SST for wind energy applications

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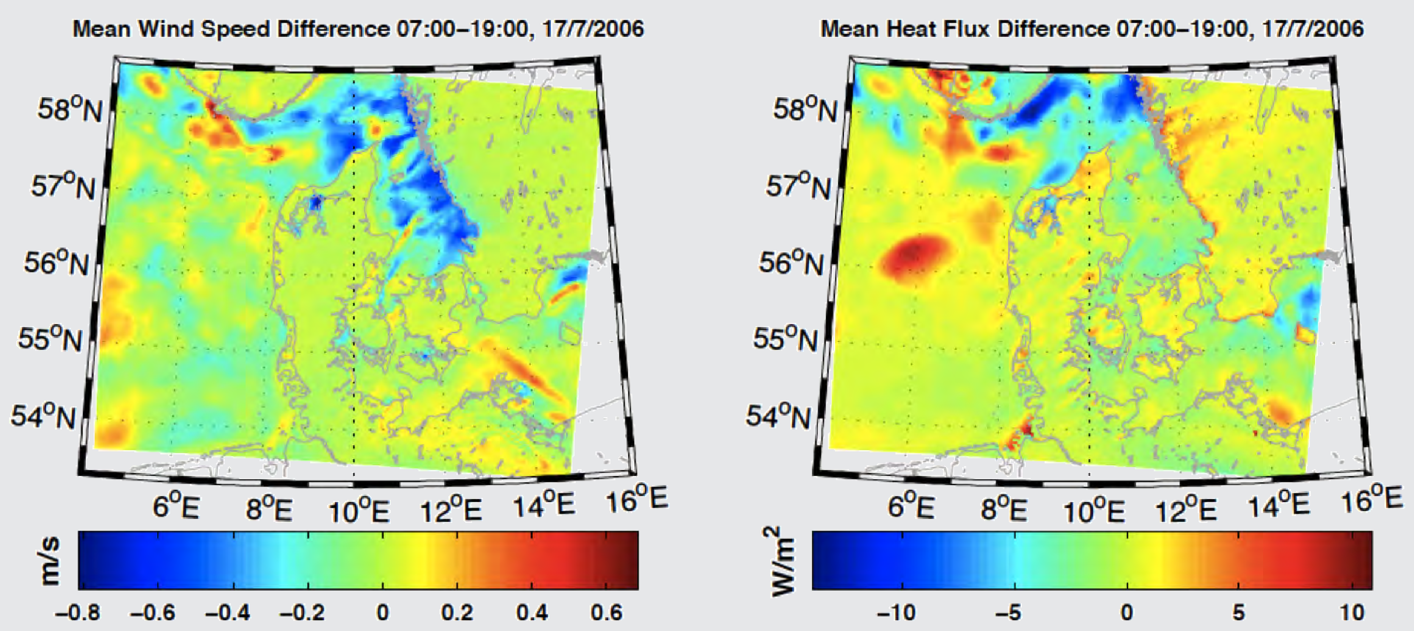
Introduction

SST input for meso-scale modelling is important for wind energy applications due to:

