**Geoscientific
Model Development
Discussions**

# *Interactive comment on* "MADE-IN: a new aerosol microphysics submodel for global simulation of potential atmospheric ice nuclei" *by* V. Aquila et al.

**V. Aquila et al.**

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We thank the referee for the useful comments. We have modified the text accordingly to the referee's suggestions.

1. **Reviewer comment (RC):** Page2228, line 20: please give some brief explanation or references at "Mineral dust is assumed to be completely hydrophobic".

   **Authors reply (AR):** The following paragraph has been added:

   Since mineral dust mostly has a very small soluble mass fraction, dust is assumed by MADE to be hydrophobic. Hence, mineral dust particles cannot be activated to form cloud droplets and are taken up by cloud and rain droplets via impact scavenging only. This, however, is in contradiction to measurements and

C875

theory showing that some mineral dust particles can act as cloud condensation nuclei and can form cloud droplets after gaining a coating of liquid solutions (e. g. Kelly et al., 2007; Andreae and Rosenfeld, 2008; Kumar et al, 2009; Sullivan et al., 2009).

2. **RC:** Page 2228, lines 25-27: please also give some brief explanation or references at "Furthermore, MADE-IN simulates also the aging of mineral dust from hydrophobic to hydrophilic by gaining a liquid coating".

   **AR:** The references that we added in response to the previous remark discuss the possibility of the aging of dust through acquisition of a liquid coating.

3. **RC:** Page 2243, lines 19-27: please describe the dry deposition process more clear. It should include two parts: sedimentation near the surface and turbulent mix-out.

   **AR:** The following part has been added:

   The dry deposition of trace gases and aerosols is calculated by the submodel DRYDEP (Kerkweg et al., 2006). With dry deposition we denote the collision of aerosols with the surface due to turbulent motion and the subsequent sticking. DRYDEP calculates the dry deposition flux using the big leaf approach, depending on the near-surface turbulence and on the properties of the surface (Ganzeveld and Lelieveld, 1995). Dry deposition is only applied to the lowermost model layer.

   The sedimentation of aerosol due to gravitational settling is calculated by the SEDI submodel (Kerkweg et al., 2006) in all model layers. A simple upwind scheme and a trapezoid scheme are available in SEDI to calculate the change in particle concentration due to sedimentation. In this work we use the simple upwind scheme: the fraction of particles falling from one box into the next box below is calculated from the geometric vertical extension of the box and the ter-

minal velocity of the aerosol particles during each time step. It is assumed that the particles of one grid box are homogeneously distributed with height.

**References**

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