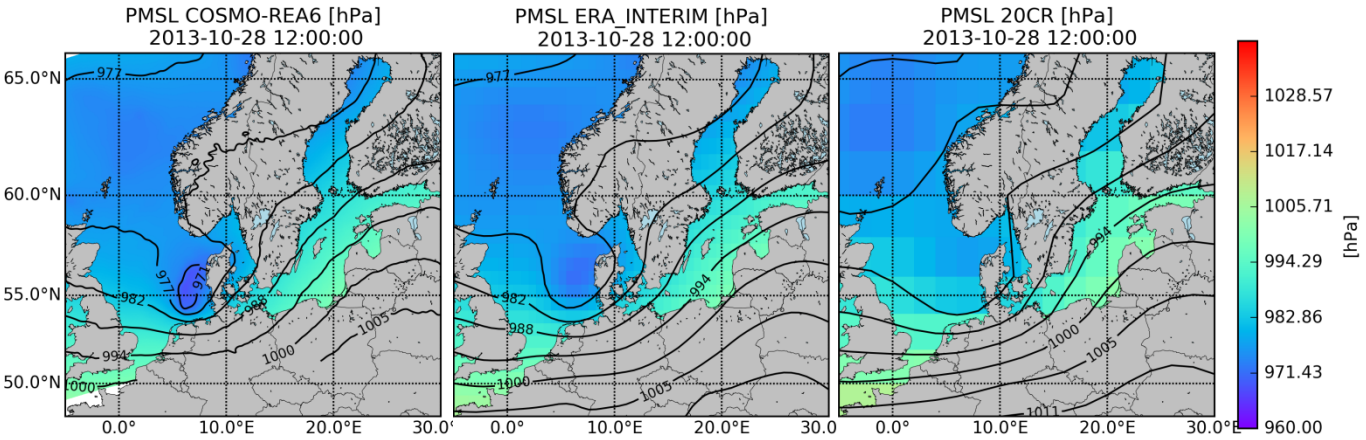
➔ *Oct. 2013*

COSMO-REA6 **ERAInterim** **20CRv2c**

Wind speed [FF]



Pressure at Mean Sea Level [PMSL]