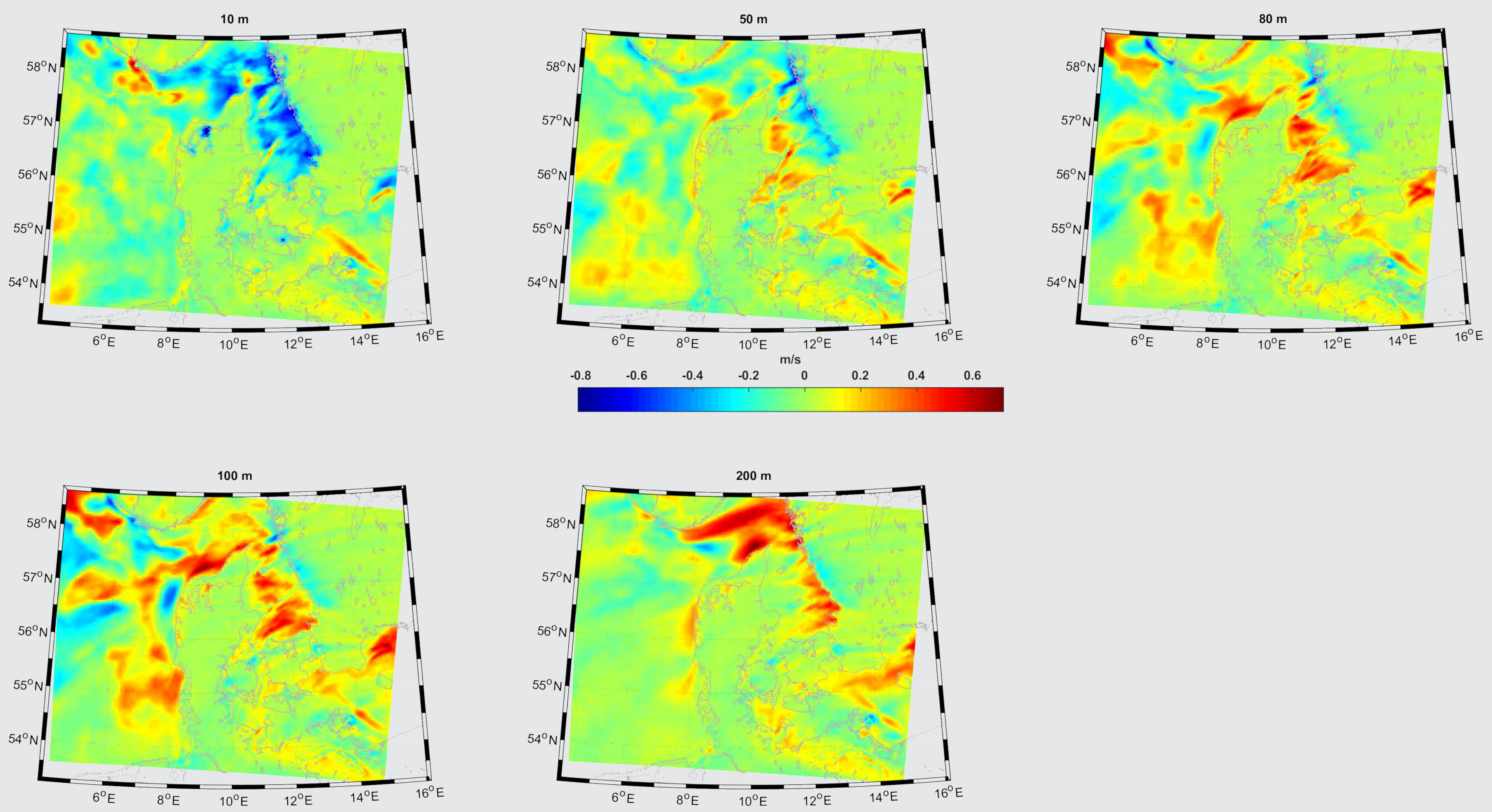
- Diurnal SST variability, not accounted for in meso-scale modelling, can introduce errors in model outputs.
- Different model Planetary Boundary Layer (PBL) schemes represent differently atmospheric stability that can be associated to diurnal SST variability.
- SST boundary conditions are may change the method for obtaining/assigning lake temperature.

Diurnal variability of SST in WRF

- WRF model [5] simulations for diurnal warming events.
- ECMWF ERA Interim, 0.75°×0.75°[1].
- OI-SST from DMI, specifically for large diurnal warming events.
- CORINE land surface data.
- Two PBL schemes (MYJ, YSU) and 2 SST strategies (daily, 6-hourly).



Mean daily difference of wind speed at 10 m and surface heat flux from WRF, using the daily vs updated SST and YSU PBL.



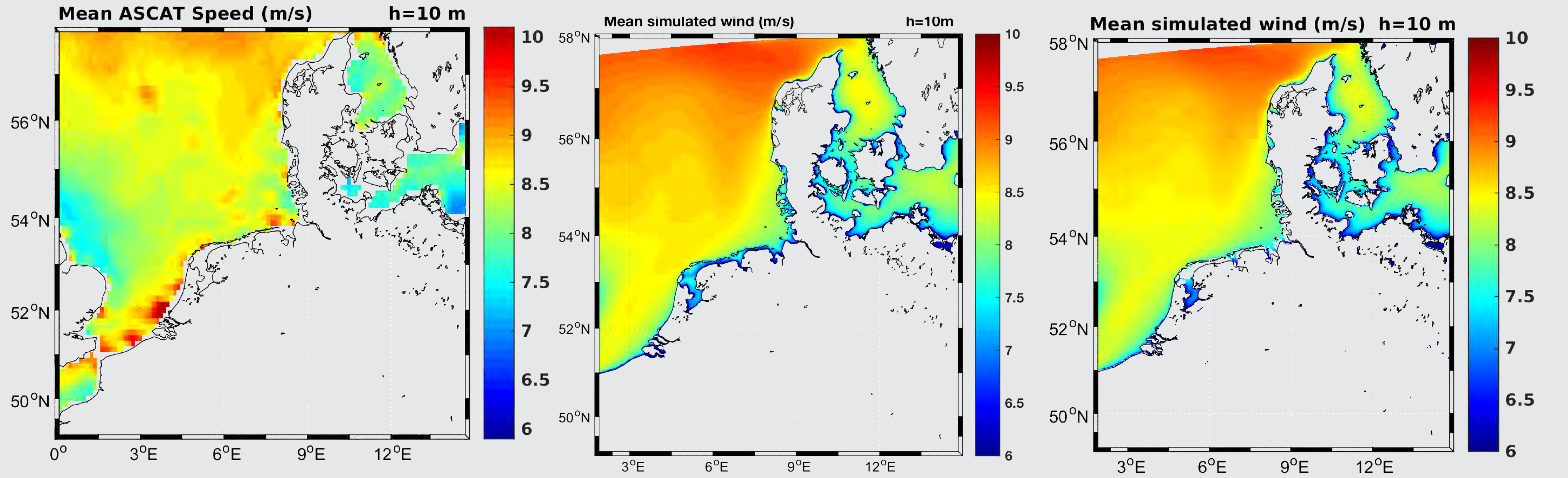
Mean wind speed difference at 5 heights (10, 50, 80, 100, 200 m), for the interval 07:00-19:00, July 17 2006.

