

***Interactive comment on “A 4-D climatology (1979–2009) of the monthly aerosol optical depth distribution over the Mediterranean region from a comparative evaluation and blending of remote sensing and model products” by P. Nabat et al.***

**Anonymous Referee #1**

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Review of paper:

A 4-D climatology (1979-2009) of the monthly aerosol optical depth distribution over the Mediterranean region from a comparative evaluation and blending of remote sensing and model products. by P.Nabat et al.

Positives - comprehensive comparison of available AOD retrieval data from satellite remote sensing - separate assessment of spatial and temporal AOD correlations (to

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AERONET reference data) - use (MODIS aqua) satellite data to describe local monthly AOD variability for 2003-2009 period

Concerns - focus only on AOD data at a solar single wavelength - composition data rely on interpretations (by two different) models - indirect path to optical properties (assumed SSA and g for components - rather than AERONET) - less useful (completely model based) for the 1979-2003 period

General comments

The paper explains multi-data source monthly average composites for the mid-visible aerosol optical depth (AOD) for the Mediterranean region (in the troposphere). A comprehensive inter-comparison among different satellite retrieval products and among model output of different simulations and assimilations is conducted. AOD data are assessed in comparisons to ground-based remote sensing statistics sampled at AERONET sites, to justify selected AOD data choices. Vertical stratification is scaled by active remote sensing from space, component sub-divisions are scaled by preferences in modeling and the temporal extension for the last 30 years is mainly tied to simulated sulfate AOD multi-annual trends by a single model according to prescribed changes in sulfur emission input to that model. The AOD data-sets comparisons are the major part of the paper while the description of the different aspects of the climatology is relatively brief. There is a strong reliance on MODIS AOD data, also maintaining their regional variations of monthly AOD. Thus, if MODIS retrievals as correct (and there are larger uncertainties over land and there are sampling biases), then this climatology is well suited to address the reduction of the visible solar radiative energy that reaches the surface (for the 2003-2009 period in the Mediterranean). Still, to perform flux calculations, spectral variations must be addressed, not only for AOD but also for the properties describing the aerosol composition (single scattering albedo and asymmetry-factor) – especially in the context of climate assessments (at TOA). The aerosol composition approach takes a rather indirect path, hereby introducing additional uncertainties. Rather than linking directly to AERONET optical properties, model

C3791

simulations are applied to split the MODIS AOD data into components of SU, SS, DU, OC and BC. Now, these models usually include model size schemes, so there is an automatic split between AOD by coarse mode sizes (DU, SS) and by fine-mode sizes (mainly SU, OC, BC). Thus, the quality of the assumed split could be demonstrated with respect to the fine mode AOD an coarse mode AOD and in conjunction with assumed component SSA of Table 5 (which seem to be high in terms of absorption for OC and high on absorption or size for DU) via AAOD data to monthly statistics at AERONET sites. It should also be demonstrated that this climatology is superior to data by any single model (e.g. LMD-INCA) without the use of data from satellite remote sensing. In that sense, why not including the final climatology as additional 'participant' in AOD assessments of Figures 5 to 7? Personally, I am biased that the detail and accuracy of AERONET should not be wasted only on evaluations, but should be an integral part of an aerosol climatology at least for the 1996-2012 period. While I am less enthusiastic about the climatology, the comparison of all these different satellite AOD retrievals alone warrants a publication, but here is would also help to be more clear, which particular versions are used or have been downloaded.

more details in the attached supplement

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/5/C3790/2013/amtd-5-C3790-2013-supplement.pdf>

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