Supplementary Material for "Modeling and evaluation of the global sea-salt aerosol distribution: sensitivity to emission schemes and resolution effects at coastal/orographic sites"

Regional high-resolution simulation in Marion Island

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In addition to the simulation of New Zealand region, we also performed a high-resolution simulation over a domain centered on the Marion Island (REG: horizontal resolution of 0.1° x 0.1°). Our aim is to investigate the strong overestimates affecting our global modeling results when comparing sea-salt surface concentrations against climatologies from the U-MIAMI gathered in this site, indicated as Marion Island (i). The Marion Island is a volcanic island with steep orographic gradients reaching $1200m$ in less than $10km$. Being located in the middle of the Roaring Forties, its meteorology is characterized by westerlies and cyclonic circulation.
In order to reduce uncertainties due to the lack of aerosol boundary conditions in the model, we simulated a sufficiently large domain, i.e. assuming a distance between station and boundaries greater than $400km$ (the maximum sea-salt path during its mean lifetime). We used 24 vertical layers and the M86/M93 emission scheme. The timestep was set to $20s$. We simulated the 2006 year. Meteorological initial conditions were initialized every 24h using the NCEP final analyses (FNL) at 1° x 1°; meteorological boundary conditions were updated every 6h using FNL.
Results are shown in Fig. S1. We obtained a strong decrease of simulated monthly mean concentrations in correspondence of Marion Island (i) with respect to those simulated at GLOB(H) and GLOB(L) resolutions. In particular, we find a very good agreement between model concentrations from the REG simulation and observed climatologies (monthly mean values around $10\mu g/m^3$). The influence of a better resolution of the island and of its orographic gradients is shown in Fig. S2. We find a strong windward enhancement of the model annual accumulated precipitations. This effect, in combination with a more detailed resolution of the island sea/land interface, leads to a decrease in the simulated surface concentrations up to 60%. These results complement and tend to confirm the conclusions discussed in Section 4 of the manuscript.

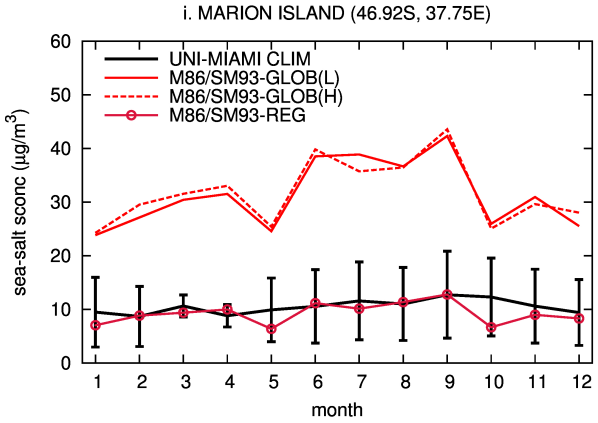

Fig. S 1: Model monthly mean surface concentration (red lines) against climatologies from the U-MIAMI (black line). Model values refer to 2006. The label CLIM stands for climatological data. The labels REG, GLOB(L), and GLOB(H) specify the employed model resolution and domain.

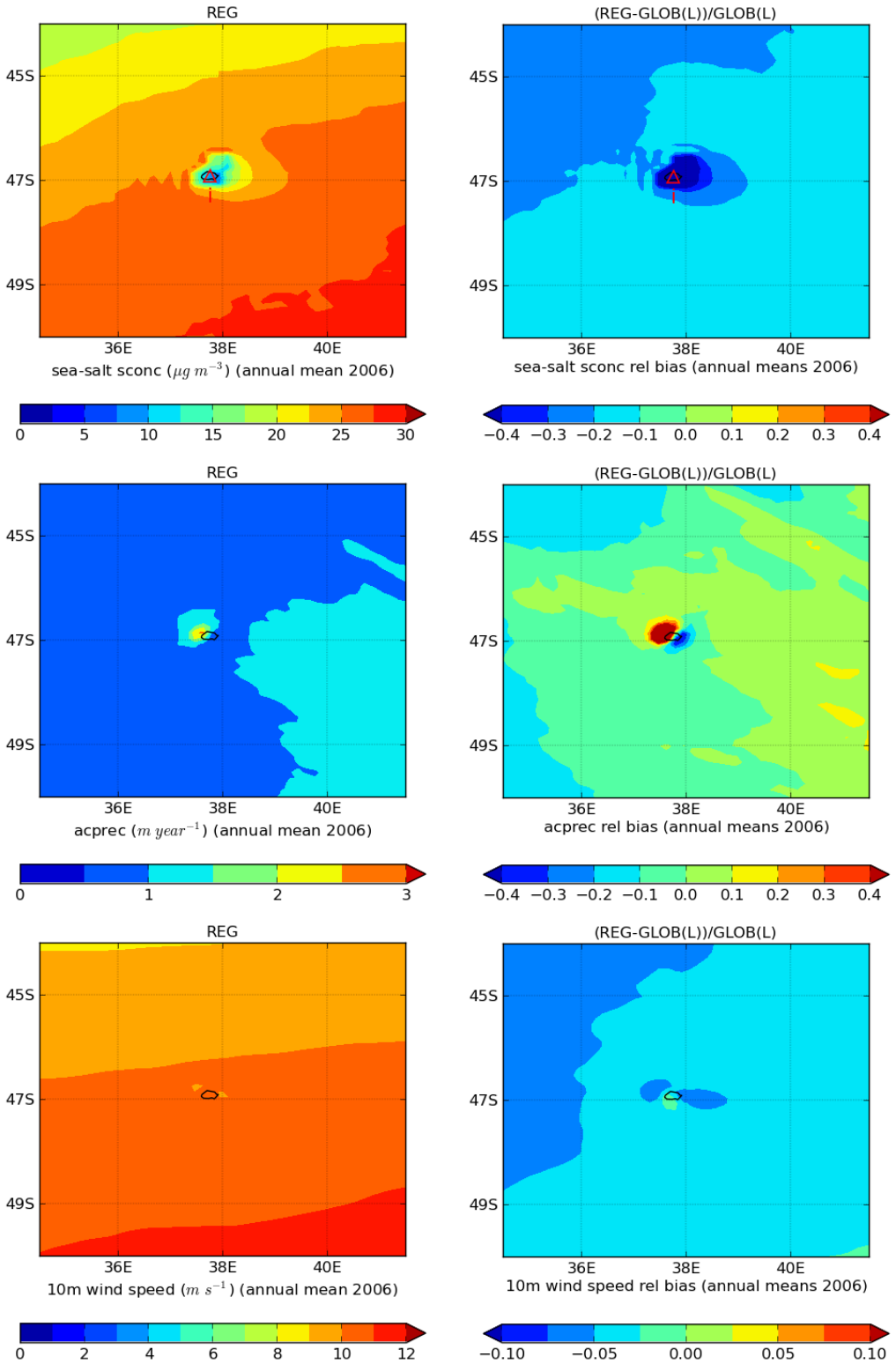

Fig. S 2: On the left: annual mean surface concentrations, annual mean wind speed at 10m, and annual accumulated precipitations as resulting from the regional simulation (REG). On the right: relative bias of annual mean surface concentrations, annual mean wind speed at 10m, and annual accumulated precipitations between the regional simulation and the global simulation at low resolution (GLOB(L)). The GLOB(L) values have been bilinearly interpolated onto the regional grid. All the values refer to the 2006. The U-MIAMI station of Fig. S1 has been highlighted in the concentration maps (the station is located at the center of the red triangle). Maps shown here represent a zoom of the simulated domain.