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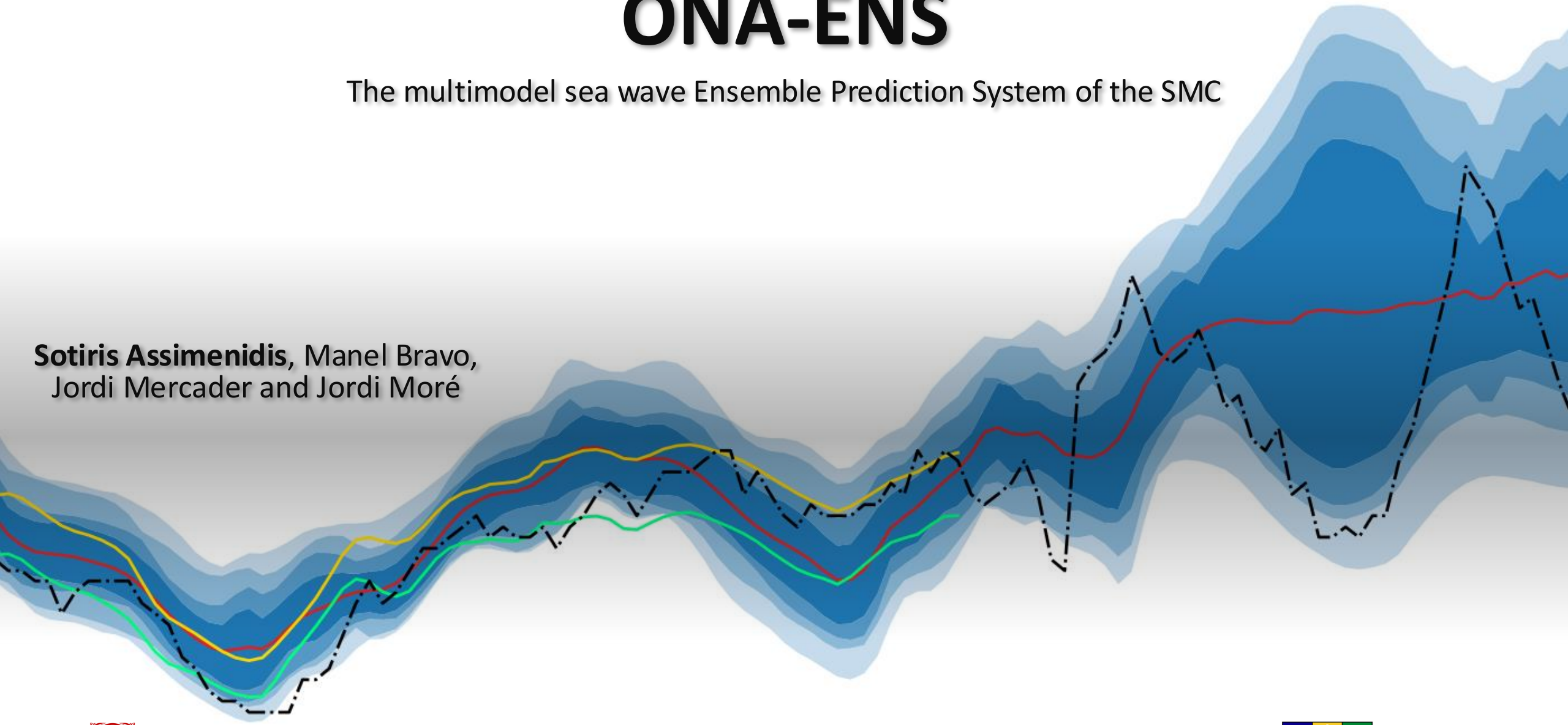
The multimodel sea wave Ensemble Prediction System of the SMC

Sotiris Assimenidis, Manel Bravo,
Jordi Mercader and Jordi Moré



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SCREEN CAPTURE WELCOME

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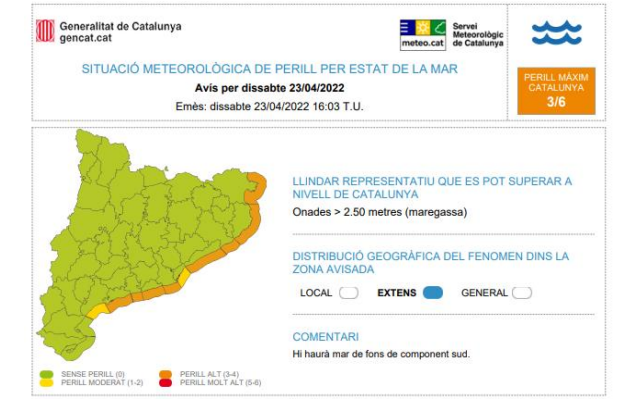
Wave prediction at SMC

Meteorological Danger Situation:

- Hs waves > 2.5 m
- Hs waves > 4 m



Civil Protection

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Operational deterministic suite

IFS (ECMWF)

9 km

Boundary conditions

WRF

3 km

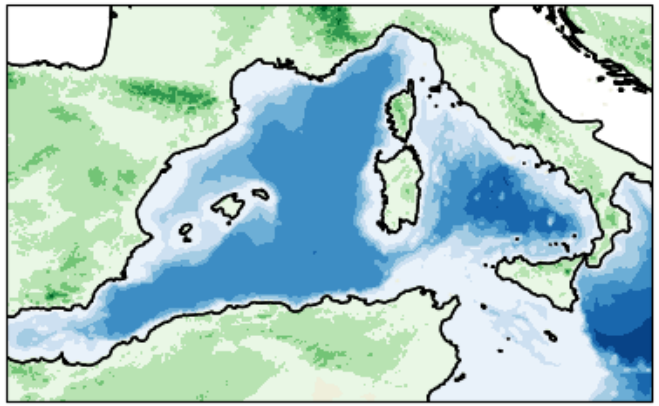
Forcing (wind)

Forcing (wind)

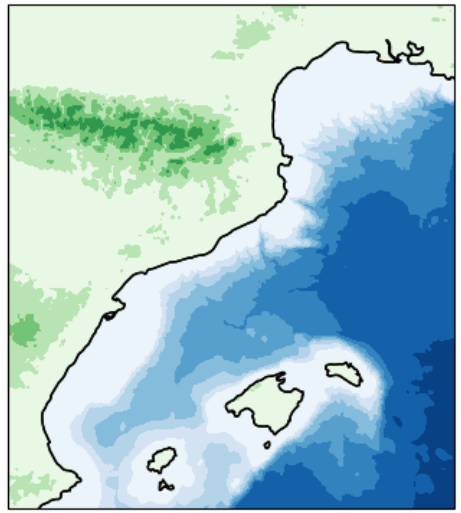
SWAN

WW3

12 km



3 km



Boundary conditions

00/12 TU

+ 72 h

Initial conditions (waves)

ECWAM (-12 h)

00/12 TU

+ 72 h

Initial conditions (waves)

Previous run (-12 h)

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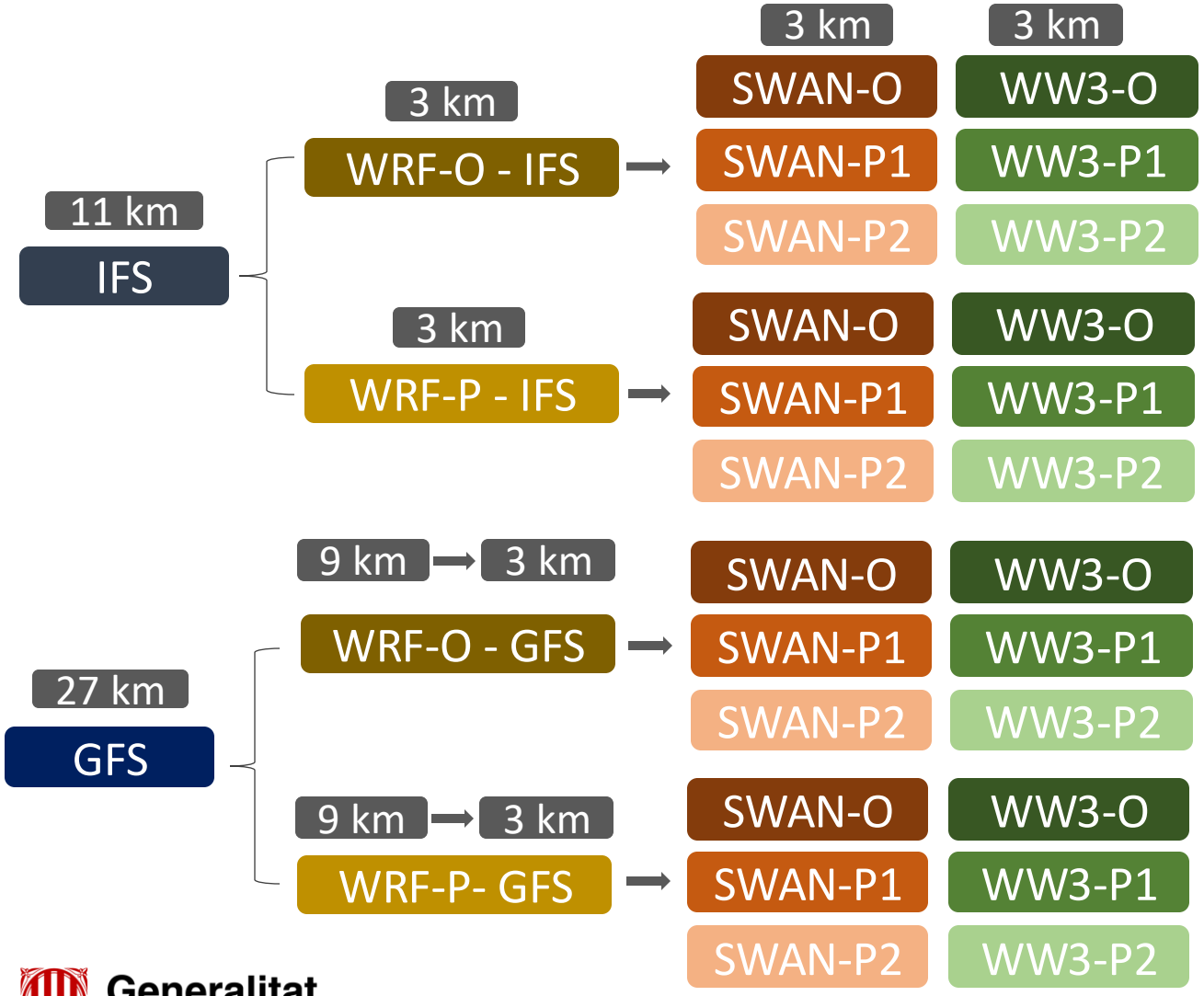
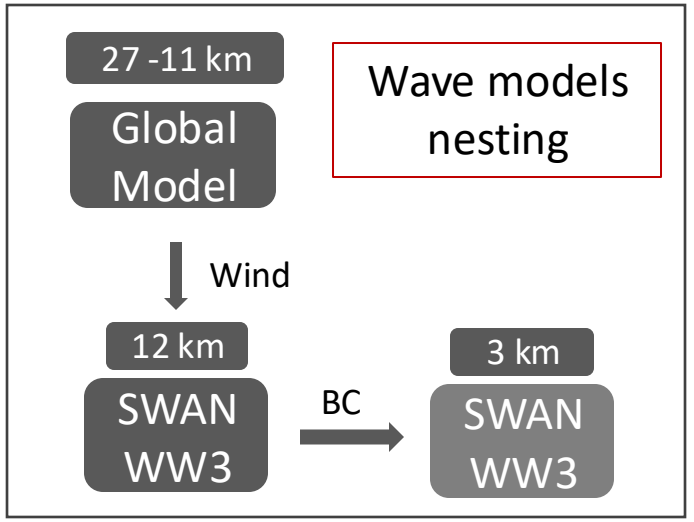
ONA-ENS scheme



