Geosci. Model Dev. Discuss., 3, C369–C373, 2010
www.geosci-model-dev-discuss.net/3/C369/2010/
© Author(s) 2010. This work is distributed under
the Creative Commons Attribute 3.0 License.

Geoscientific
Model Development
Discussions

Interactive comment on "Development of an online radiative module for the computation of aerosol optical properties in 3-D atmospheric models: validation during the EUCAARI campaign" *by* B. Aouizerats et al.

B. Aouizerats et al.

benjamin.aouizerats@cnrm.meteo.fr

Received and published: 14 September 2010

Geoscientific Model Development

To Reviewer#2,

The authors appreciate the constructive and helpful comments provided by Re-

viewer#2. They helped improve our manuscript. The paper has been modified to take into account the recommendations given. Below, we have copied the referee comments in italics and inserted our responses in standard font where appropriate.

Regards,

Benjamin Aouizerats

1 Specific comments

1. *So, I'm not totally convinced by the validation because it's not a complete validation. Authors present a case evolving apparently 1 single mode for the aerosol model. What about more complicated and realistic cases such as urban aerosol, dust, bimodal continental aerosol model (these cases are presented in the paper as the main studies to be done)?.*

   The radiative module presented here is used in the configuration of a 3-mode aerosol size distribution. The fits performed from the SMPS+APS observations are along three modes, in order to approach the realistic cases of continental and urban aerosols. Although we suggested it in the article (P.746 L.21, P.747 L.12 or P.748 L.9), we understand that it may be not very clear, so we added some details in the text and figures about the choice of 3 modes.

2. *I'm surprised about the choice of the Mie theory. Why Authors didn't choose*

something more developed? It has been demonstrated that a non spherical approach works better if you want to study Dust or urban environment (Mie works fine for aerosol having around 1 micrometer size). It's time consuming but it's not a problem of time, as authors use Look Up Table. I think it can be an improvement for an advance version of this radiative module.

We understand that the spherical assumption shows some limitations for particles like dusts. However, several studies have shown that in urban areas, only the freshly emitted Black carbon with fractal forms and is generally coated with hydrophilic inorganic species (Giawaly et al., 2009) allowing to use the Mie theory for calculating optical properties. Furthermore, this optical scheme is treating aerosols in the internal mixing way, using the core/shell representation (to calculate associated refractive indexes), that allows to take into account the coating of primary BC by secondary aerosols. Finally, it should be noted that an associated aerosol scheme dedicated to dust particles is already existing (Grini et al. 2006) and has been evaluated in the frame of the AMMA experiment (Tulet et al., 2008, Mallet et al., 2009). This last point was not so clear in the article and we have now modified it.

3. *Part 2, Introduction: the Mie theory is well known, so it's not necessary to re-describe it. - Part 2.2.1: Comments about Figure 1 are obvious. A figure is not necessary, and it will be more interesting to explain why you get optically this result. What's happened if you have several lognormals in the size distribution?*
   As mentioned in the introduction of this part, we understand that these results are well known by the radiative scientific community . However, we think that they could be interesting for a nonradiative community and helpful for the understanding of the article. However, if Reviewer#2 really thinks that this part is useless, we agree to remove it. Finally, as previously mentionned, several

modes are considered.

4. *Part 3.1: Will you get the same result with several aerosol mode?*

   As previously mentionned , several modes are considered.

5. *Part 3.3: the scattering is mainly absorbing I guess you wanted to write: The extinction is mainly absorbing*

   Indeed, we thank Reviewer#2 for mentionning it.

6. *Part 4: What is the environment around Cabauw? What kind of aerosol are you study about? Figure 8 suggests a mono modal aerosol, is it true?*

   This information is detailed in 4.1.3: several kinds of aerosols were present during the 15-day measurements corresponding to different weather regimes.
   Figure 8 shows the observed mass size distribution. Although It doesn't show separated peaks, the resulting mass size distribution is not along a single mode.

7. *Part 4.1.2: It's not hypothesis, it's assumption! Could you justify your assumption? Apparently, you work assuming atmospheric dry conditions. But how do you manage your module (and the fit) if you have wet condition to consider (in a 3D simulation for example)?*

   Indeed, we replaced the word hypothesis by assumption.
   The work presented here is under dry conditions as experimental observations

were performed at controlled relative humidity. The module is able to manage the wet conditions by considering the resulting water in the aerosol (in the shell) as presented in table 1.

8. *Part 4.2: This part is not enough developped!! I'll appreciate more detail in the analysis, and particularly more references. For example,I'm really really surprised by your SSA values and by what you show Figure 3. A SSA=0.5 (or even 0.6; 0.7) is almost impossible in a natural environment.*

   We understand that SSA values below 0.6 are unusual and may be surprising. However, we would like to insist that most of the observed and modelled values of SSA reported in this work are around 0.8 (with a mean value of 0.815 for the modelled values and 0.818 for the observed values). during the period studied) and only a few limited observations reach values lower than 0.6 (Figure 10). Moreover, it should be noted that several studies (Marley et al., 2009, Gomes et al., 2008, Babu et al. 2002, Singh et al. 2005, Ganguly et al., 2006) have reported chronic low SSA values for continental/urban polluted atmosphere. In addition, it has to be noted that the SSA observed and modelled are both under dry conditions, leading to lower SSA values compared to wet conditions. In that sense, we have now modified the text (we added some references) to clarify this specific point.