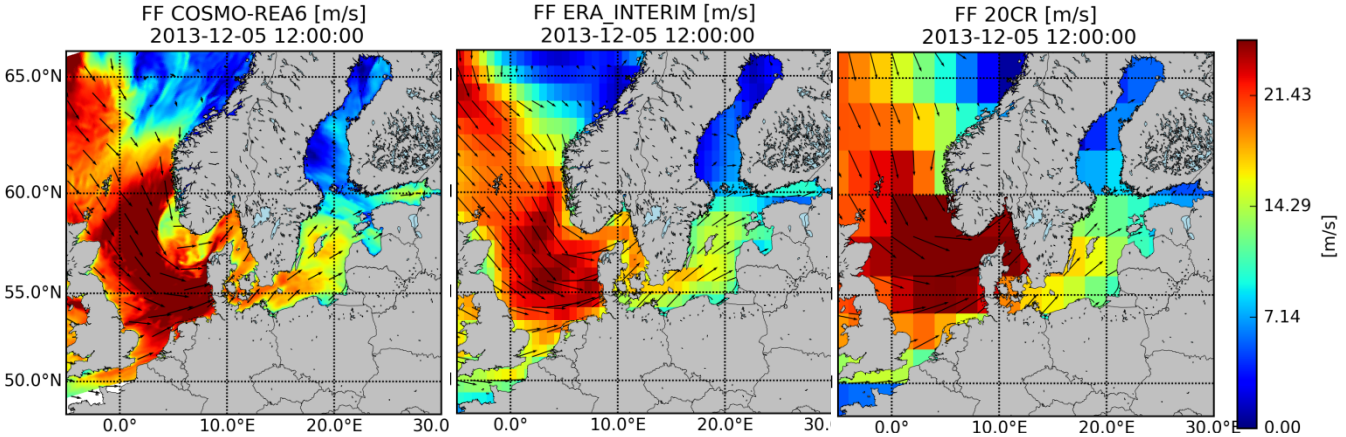


Spatial distribution

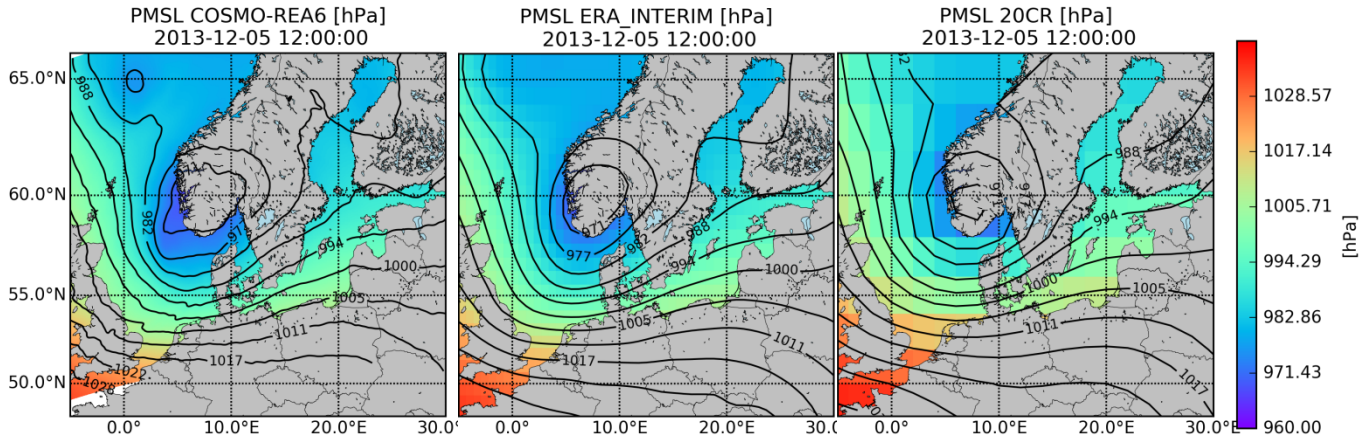
➔ *Dec. 2013*

COSMO-REA6 **ERAInterim** **20CRv2c**

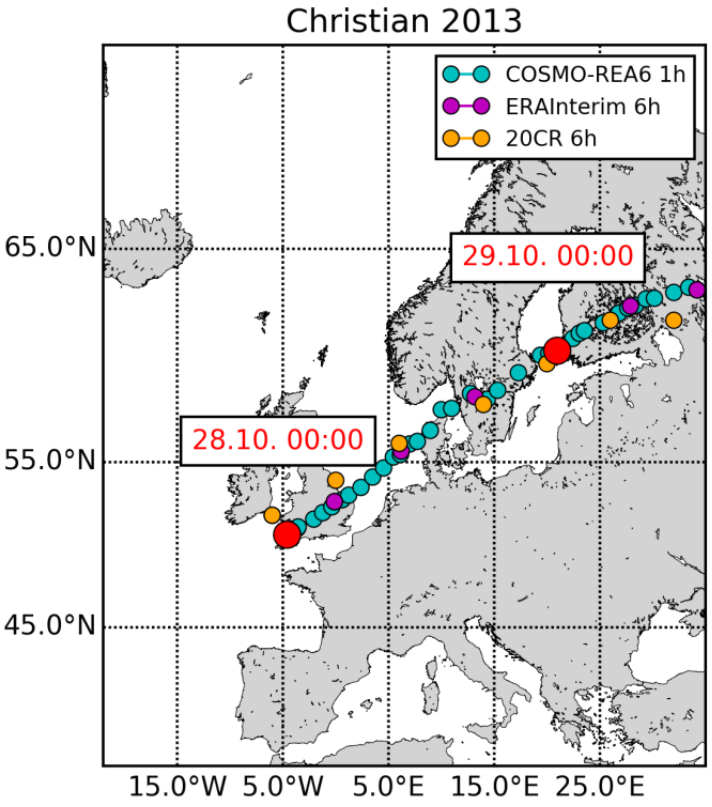
Wind speed [FF]

