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Solar power forecasting: application of the NMMB/BSC-CTM on-line chemical weather prediction model in central Europe

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It has been shown that dust plays a significant role in atmospheric dynamics. On the global scale, mineral dust loading in the atmosphere is the most abundant of all aerosol species, together with sea-salt aerosol. When winds are strong, large amounts of sand and dust are lifted from bare, dry soils into the atmosphere. After being released, dust particles are raised to higher levels of the troposphere and transported downwind affecting regions hundreds to thousands of kilometers away. Central Europe is periodically affected by Saharan dust intrusions, mainly in Spring. Despite that, none of the current solar power forecasting systems uses online predicted mineral aerosol concentration for radiation calculations while it has been demonstrated that a large proportion of the uncertainty of existing numerical weather prediction (NWP) models can be attributed to the lack of accurate aerosol data used to model solar radiation.

This contribution focuses on the analysis of a Saharan dust intrusion that affected central Europe in the beginning of April 2014 using an online chemical weather prediction model, NMMB/BSC-CTM (http://www.bsc.es/earth-sciences/nmmbbsc-project). The analysed dust event implied a significant reduction of the observed solar radiation, compared with the predicted one, which strongly affected the wholesale electricity market. The NMMB/BSC-CTM model is applied on a regional domain covering Europe and main desert dust emission regions in North Africa and the Middle-East. The impact of the mineral dust outbreaks on meteorology is discussed by comparing model forecast and available meteorological (i.e. solar radiation, cloud and temperature) and dust concentration (i.e. aerosol optical depth, dust vertical profiles) observations. The analysis focuses on the performance of NMMB/BSC-CTM to simulate vertical atmospheric profiles that affect radiative effects. Model results would help to illustrate the added value of on-line models for solar power forecasting.

Ongoing works will also be described: identifying a statistically representative group of mineral dust episodes affecting central Europe to classify them according to major weather events.