Conclusions

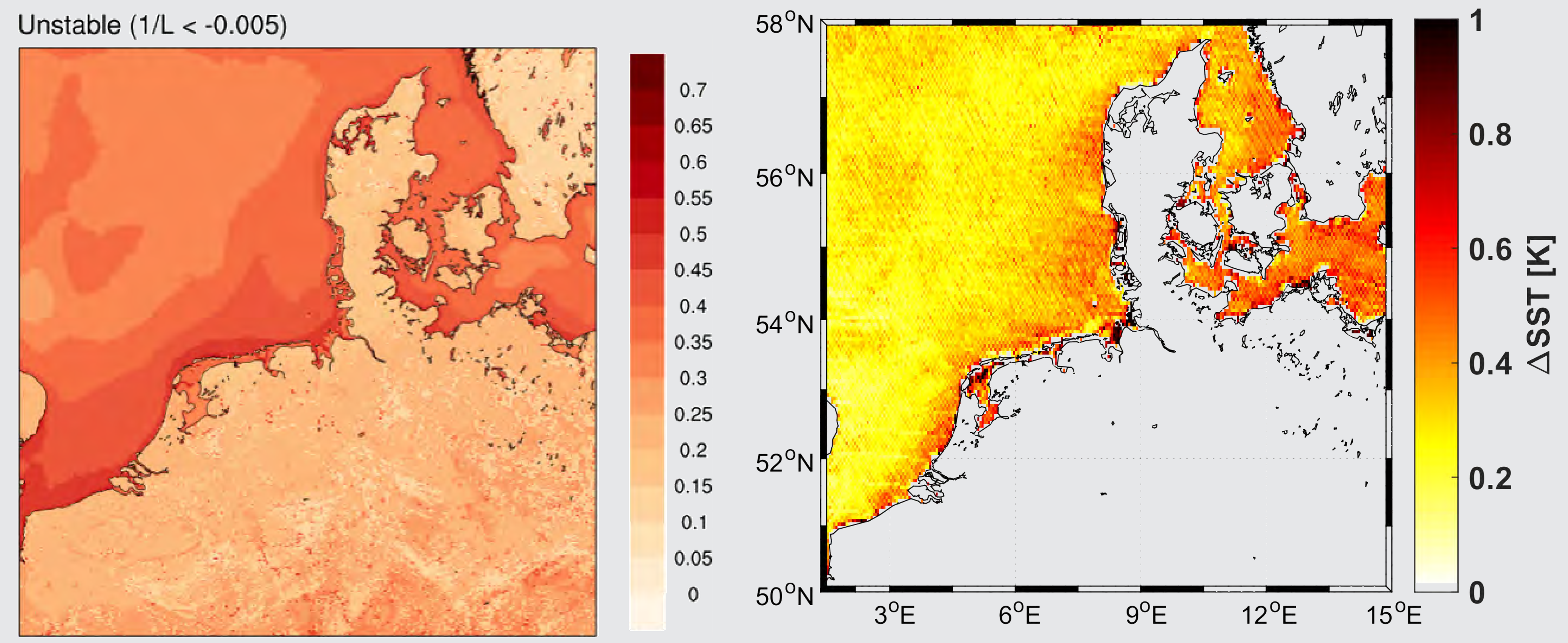
- SST diurnal variability in WRF can cause mean day-time (07:00-19:00) differences up to 10 Wm^{-2} for heat fluxes and from 0.2$\mathrm{m\,s}^{-1}$to 0.8$\mathrm{m\,s}^{-1}$ for 10 m winds.
- Wind speed differences identified up to 200 m with magnitude of up to 0.6.
- Differences in WRF simulated 10 m winds due to PBL schemes on average 0.4.
- WRF stability parameter indicates highest fraction of unstable conditions with good spatial fit to regions of diurnal SST variability.

WRF Stability

- WRF model [5] simulations for test year, 2015, using the method of [2].
- ECMWF ERA Interim, 0.75°×0.75°[1].
- OISST at 0.25°×0.25°from NOAA, [4], with sea ice concentrations and a lake product.
- CORINE land surface data.
- Surface roughness coefficient for each land cell was assumed constant over time.



Mean wind speed at 10 m above the ocean surface from ASCAT (left) and WRF using the MYNN (middle) and YSU (right) PBL schemes, for 2015.



Fraction of unstable conditions from the WRF surface-layer Monin-Obukov stability parameter, L (left) and an estimate of the maximum diurnal variability signal of the sea surface temperature (SST) from [3].

Acknowledgements

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References

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