

## ***Interactive comment on “The Mineral Aerosol Profiling from Infrared Radiances (MAPIR) algorithm: version 4.1 description and validation” by Sieglinde Callewaert et al.***

### **Anonymous Referee #2**

Received and published: 1 April 2019

The authors present a useful multi-sensor study, a fairly comprehensive validation of the updated version 4.1 IASI MAPIR dust retrieval algorithm with respect to data from numerous AERONET sites, CALIOP spaceborne lidar data, ground-based lidar data, and lidar data from the CATS instrument onboard the International Space Station. Updates to the previous version of the algorithm include a change of the radiative transfer model used (RTTOV), a change to logarithmic aerosol concentrations, and the use of the Levenberg-Marquardt modification of the Gauss-Newton iteration scheme. The updates seem to enhance the performance of the MAPIR AOD retrieval algorithm with respect to AERONET measurements, reducing the previous bias of +0.28 to -0.04 in the new version. Validation with various lidar instruments indicates that the MAPIR

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algorithm has some useful skill in retrieving the dust aerosol height.

One broader question that I have, which I feel is considered implicitly but not explicitly throughout the manuscript, is whether there is much to be said about the relationship between the IASI-derived atmospheric profiles of water vapour (and temperature) and the dust aerosol profiles (validated in Sections 5.2 and 5.3). In the infrared, the significance of the dust heights for the measured signal at TOA is surely dependent on the coincident water vapour and temperature profiles. Depending on the wavelength, the signal of a dust layer may be obfuscated by a particularly moist atmosphere above it: the signal of two identical dust profiles will be different if their water vapour profiles are different. Would it be possible for you to discuss, briefly or otherwise, how often the dust layers are lofted above the moistest layers of the atmosphere and to what extent this might be significant for the retrievals?

### Specific comments

p.4, line 28: “this is a new aspect...” Could you briefly mention what the process was in the previous version, to put this into context?

p.5, line 5: this could also use a brief extra explanation, to define what the convergence criteria are.

p.7, line 22: would it be possible to quantify the number of very dusty IASI scenes which get discarded? Can this information be retained somehow in the retrieval output?

p.21, line 4: the higher dust layer is stated to be around 15th February but in the plot it

appears to be 16-18th?

p.23, line 3: does this potential underestimation of the LIDAR signal in the bottom layer of the atmosphere imply that the MAPIR retrieval has a better ability to retrieve dust at these altitudes?

Figures 11 and 12: instead of presenting the near-global maps of the AOD, it might be better here to zoom in instead on Africa and the rectangular region directly over the CATS tracks. It is quite difficult to see on the map where the pink parts of the tracks are, and to distinguish the AODs. Does the global view add any insight to this analysis compared to the regional view?

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-84, 2019.

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