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Spatio-temporal representativeness of aerosol remote sensing observations

Nick Schutgens (1), Edward Gryspeerdt (2), Svetlana Tsyro (3), Daisuke Goto (4), Duncan Watson-Parris (1), Natalie Weigum (1), Michael Schulz (3), and Philip Stier (1)

(1) University of Oxford, AOPP, Physics, Oxford, United Kingdom (schutgens@physics.ox.ac.uk), (2) University of Leipzig, Institute of Meteorology, Leipzig, Germany, (3) Norwegian Meteorological Institute, Oslo, Norway, (4) National Institute for Environmental Studies, Tsukuba, Japan

One characteristic of remote sensing observations is the strong intermittency with which they observe the same scene. Due to unfavourable conditions (due to e.g. low visible light, cloudiness or high surface albedo), sampling constraints (due to e.g. polar orbits) or instrument malfunction or maintenance, gaps in the observing record of hours to months exist. At the same time, satellite L3 products often are spatial aggregates over considerable distances (e.g. 1 by 1 degree).

We study the impact of spatio-temporal sampling of observations on their representativeness: i.e. how well can satellite products represent the large scale ($\sim$ 100 by 100 km) aerosol field over periods of days, months, or years. This study was conducted by using diverse global and regional aerosol models as a truth and sub-sample them according to actual observations.

In this way, we have been able to study the representativeness of different observing systems like MODIS, CALIOP and AERONET. Monthly and yearly averages allow serious sampling errors, that may still be present in multi-year climatologies due to recurring observing patterns. Even daily averages are affected as diurnal cycles can often not be observed.

We discuss the implications these representativeness errors have for e.g. model evaluation or the construction of climatologies. We also assess similar representativeness issues in ground site in-situ observations from e.g. EMEP or IMPROVE and show that satellite datasets have distinct advantages due to their better spatial coverage provided temporal sampling is dealt with properly (i.e. through collocation of datasets). Finally, we briefly introduce a software tool (the Community Intercomparison Suite or CIS) that is designed to improve representativeness of datasets in intercomparion studies through aggregation and collocation of data.