Multimodel & multiphysics ensemble prediction system

24 wave members

+ 120 h



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O: Operational
Px: Perturbed (x)

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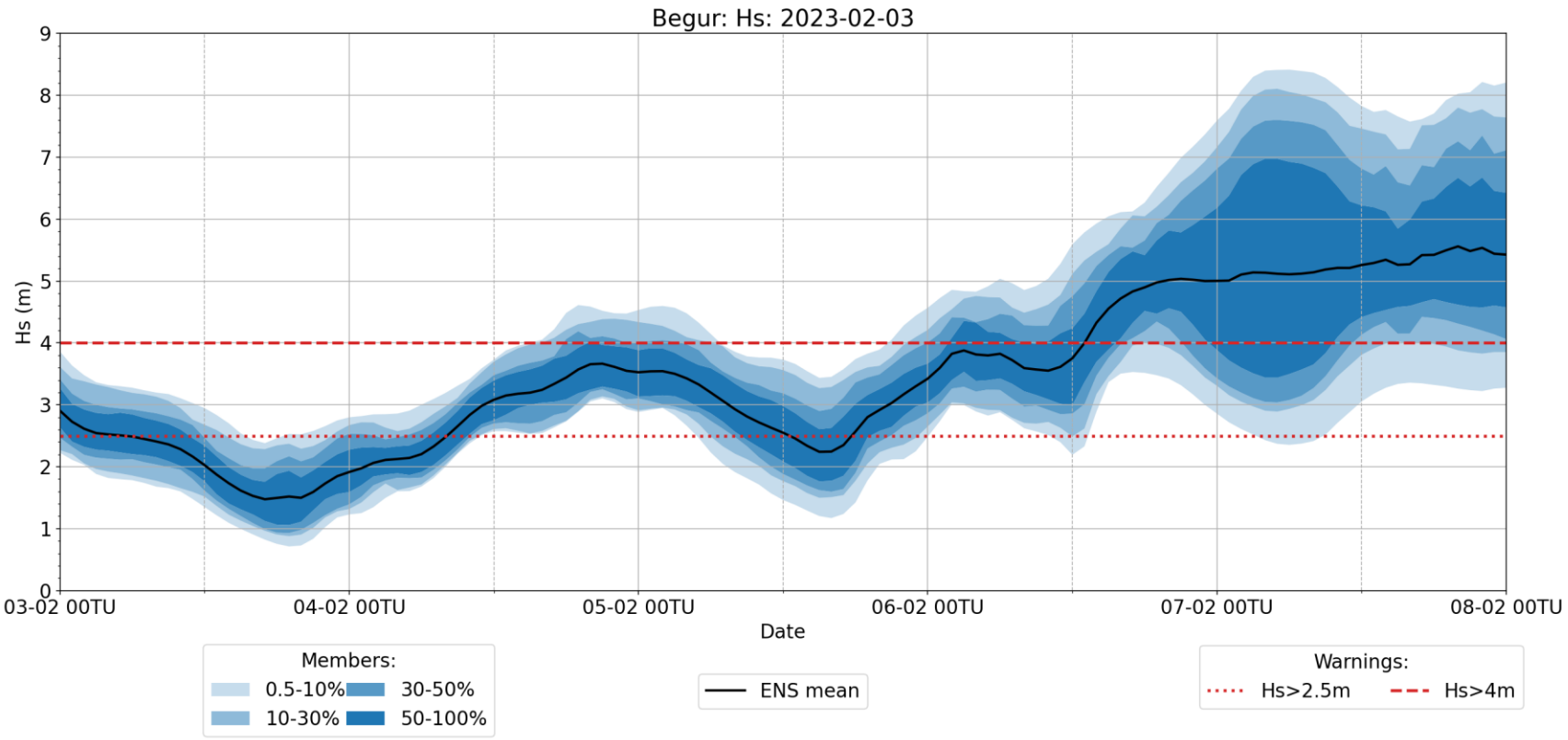
Configuration

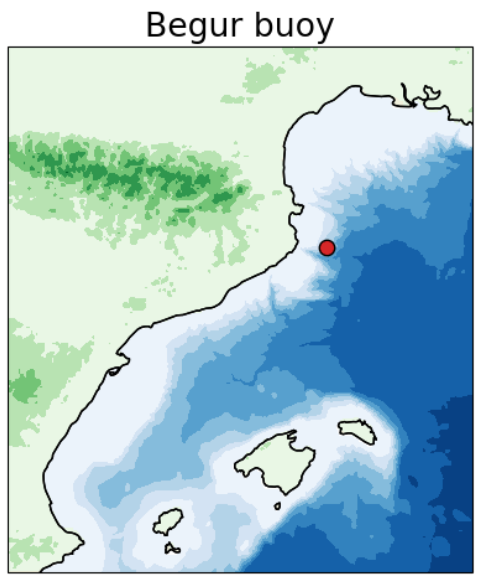
Atmospheric model	WRF operational	WRF - P
Vertical levels	31	33
Surface layer	Revised MM5	MM5 similarity
PBL	YSU	EEPS

Wave model	SWAN operational	SWAN P1	SWAN P2
Input term	Komen	Komen	Komen
Whitecapping	Janssen (C_d = 1)	Janssen (C_d = 0.5)	Komen

Wave model	WW3 operational	WW3 P1	WW3 P2
Source term	ST4 (β = 1.55)	ST4 (β = 2.1)	ST6

