

Numerical weather prediction for the Bulgarian Antarctic Base area and sensitivity to the SST variable

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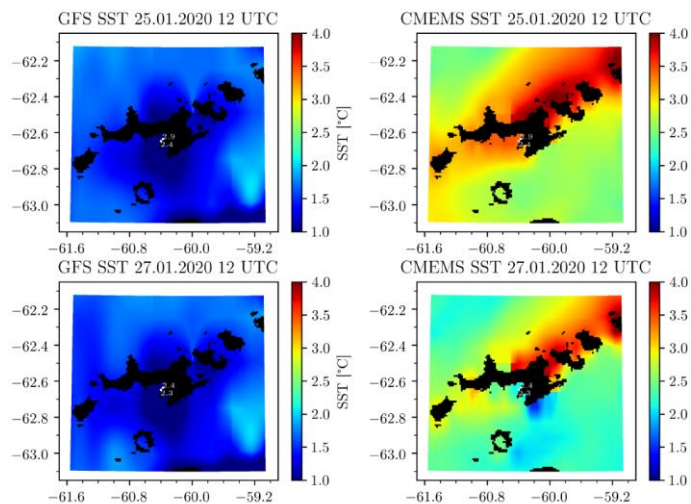


Figure 1: SST comparison with data from GFS and data from CMEMS and its evolution in time. The white points indicate measurements of the sea temperature in °C.

❖ Description of the problem

The weather forecast of good quality is essential for the humans living and operating in the Bulgarian Antarctic base (BAB), located on the Livingston Island coast at 62.64 S and 60.36 W. The numerical weather prediction models in southern high latitude regions still need improvement as the user community is limited, little test cases are documented and validation data are scarce. We configure the Weather Research and Forecast model (WRF) for the area of Livingston Island and we suggest several ways to improve the local weather forecast model skill by modifications of the land cover and ocean temperature. The domain configuration is centered over the Bulgarian Antarctic Base (BAB) and consists of three nested domains, in a 3:1 ratio, with a finest resolution of 1 km. We tested the sensitivity of the numerical weather prediction modelling system to the Sea surface temperature (SST) of the ocean around the island. Several experiments where the SST is scaled linearly are performed.

❖ Use of HPC Infrastructure

The HPC heterogeneous cluster PhysOn [1] was used to obtain the simulation results. PhysOn is located in the HPC laboratory of the Faculty of Physics, Sofia University St. Kliment Ohridski. The simulations are performed using 88 nodes.

❖ Results

- The topography and land use datasets, available with WRF, do not represent adequately the area of study. A change in the land use type significantly increases the forecast quality.
- There are spatial and temporal differences in the SST fields provided by GFS and CMEMS, as the second tend to forecast higher values of SST with a sensible temporal evolution.
- The 2 m temperature increases with rising SST. With SST = 3°C, the 2m temperature at BAB rises with ~0.75°C.
- With an increase of SST, the sea level pressure increases and the maximum wind speed decreases. [2]

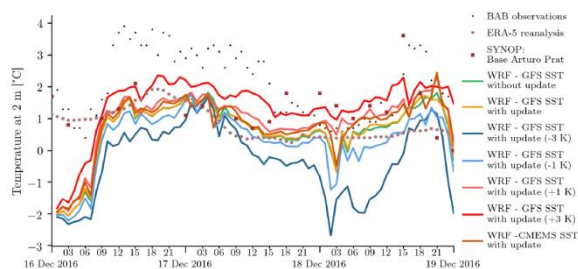


Figure 2: 2m temperature timeseries

[1] <http://physon.phys.uni-sofia.bg/hardware-en>

[2] Chtirkova, B., Peneva, E., Georgieva, G., Weather Prediction for the Bulgarian Antarctic Base Area and Sensitivity to the SST Variable, Studies in Systems, Decision and Control, 2021, 361, pp. 339–355