Circumpolar transport of volcanic ash plume with CHIMERE : the case of the Puyehue-Cordon Caulle eruption (June 2011)

Sylvain Mailler, LMD

The volcanic eruption of Puyehue-Cordon Caulle in Chile (June 2011) is an example of massive, global-scale eruption that generated a plume of ash and SO2 that has been observed by instruments such as IASI while circling twice around the southern hemisphere before dwindling below the SO2 concentration threshold. As such, it is both a subject of strong interest from a geophysical point of view, due to the possible impacts of this plume on tropospheric and stratospheric chemistry, radiative balance, and deposition of minerals such as soluble iron and others over continental and oceanic surfaces.

The present study focuses on using this eruption as a test case to improve the ability of a Chemistry-transport model, CHIMERE, to represent the transport of such a massive and concentrated plume of SO2 and ash around a hemisphere and back to its source point in southern Chile.

Initial simulations have shown the need to improve the vertical transport processes in the model in order to take into account realistic vertical motion of the atmosphere, and to extend the modelled atmospheric column towards the lower stratosphere, two points that have often been overlooked in Chemistry-transport models due to their focus on regional studies and on the lower troposphere where PBL processes are much more critical than explicit vertical motion.

The result of the initial simulations as well as the resulting improvements in the model formulations for vertical transport will be presented, and the resulting improved simulations will be compared with IASI data for SO2 column and MODIS data for the Aerosol optical depth, showing that the CHIMERE model in this improved version, which will be distributed in the forthcoming months, permits an adequate representation of the long-range transport of volcanic plumes, including transport at hemispheric scales, while at the same time permitting a complex representation of atmospheric chemistry below the plume, including natural and anthropogenic emissions, and the optical effect of the volcanic plume on tropospheric photochemistry.