Case study





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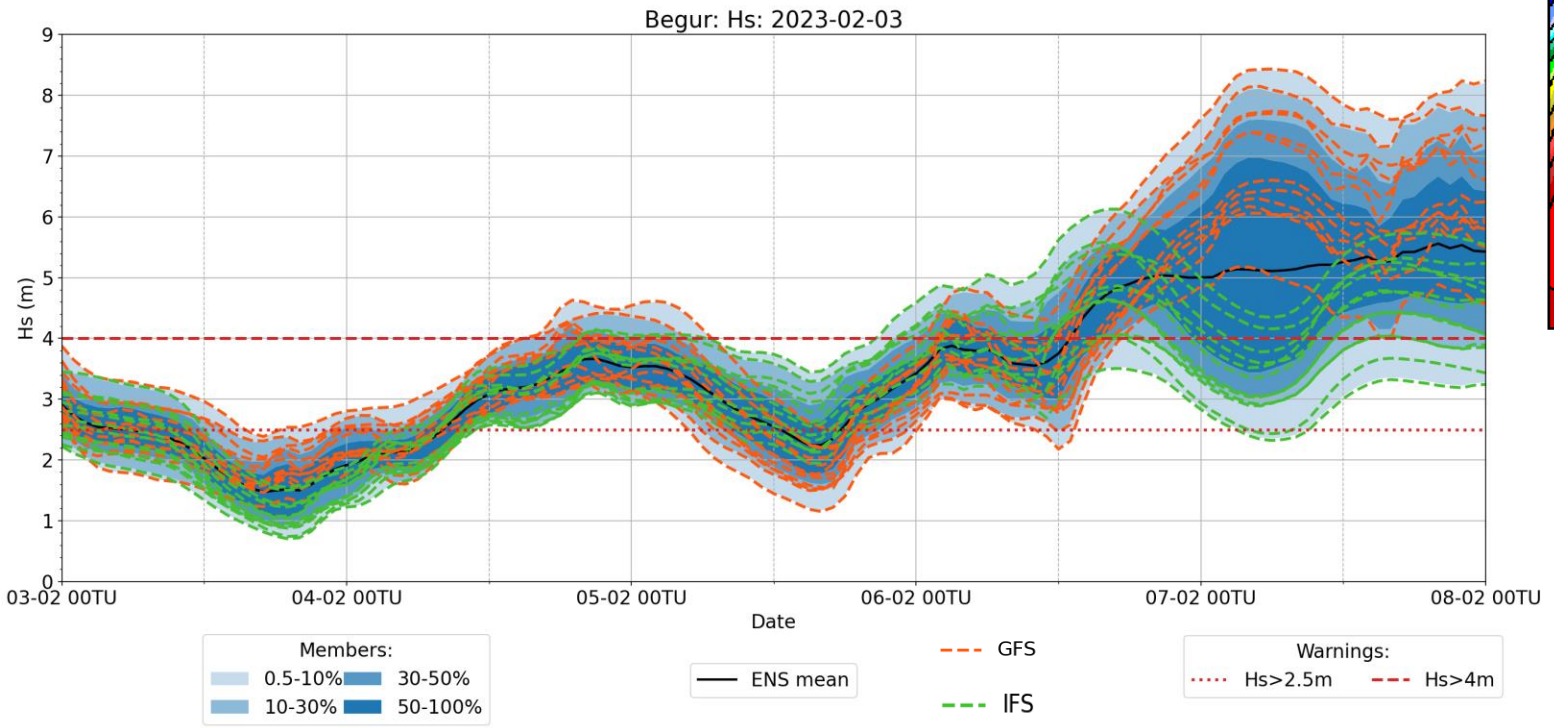
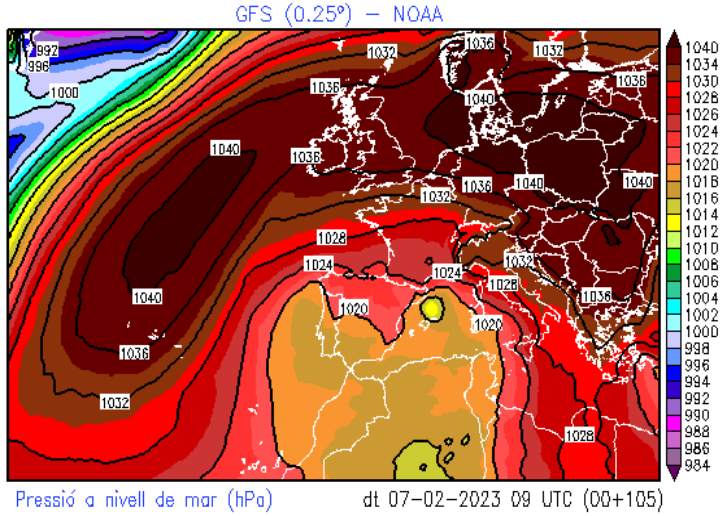
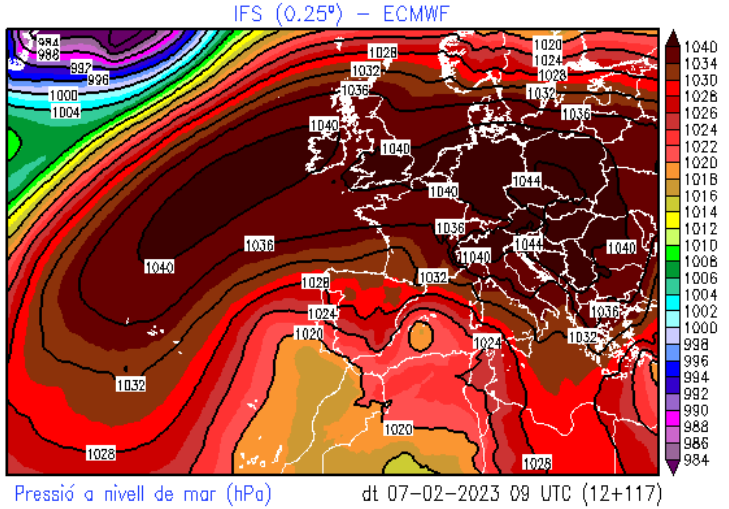
Case study







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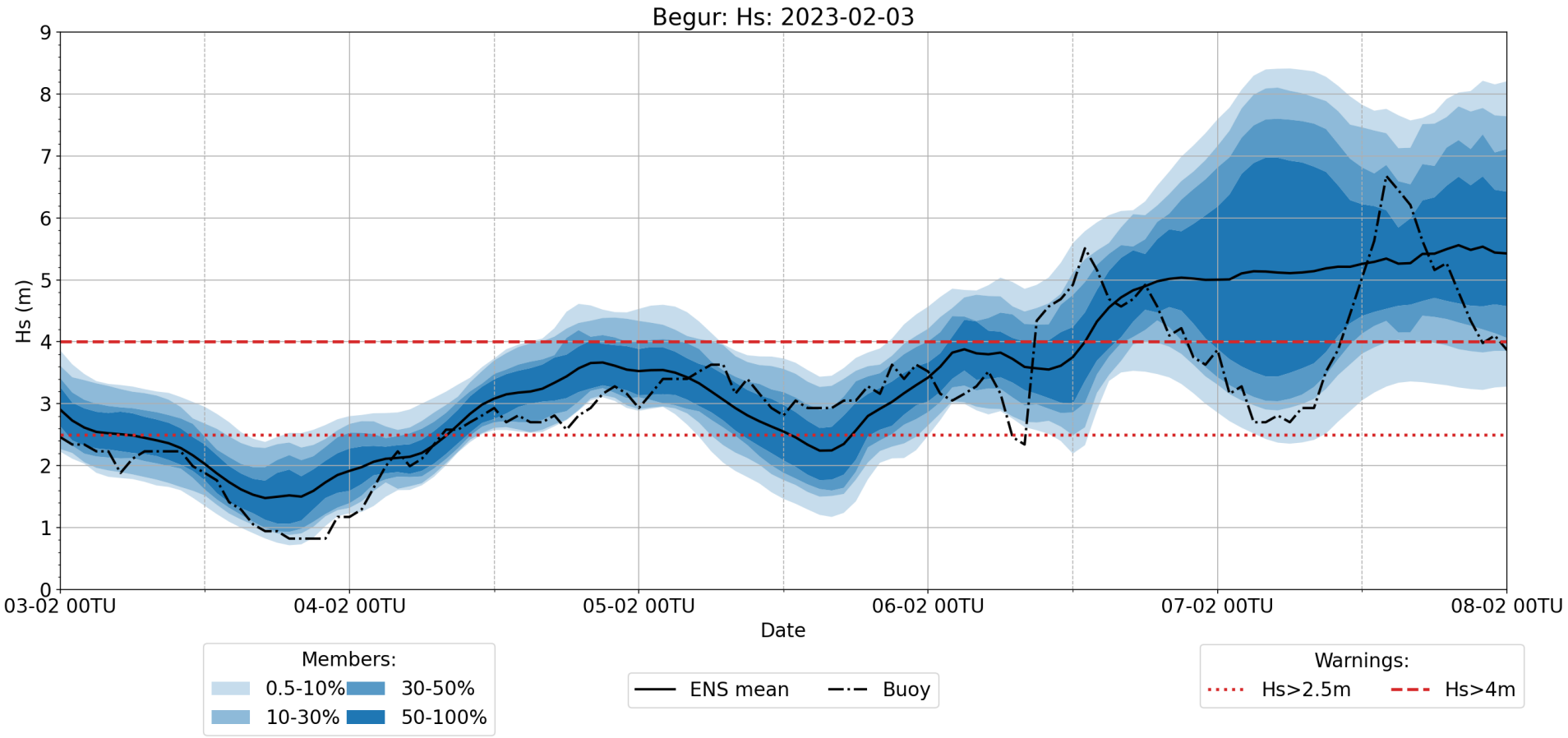
Case study



