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A comparative synthesis of satellite-derived and model-simulated aerosol optical depth products in the Mediterranean region: towards a new 4D-reconstruction of the aerosol field

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The Mediterranean region is strongly influenced by the accumulation of aerosols from different sources : industrial and urban aerosols from Europe, biomass burning from Eastern Europe, dust and carbon aerosols from Africa, and sea salt from the sea. As aerosols can have very important effects on the climate through radiative forcing, it is essential to have the most possible relevant estimation of the atmospheric aerosol content.

Since the 1980s several spaceborne sensors have retrieved aerosols and provided measures of the Aerosol Optical Depth (AOD). The present study aims at comparing AOD climatologies available from the different sensors that provided multi-year monitoring of aerosol over the Mediterranean basin: CZCS (1978-1986), TOMS/NIMBUS7 (1980-1992), NOAA/AVHRR (1982-2007), METEOSAT (1984-1997), SeaWiFS (1997-2011), MISR/TERRA (2000-2011), TERRA/MODIS (2000-2011), AQUA/MODIS (2002-2011), MERIS/ENVISAT (2002-2010), OMI/AURA (2004-2011), PARASOL (2005-2011) and SEVIRI/MSG (2005-2011). We also include in our comparison observations from the AERONET network, as well as AOD climatologies coming from several model data (Tegen, LMDz-INCA, RegCM, GEMS, and MACC), which allow us to distinguish several aerosol types.

The comparison shows clear limitations of certain data sets. From the most robust time series we derive an average seasonal cycle for the various sub-basins of the Mediterranean region. Model data also enable us to elaborate on the different aerosol types. Finally we discuss interannual variability, even if some of the trends observed in satellite data may be attributed to calibration shifts. From this compilation, we propose a 4D blended product from model and satellite data, consisting in monthly time series of 3D aerosol distribution over the Mediterranean marine and continental region and the period 2003-2009. This reconstruction can be used for aerosol radiative forcing in regional climate models.