Abstract

The atmospheric transport of mineral dust is difficult to reproduce using global circulation models because their coarse spatial and temporal resolutions limit their ability to represent the small-scale processes that control the generation and the deposition of these particles. The mineral dust transport model CHIMERE-DUST enables to generate concentration fields of mineral dust at high temporal (1h) and spatial (a few kilometers) resolutions for long time periods (several years). The modelled results are finally compared to SeaWiFS images and AERONET data for selected dust storms that occurred over western Africa.

1. The transport model CHIMERE-DUST

Developed on the basis of the CHIMERE chemistry-transport model, CHIMERE-DUST enables to generate concentration fields of mineral dust at high temporal (1h) and spatial (a few kilometers) resolutions for long time periods (several years). The modelled results are compared to SeaWiFS images and AERONET data for selected dust storms that occurred over western Africa.

2. Studied case: 31 January to 16 March 2004 for the dust storms of 6 March 2004

For the reference run with 40 bins in iso-log size distribution, the modelled AOT over Capo Verde is compared to the observed AOT (recorded by the AERONET network).

Surface concentrations and vertical cross-section

For the dust storm of 6 March 2004, the modelled surface concentrations are in good agreement with the SeaWiFS image showing the huge dust plume flowing along the western Africa coastline.

Size distribution

The parameterization of [Alfaro and Gomes, 2001] is able to estimate size distribution of central dust. The different modes of dust concentrations are presented and we show that the coarse mode is only present over Nia- mey.

6 March 2004:

Sensitivity study on the bin scheme

We use the new iso-logarithm binc scheme proposed by [Froet et al., 2005]. The size distributions follow iso-values of dry deposition velocity gradient. The "size" are thus chosen where the deposition process is the most impor- tant. Simulations are done with an usual logarithm distribution and 12 bins (LogD), and the new scheme with 6 and 12 bins, Adpt6 and Adpt12, respec- tively.

Results are presented in the following Figures in the form of ratios between the reference run and the tested runs. The Adpt12 configuration gives an error twice smaller than LogD.

Comparison between different bins number

In Adpt better than LogD**: The comparison between Adpt6 and LogD exhibits heterogeneous results. The main tendency is that Adpt configura- tions give worse results than LogD. But over the Saharan region, Adpt6 is better — it means that the largest particles sizes (the emissions) are better described.

6 March 2004:

(Sref/Bins Adpt6/Ref60/LogD)

**Conclusion**

• Obviously, more the bins number is large more accurate are the concentrations fields.

• The adaptative approach of [Froet et al., 2005] always gives results two times better for the same number of bins compared to the "Classi- cal" iso-log size distribution.

• But, even if we used an optimised size distribution, the better re- sults are obtained with "Adpt6" instead of "Adpt12". But in the modelled area the 6 bins are know sufficient to accurately model dust mass concentrations, from emissions to long-ranged locations.

References

[Alfaro and Gomes, 2001], [Van Leer, 1979], [Menut and Marticorena, 2005], [Marticorena and Bergametti, 1995], [Loosmore and Cederwall, 2004], [Menut, Schmechtig, and Marticorena, 2005], [Venkatram and Pleim, 1999], [Froet et al., 2005], [Foret et al., 2005], [Marticorena, B., and G. Bergametti (1995), Modeling the atmospheric transport of mineral dust at high temporal (1h) and spatial (a few kilometers) resolutions for long time periods (several years). The modelled results are compared to SeaWiFS images and AERONET data for selected dust storms that occurred over western Africa.

http://euler.lmd.polytechnique.fr/menut/chimeredust/chimdust.html

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References

[Alfaro, S. C., and L. Gomes (2001), Modeling mineral aerosol production by sandblasting, [Loosmore and Cederwall, 2004], [Menut, Schmechtig, and Marticorena, 2005], [Marticorena, B., and G. Bergametti (1995), Modeling the atmospheric transport of mineral dust at high temporal (1h) and spatial (a few kilometers) resolutions for long time periods (several years). The modelled results are compared to SeaWiFS images and AERONET data for selected dust storms that occurred over western Africa.

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