Treatment of SSTs derived from CESM for their use in WPS

Emmanuele Russo

This document serves as a short reference for the preparation of a WRF simulation using results of the CESM model. Running WRF using the output of CESM simulations resulted in some very strange and unrealistic model behaviour, detectable for several variables, and mainly due to the fact that the interpolation program WPS considers, in the interpolation of SSTs, part of sea as land. This should be somehow related to the fact that raw CESM SSTs outputs have zero values over land. We conducted several tests by changing METGRID tables options for interpolation and masking a priori the raw CESM outputs over land. The latter seems to be the most reliable method. Find more inforation on the conducted tests and their results below.

Changes in METGRID.TBL

The Metgrid program of WPS interpolates ungribbed data files over the model domain. Different interpolation options are controlled in metgrid through the METGRID.TBL. First of all we tried to solve the mentioned issue trying different interpolation options via the METGRID.TBL

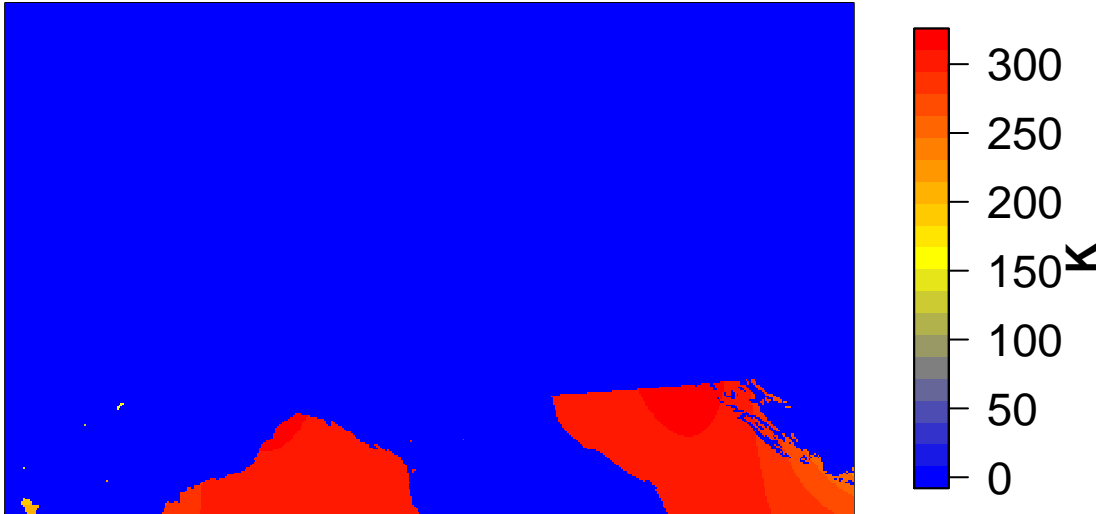In a first place we substituted the default interp_mask LANDSEA with the LANDMASK mask.

Figure 1: *Map of SSTs derived from the CESM raw data and setting interp_mask=LANDMASK in the metgrid table*

This did not solve the problem. Consequently, we performed another test keeping interp_mask=LANDMASK and setting the fill_missing option with the value of -1.E30 instead of 0.
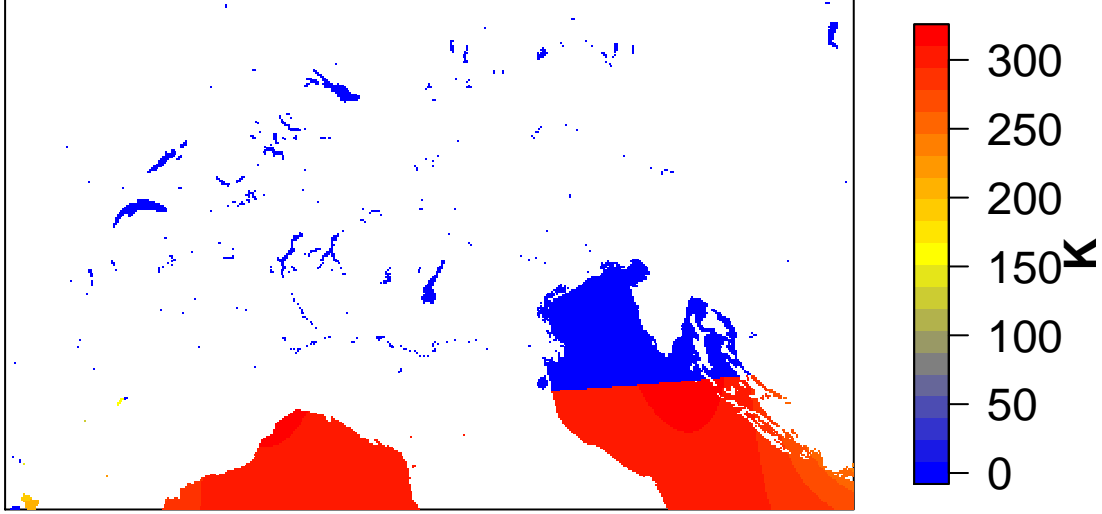
Figure 2: *Map of SSTs derived from the CESM raw data, setting interp_mask=LANDMASK and fill_missing=-1.30E in the metgrid table*