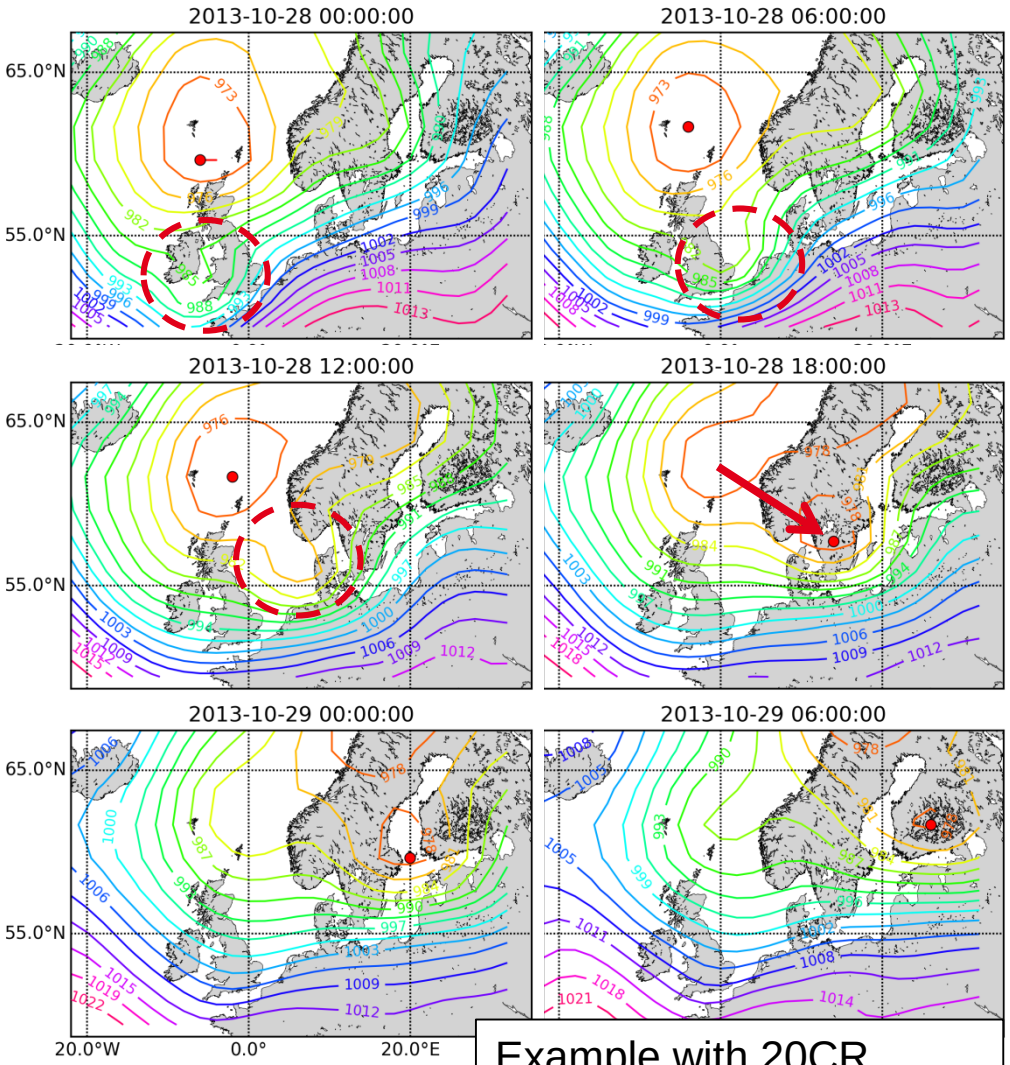


Pressure at Mean Sea Level [PMSL]