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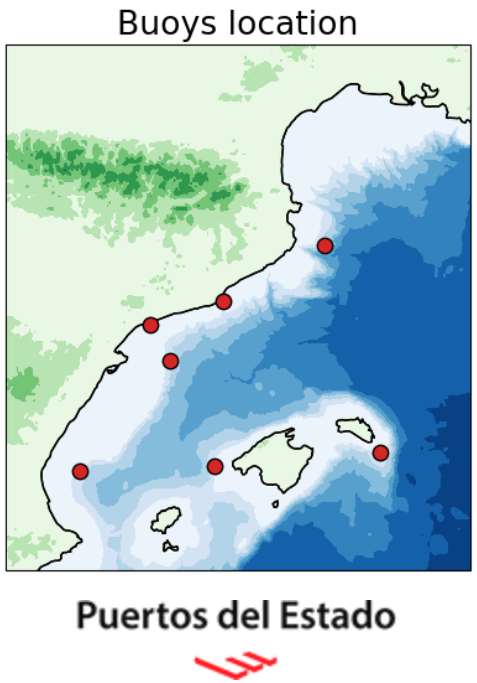
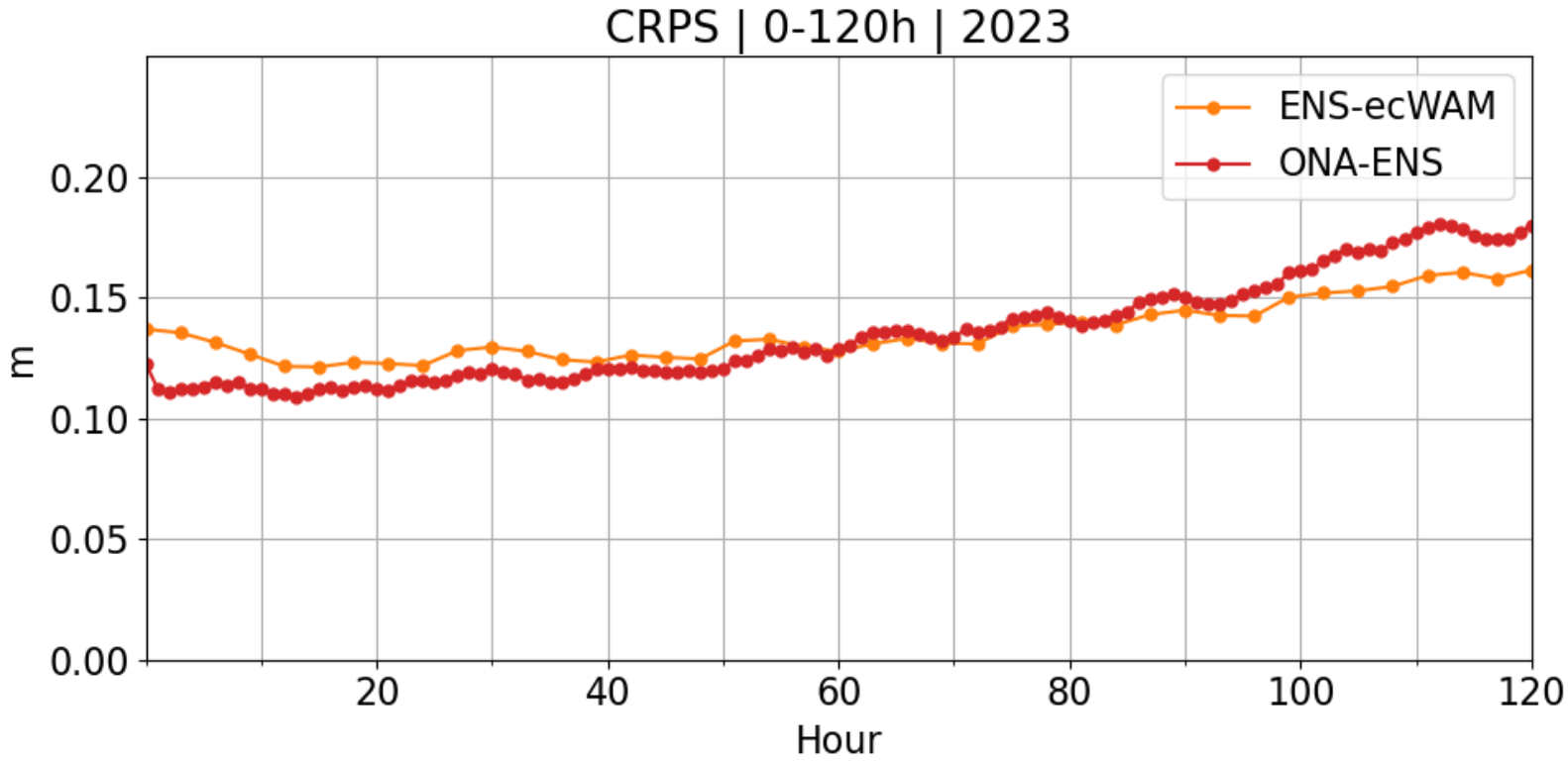
Verification





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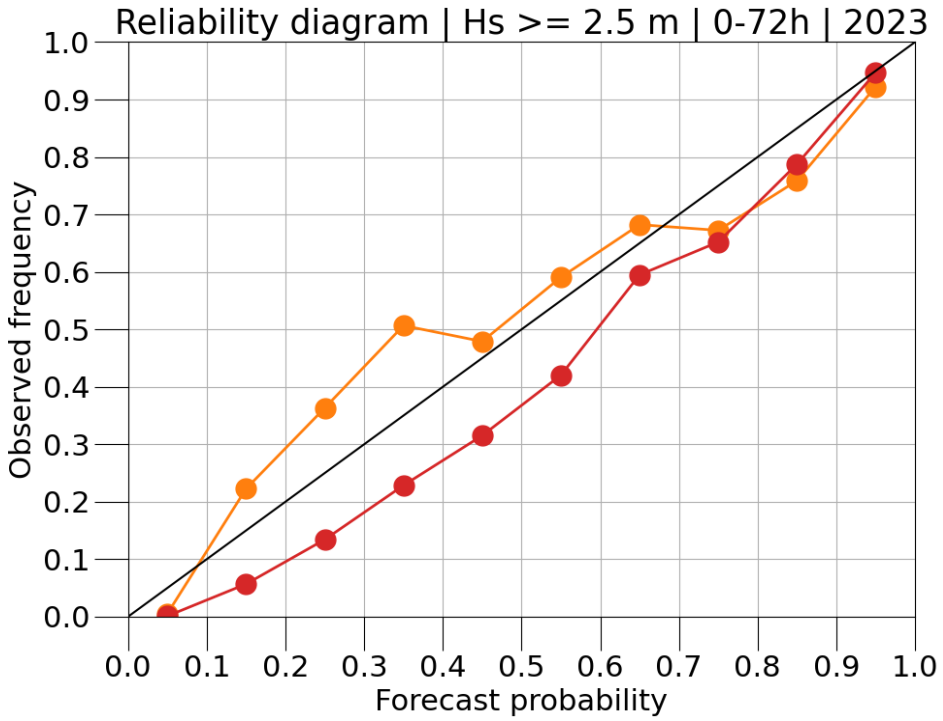

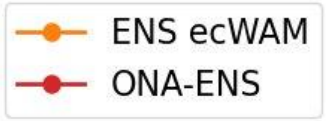

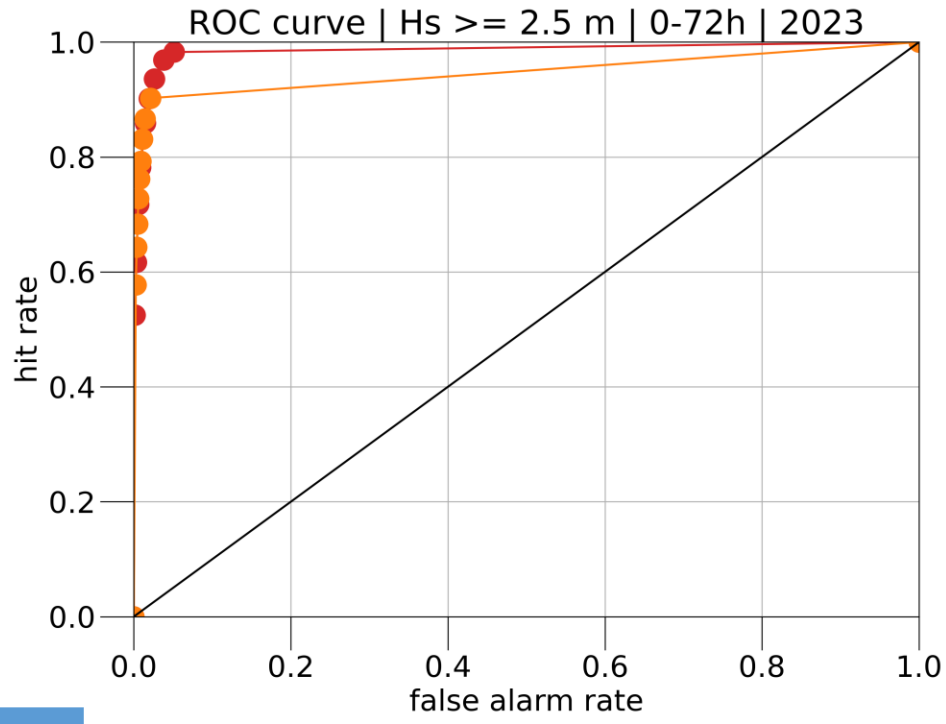

	ONA-ENS	ENS ecWAM
BRIER	0.017	0.017
RESOLUTION	**0.036**	0.034
RELIABILITY	0.003	**0.002**
UNCERTAINTY	0.050	0.049
AUC	**0.985**	0.947

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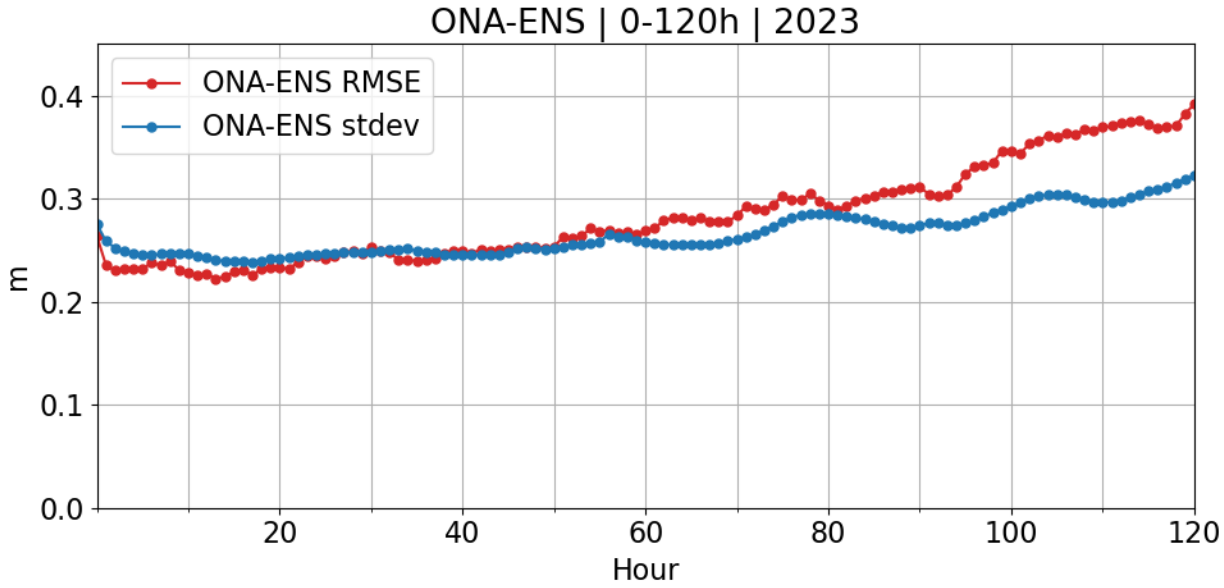