Again the chosen configuration did not solve the problem. Here what we see (Fig.2) is that over land we will have -1.30E values instead of 0s. Still, over the Northern part of the Adriatic Sea a strange artifact of the interpolation is present, with null SST values over part of the sea. Subsequently, we tried a further test modifying the metgrid table with the following options:

interp_option=sixteen_pt+wt_average_16pt+search

masked=land

interp_mask=LANDMASK(1)

fill_missing=-1.E30

flag_in_output=FLAG_SST

missing_value=-1.E30

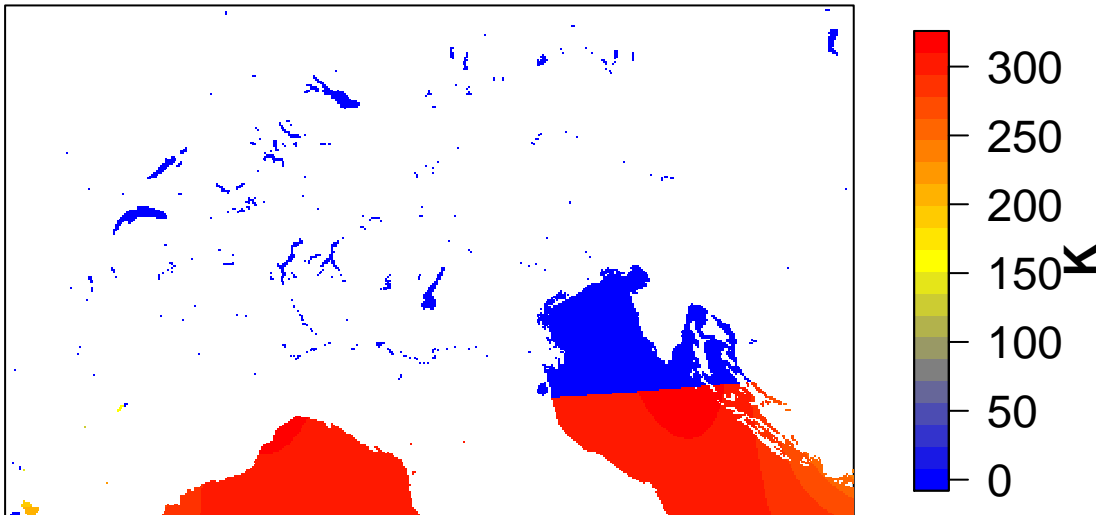Again, we did not manage to solve the problem (Fig.3).

Figure 3: *Map of SSTs derived from the CESM raw data and several changes in the metgrid table*

All the tested changes in the metgrid table configuration did not produce any relevant changes on the interpolation results and did not help resolving the issue.