Storm tracks

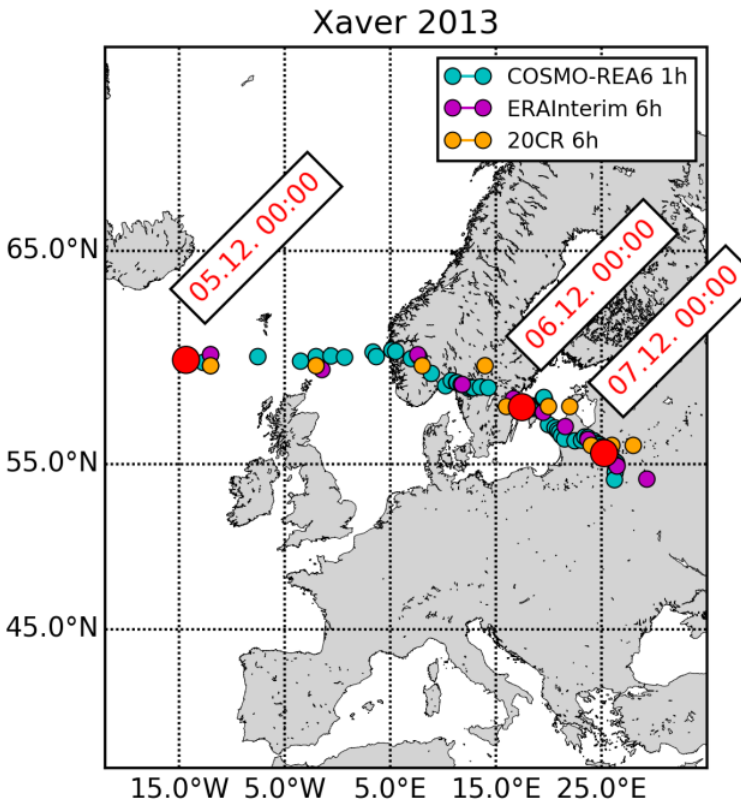


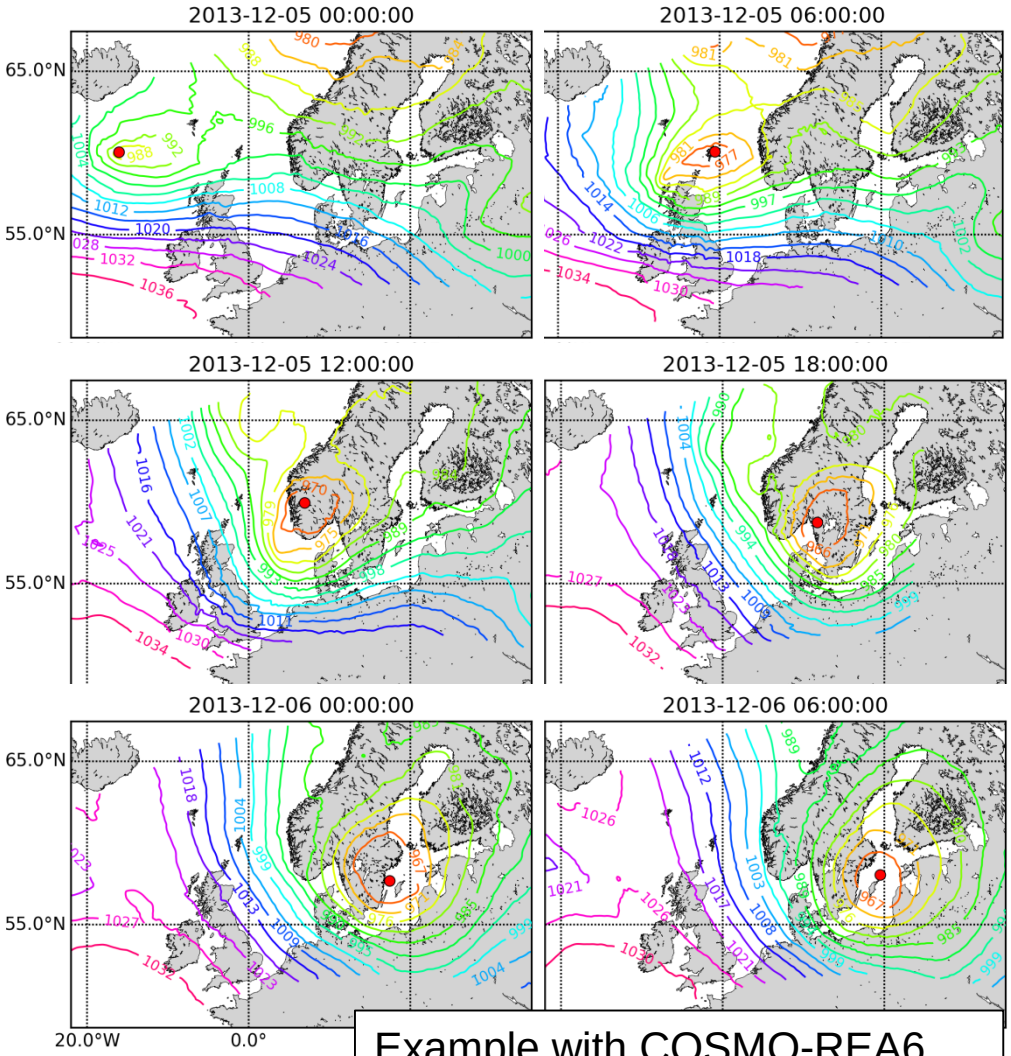


Example with 20CR

- **Secondary low**

Storm tracks





Example with COSMO-REA6

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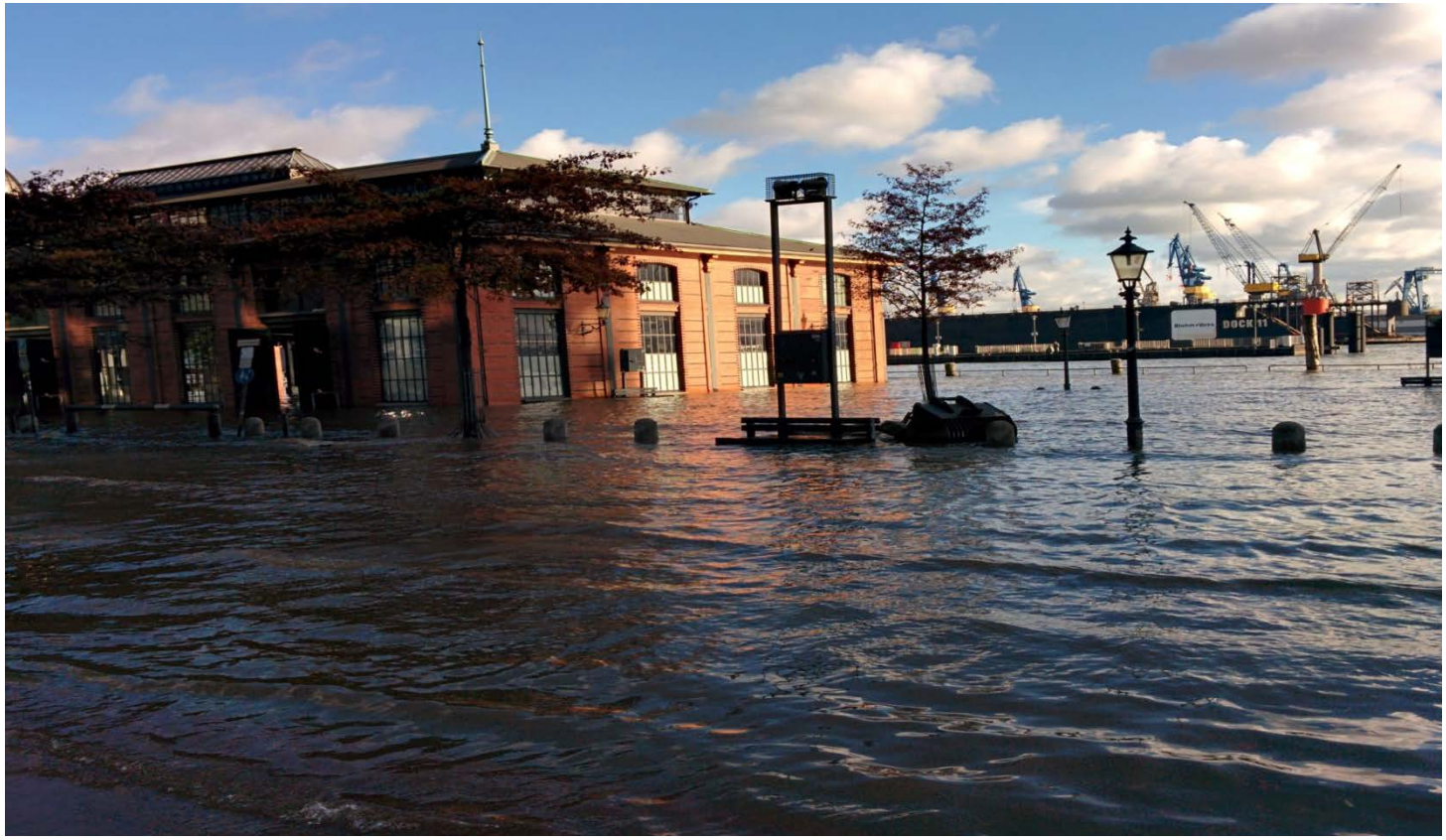
Conclusions

- Global atmospheric reanalyses are suitable to describe the main characteristics of storms in the North Sea and the Baltic
- Emphasis was given to 2 recent storms to which wind information is available at locations with the best data coverage
- Global reanalyses => only long lasting storms (often leading to storm surges along the coasts)
- Regional reanalyses => short and long lasting storms
- Similar results were found for additional analysed storms (i.e 2006, 2007)
- Importance of atmospheric observations over sea for calibration/validation of the numerical modesl (i.e reanalyses)
- Overall, the mast correction of the measurements at the FINO research platforms performs well

Thank you for your attention



Literature

Bollmeyer, C., Keller, J. D., Ohlwein, C., Wahl, S., Crewell, S., Friederichs, P., . . . Steinke, S. (2015). Towards a high-resolution regional reanalysis for the European CORDEX domain. *Quaterly Journal of the Royal Meteorological Society, 141*, 1-15. doi:https://doi.org/10.1002/qj.2486

