

Interactive comment on “1-D-Var retrieval of daytime total columnar water vapour from MERIS measurements” by R. Lindstrot et al.

Anonymous Referee #2

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This paper describes the method for obtaining total column water vapor from the MERIS instrument. The paper is well organized and in general clearly written. It provides a good summary background on measuring water vapor from space. It should be published in AMT with some clarifications and minor revisions. My main concern is section 3.1: the authors have skipped many details, which makes it very hard to follow as is. While readers familiar with the MODIS water vapor retrievals may not miss this information, others will have trouble understanding the process. Please see below for my detailed content comments and suggested wording changes.

Section 3:

1. Adding the equation for the cost function would be helpful 2. A flow chart of the
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forward model retrieval process would be extremely helpful

Section 3.1: This section is somewhat confusing. 1. On line 145 the authors state that the radiance ratio differs from the transmittance due to the influence of the surface reflectance and atmospheric scattering. Are the authors assuming that the water vapor transmittance in channel 14 is 1.? Otherwise you cannot obtain the water vapor transmittance from the radiance ratio. 2. Please explain what you mean on line 164 by “adjusting the tabulated optical depths”. This seems somewhat backwards. I would think you would start with TCWV and calculate ODs. You appear to have pre-calculated ODs and are adjusting them to match the TCWV. 3. I am going to summarize my understanding of the forward model. The authors should use this to determine where the gaps in their explanation are. Again, a flow chart would be very helpful. a. Ab initio a look-up table of optical depths is built using model X (which model)? b. This look-up table is indexed by pressure and temperature (and TCWV?) c. The estimated transmittance ratio is calculated (from the first guess described in section 3.2). d. This transmittance ratio is corrected for differences in spectral surface reflectance (should have equation here). e. Scattering correction is applied. 4. Where do the surface temperature and pressure come from? 5. On line 176: how well correlated are the temperature profiles with the surface temperature? Please add a line or two to justify this statement, as the temperature profile has a significant impact on the retrieval of any species. 6. On line 185, define α . 7. Make a new paragraph on line 239. 8. On line 249: comment on the impact of the uncertainty in f on TCWV. 9. On line 260, be not bet.

Section 3.2:

1. On line 292 retrieved, not retrievedd. 2. On line 296 perturbation not perturbance.

Section 4: 1. Provide a reference for the statement on line 328. 2. Reference for bias in the Aeronet sun photometer measurements 3. Reference for SSM/I TCWV accuracy. 4. On line 23 reflectance not reflectance. 5. On line 452 bright not brigh 6. Is there an

inconsistency on line 471? On line 242 the authors state that over ocean the surface reflectance is calculated with Cox and Munk. 7. Does MERIS do TCWV retrievals with sun glint or not? Please make this clear. 8. Line 510, if LBLRTM is used to calculate the optical depths in the forward model state this in the FM section. 9. Figure 8 is very interesting. The authors should show the perfect fit with MWR measurements they get with setup 4. However, setup is unrealistic, as it is well known that the line wings are sub-Lorentzian; a better test would be to scale the continuum by a smaller factor than 2.0. 10. On line 509, "In this work" rather than "In the frame of " 11. Authors should add the conditions of the tests in Figure 8, which are in the caption, to the body of the text.

Figure 1 and Figure 3: "as a function of" rather than "depending on" Figure 8: "All results shown " rather than "all shown results".

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