Masking Raw Data

Analyzing the results of a simulation performed using ERAInterim data as drivers, we noticed that in this case the interpolation of SSTs was realistically performed by WPS. Comparing the raw ERAInterim data and the CESM ones, we noticed that the main difference in SST between the two cases was that ERAInterim used NA values over land for the considered variable, while CESM had 0 values for SSTs over land. Therefore we conducted a test masking SSTs values derived from CESM over land prior to running WPS.
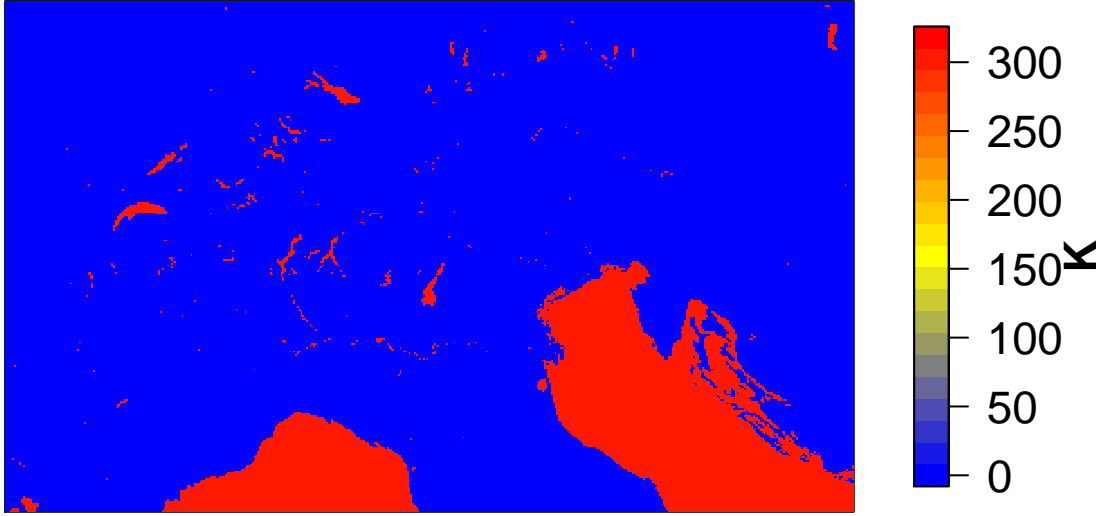

Figure 4: *Map of SSTs derived masking a priori SSTs values over land from the CESM raw data*

In this case (Fig. 4) we can see that SSTs are correctly interpolated only over sea and that the weird artifact evident over the Northern Adriatic Sea is no longer present. Finally, we repeated the same experiment but with the METGRID.TBL option **interp_mask** set to **LANDMASK**. No significant changes were evident in this case.

The presented results were obtained from a CESM simulation at 2 degrees resolution. Please note that some differences might arise between the different considered tests using the same driving dataset but at a different resolution. Nevertheless, the encountered problem using CESM data seems to be completely solvable only with the a priori masking of SSTs over land. We have to acknowledge the fact that we did not conduct further tests beside the presented ones, and that other options (that we are not aware of) could possibly lead to a similar solution of the encountered problem.
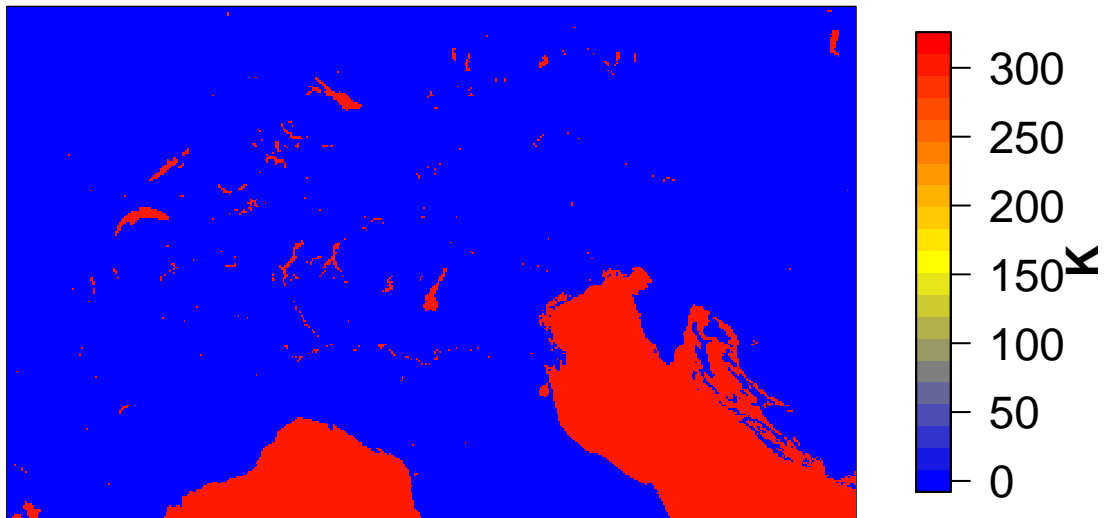
Figure 5: *Map of SSTs derived masking a priori SSTs values over land from the CESM raw data and setting interp_mask=LANDMASK in the metgrid table*