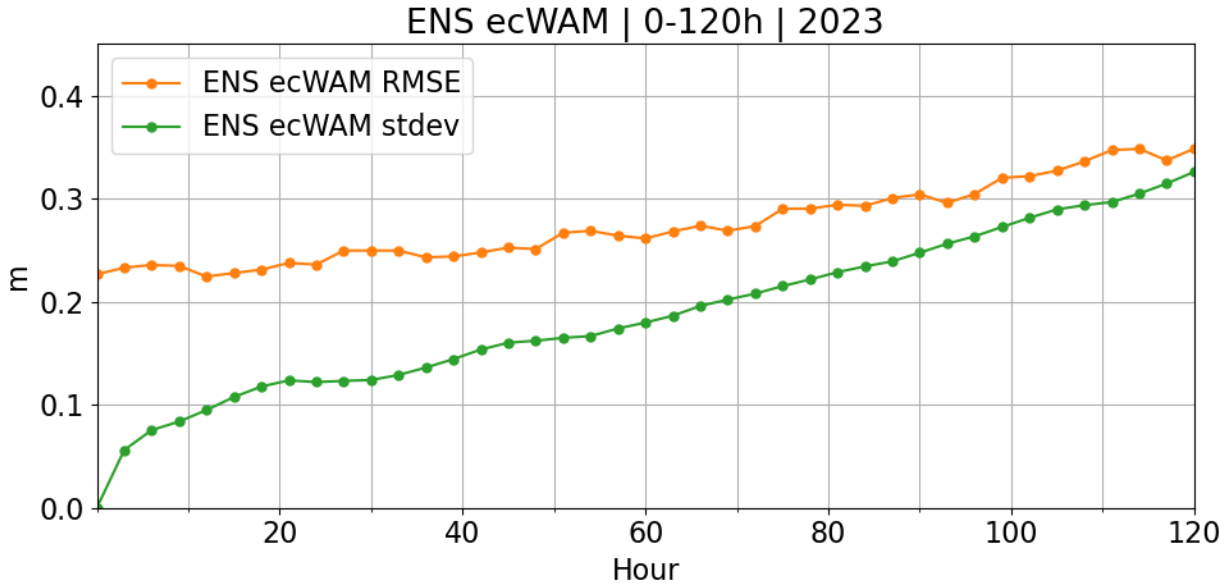

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Conclusions

- Using different global models for initialising the atmospheric component allows us to see different synoptical patterns and provides more dispersion.
- ONA-ENS has a good ability to predict the Meteorological Danger Situations.
- For the first hours of the forecast, it is more reliable than the ensemble from ECMWF, which is under dispersive during the compared period.

Overall, it shows good results and serves as a solid starting point for addressing probabilistic wave prediction in the SMC.

Thank you

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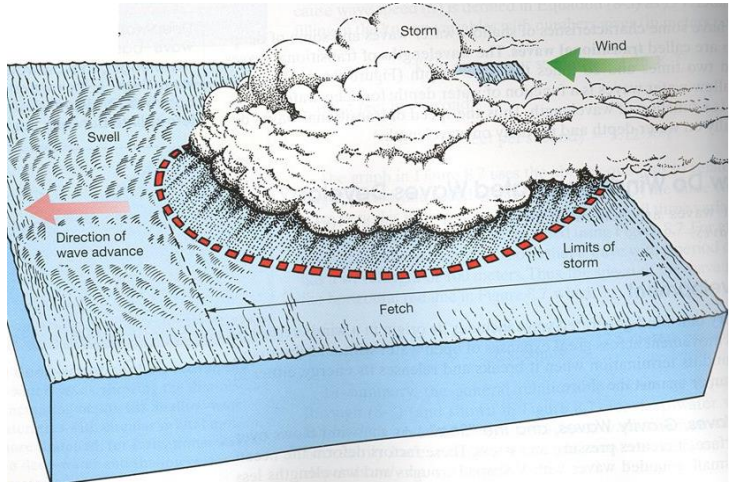
Ocean wave model

Spectral action balance equation

Generation and dissipation

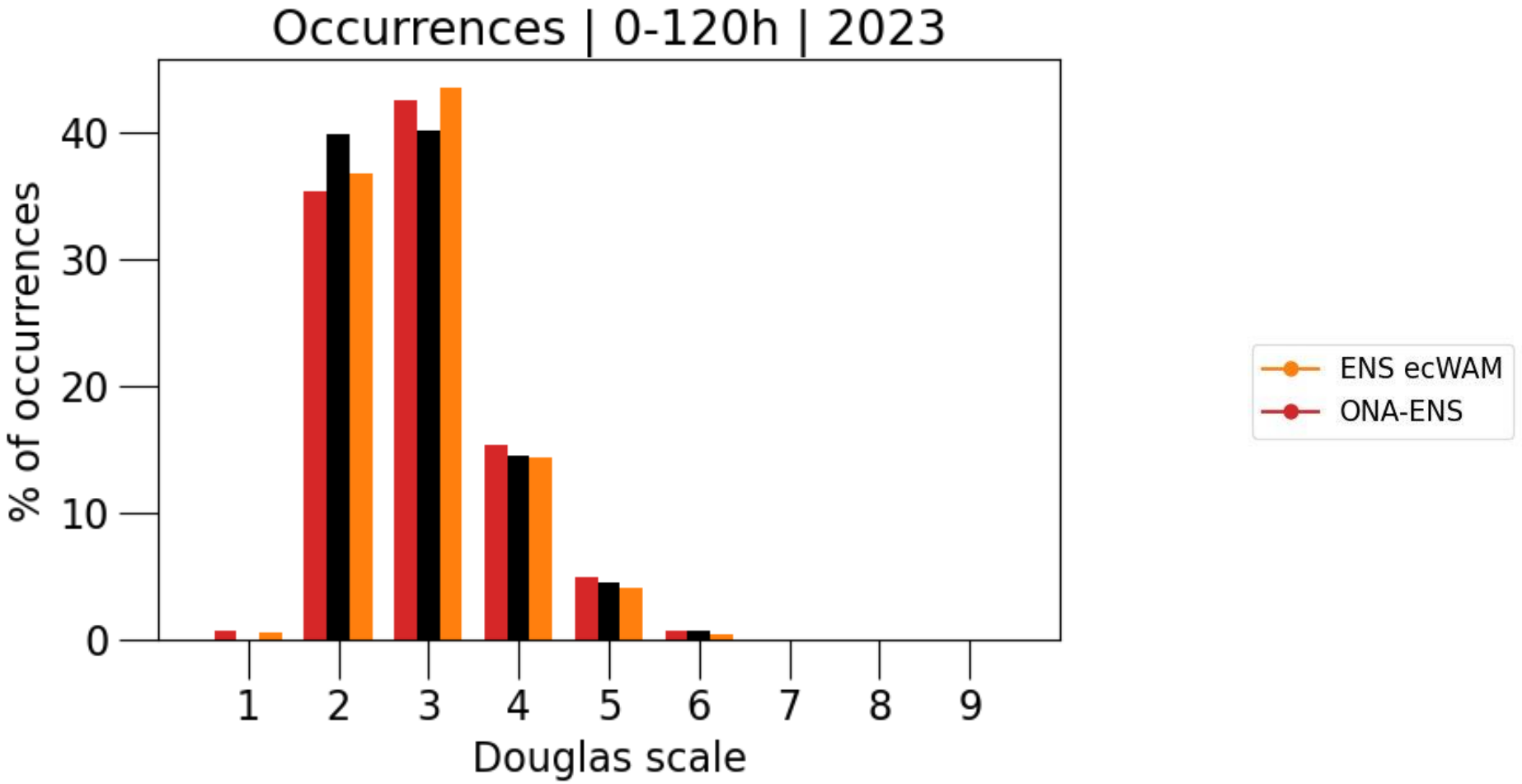
$$\frac{\partial N}{\partial t} + \frac{\partial c_x N}{\partial x} + \frac{\partial c_y N}{\partial y} + \frac{\partial c_\sigma N}{\partial \sigma} + \frac{\partial c_\theta N}{\partial \theta} = \frac{S_{tot}}{\sigma}$$



$$S_{tot} = S_{in} + S_{nl3} + S_{nl4} + S_{ds,w} + S_{ds,b} + S_{ds,br}$$

- S_{in}: Wind input
- S_{nl3}: Nonlinear transfer
- S_{nl4}: Whitecapping
- $S_{ds,w}$: Bottom friction
- $S_{ds,b}$: Depth-induced wave breaking
- $S_{ds,br}$

Occurrences



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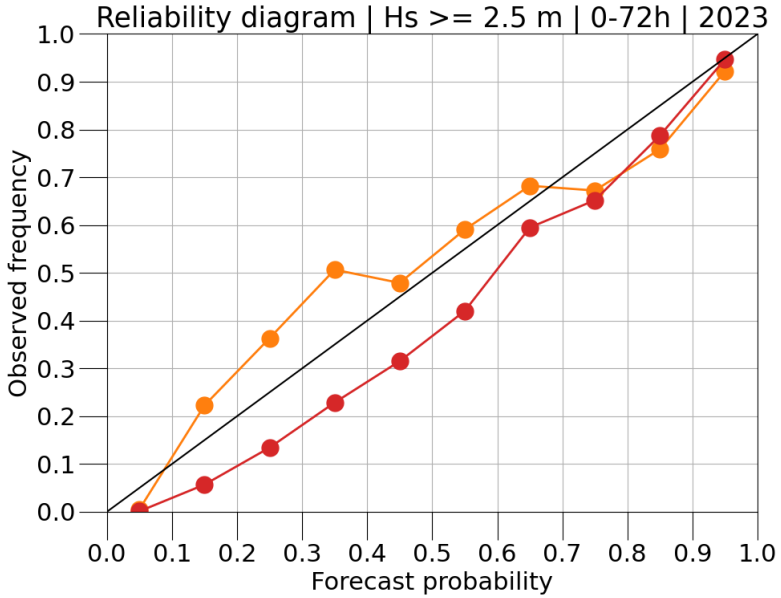