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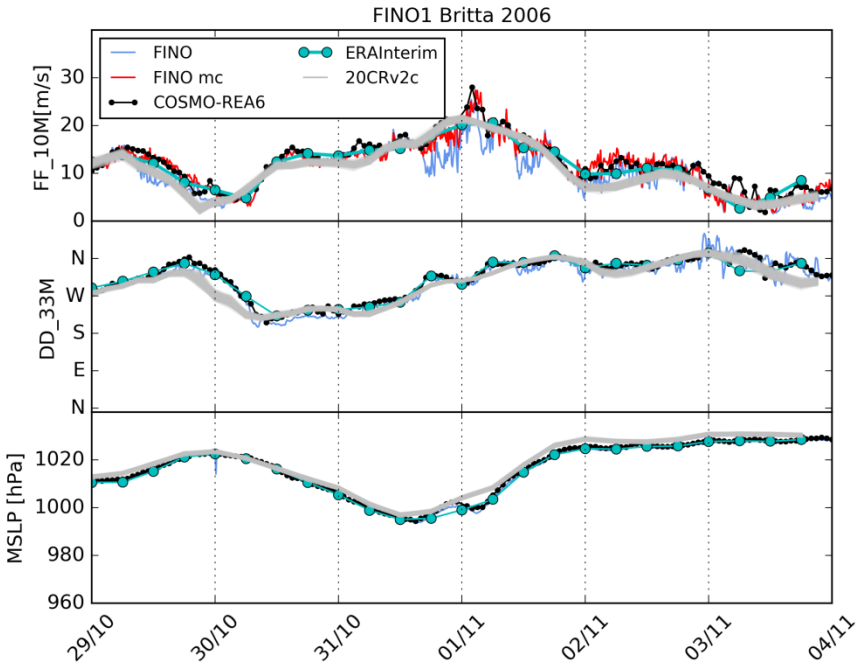
Compo, G. P., et al. (2011). "The twentieth Century Reanalysis Project." Quaterly Journal of the Royal Meteorological Society **137**: 1-28.

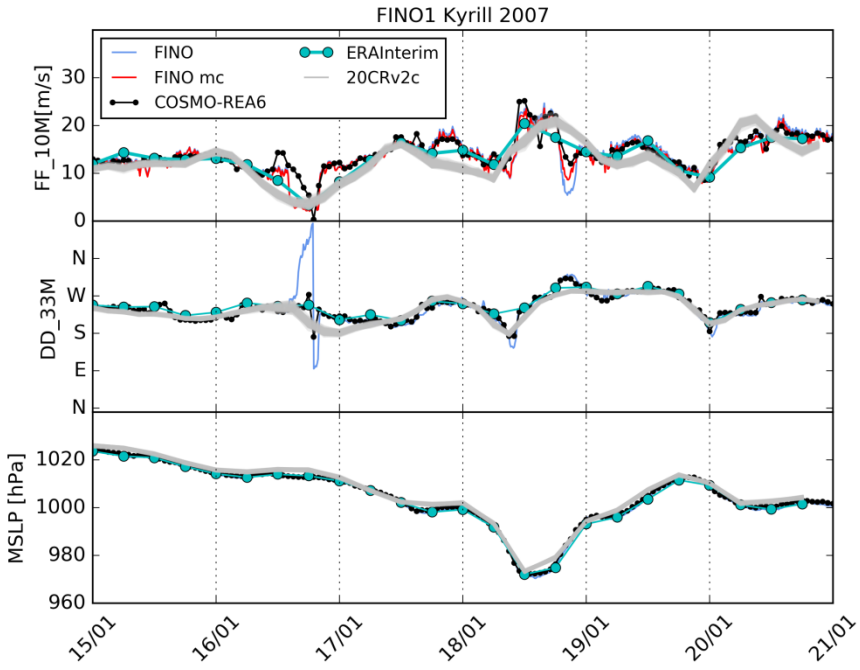
Dee, D. P., et al. (2011). "The ERA-Interim reanalysis: configuration and performance of the data assimilation system." Quaterly Journal of the Royal Meteorological Society **137**.

Leiding, T., et al. (2014). "Meteorological and oceanographic conditions at the FINO platforms during the severe storms Christian and Xaver." DEWI-Magazin **44**: 16-26.

Other storms

➔ Britta 11.2006 and Kyrill 2007 (measured by FINO1 only)





Coastal station Heligoland (North Sea)