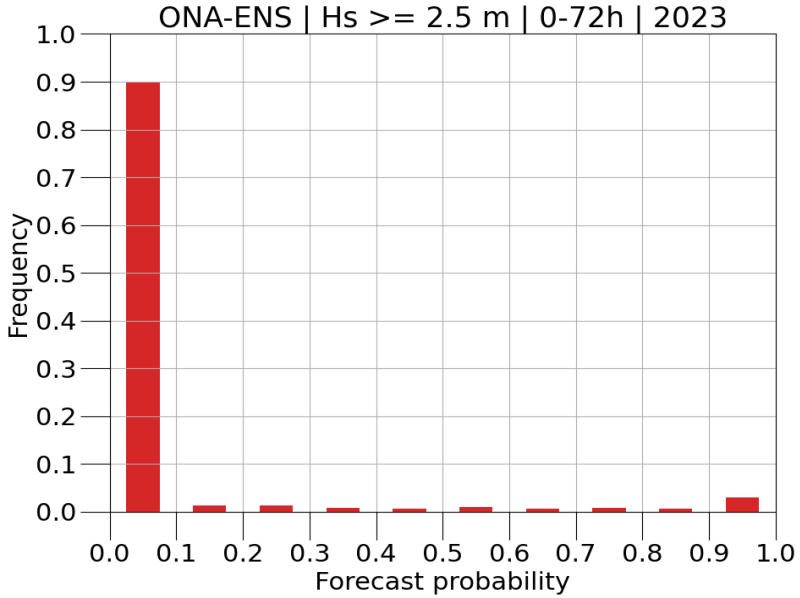

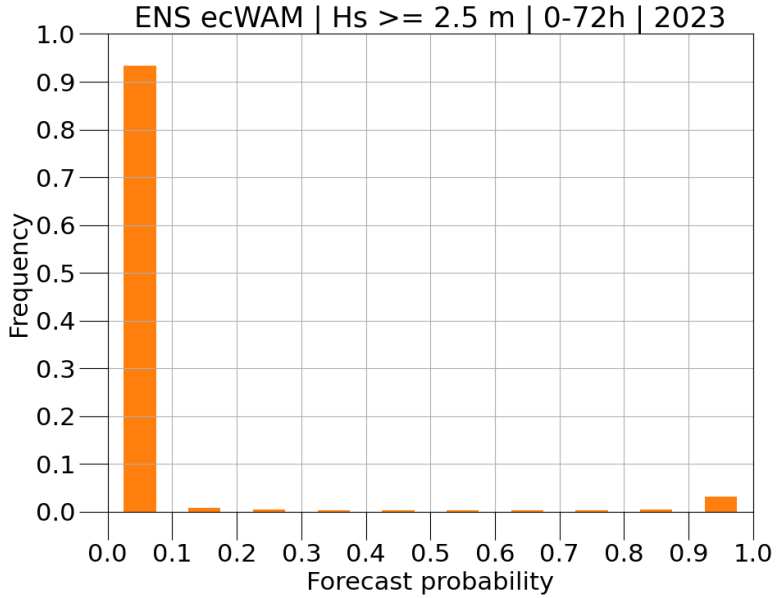

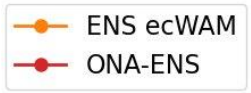

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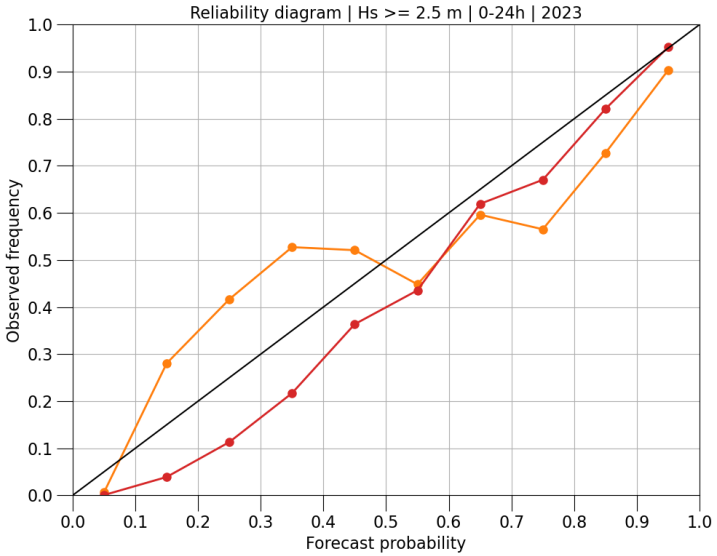
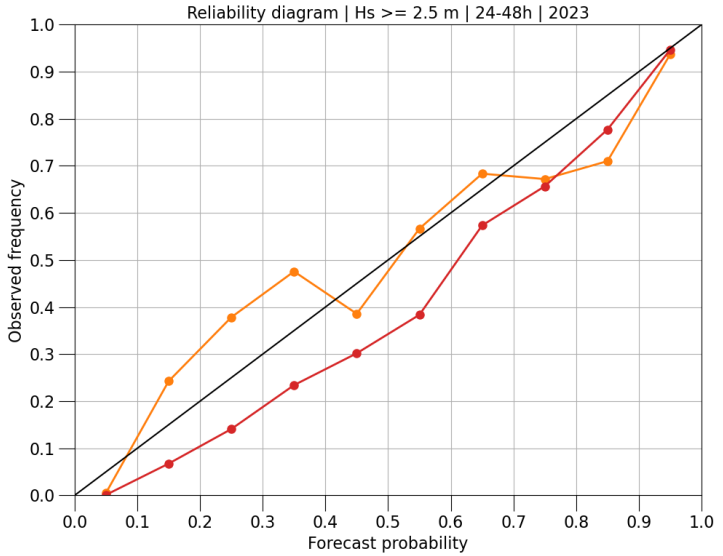
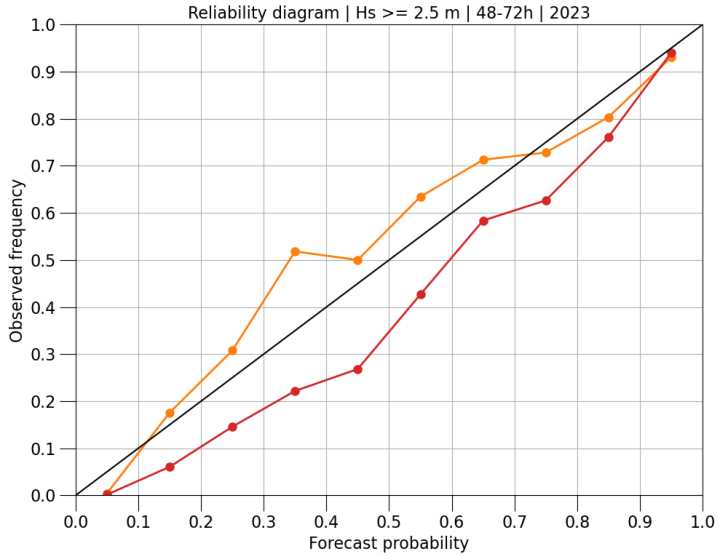
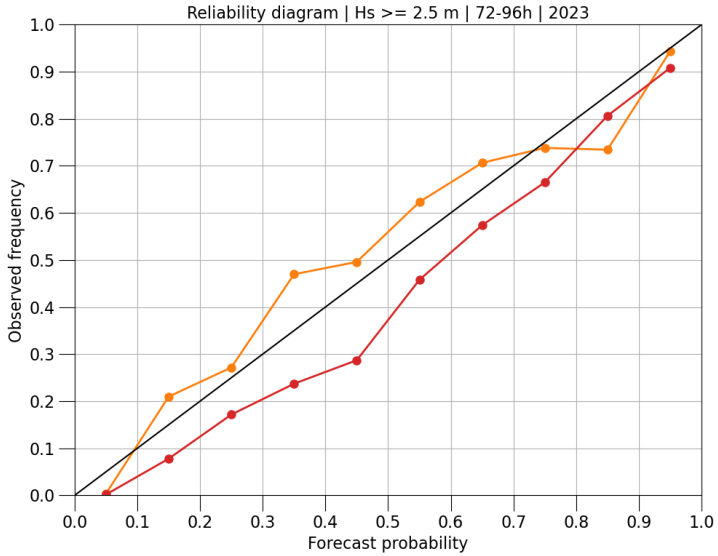
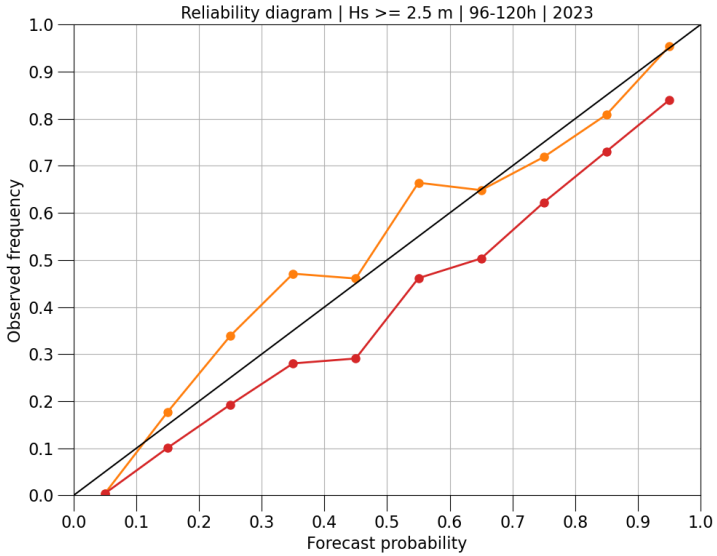
Reliability diagram Hs > 2.5 m











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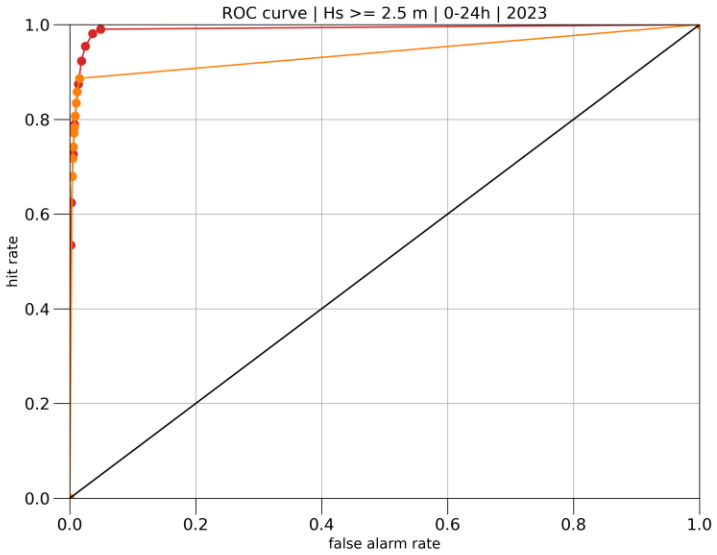
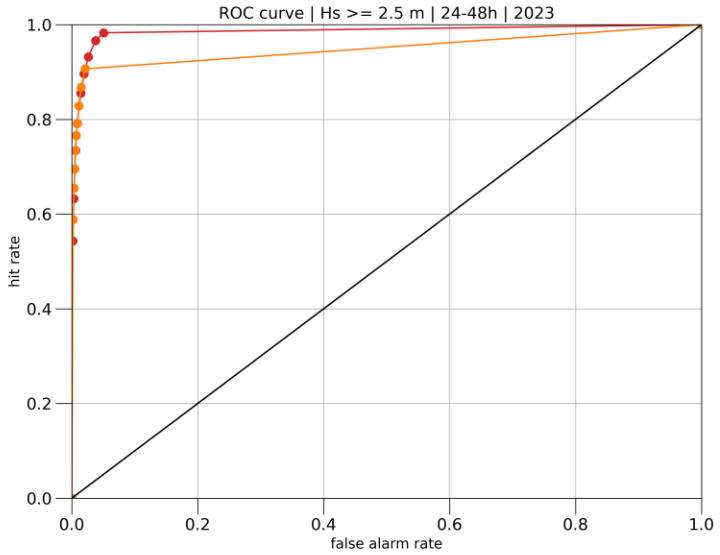
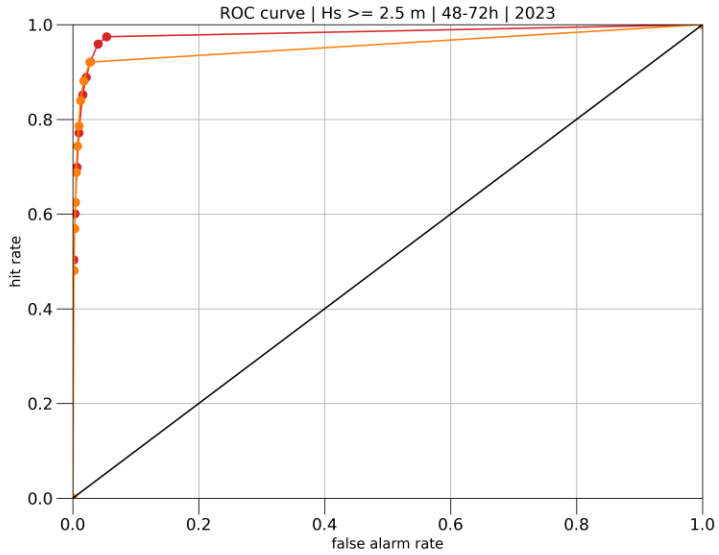
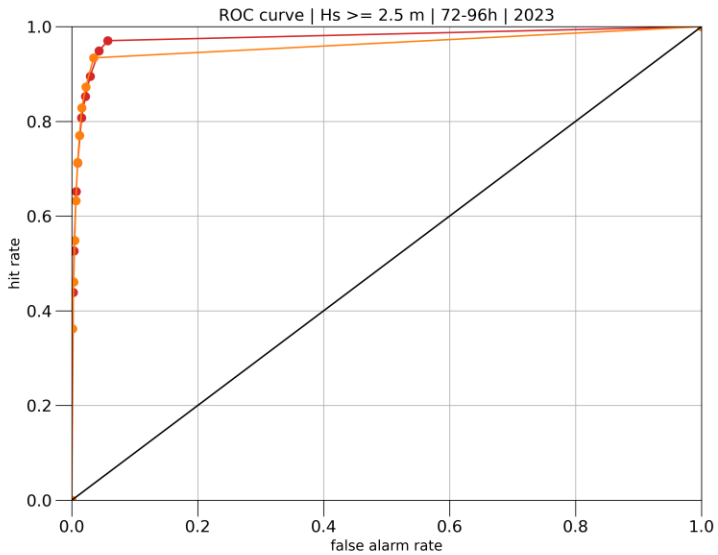
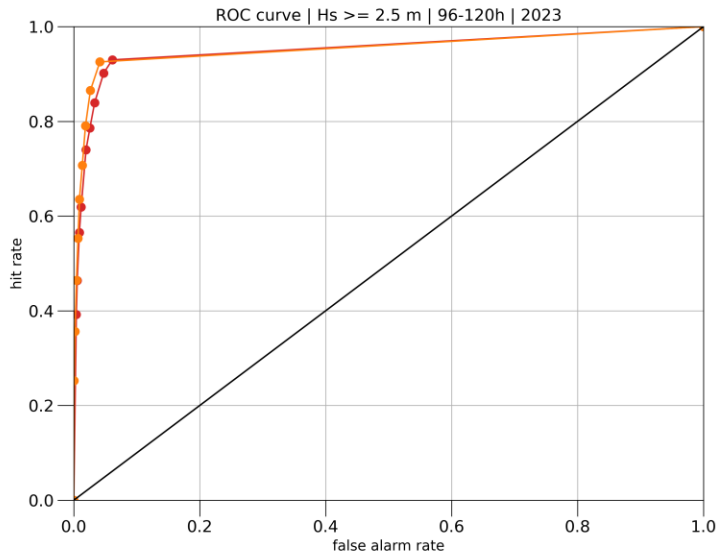
ROC curve Hs > 2.5 m

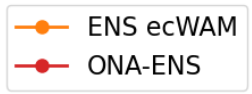












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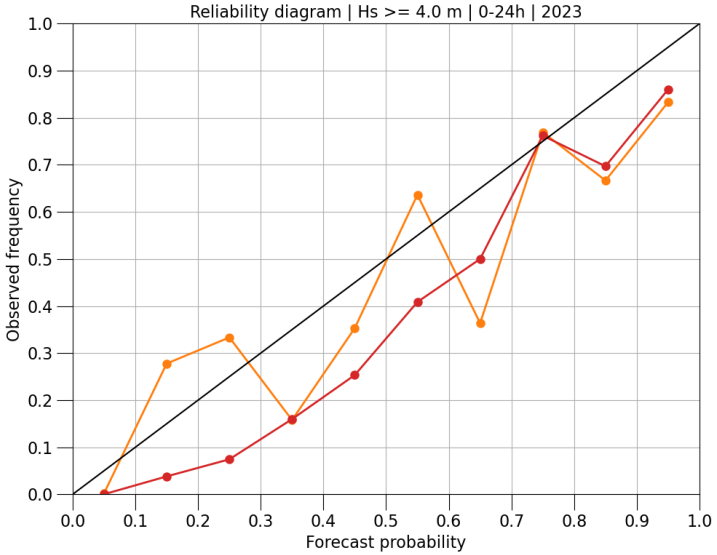
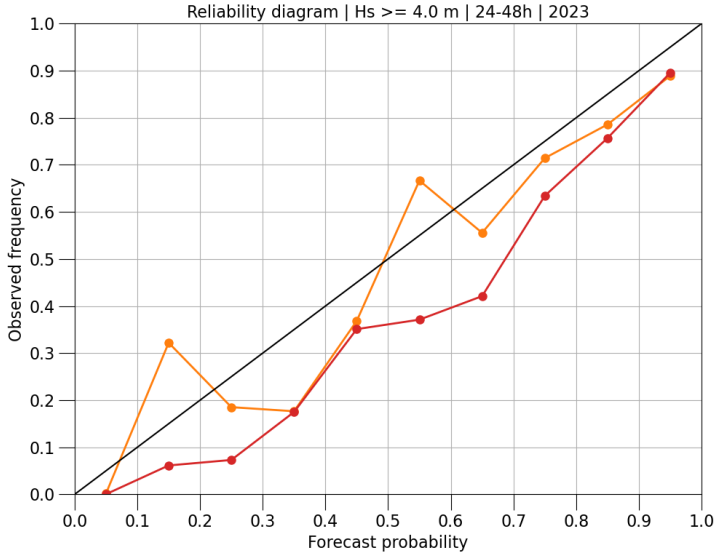
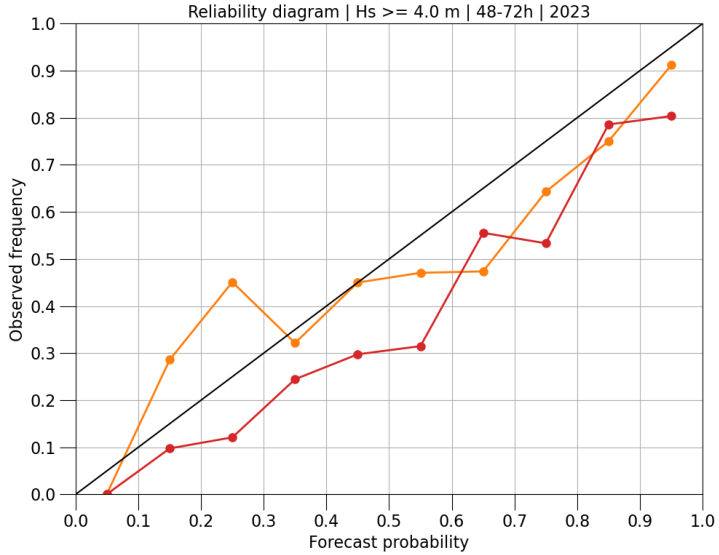
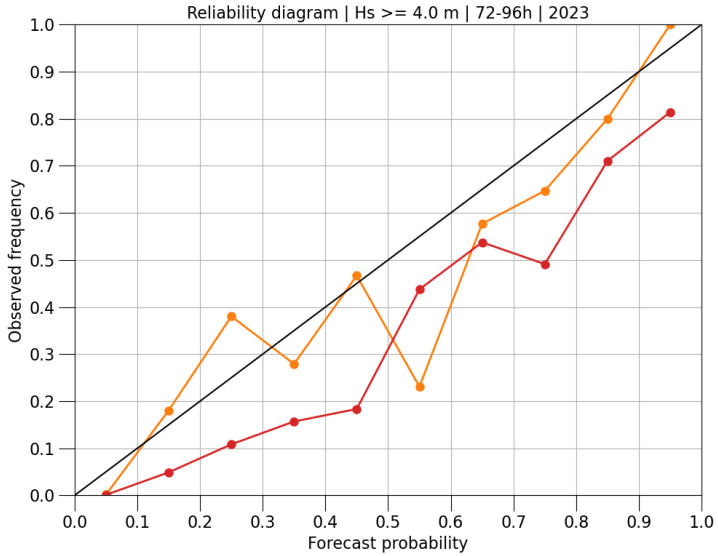
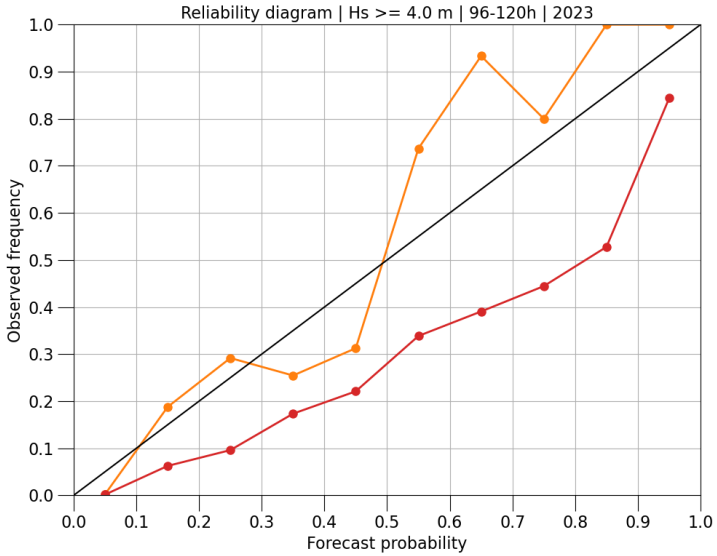
Reliability diagram Hs > 4 m











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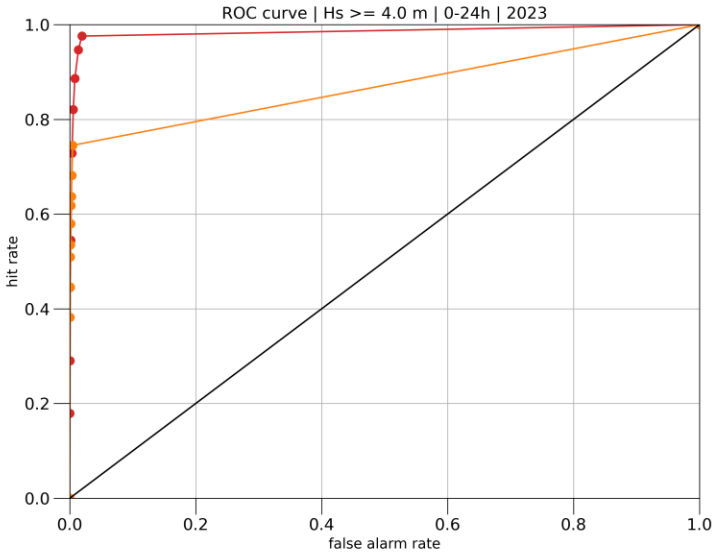
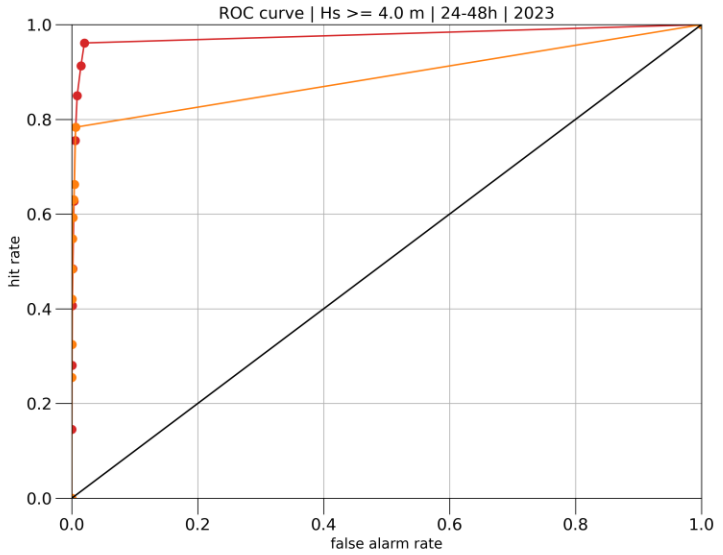
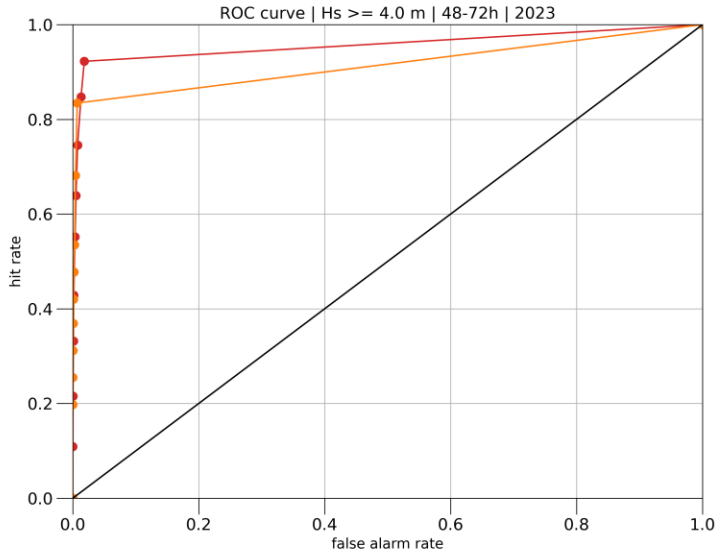
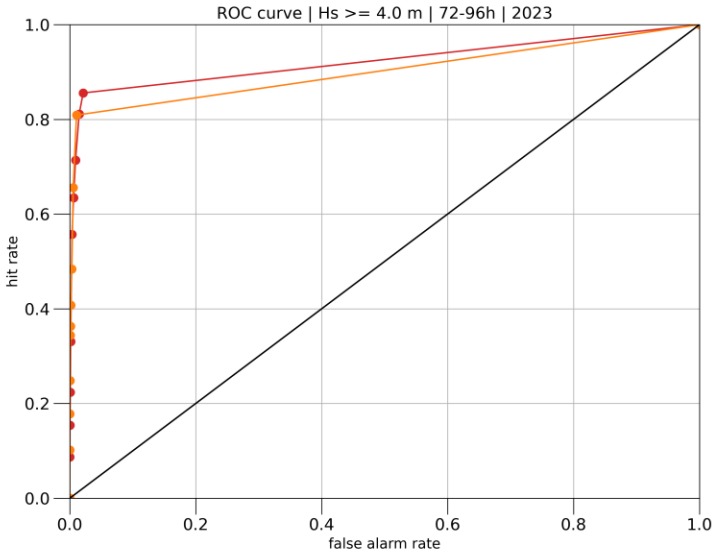
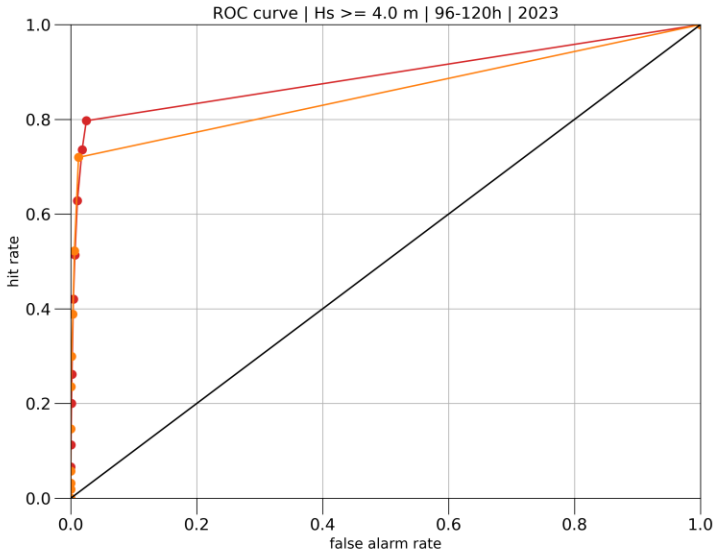
ROC curve Hs > 4 m











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Case study – next days