Geophysical Research Abstracts
Vol. 13, EGU2011-10069, 2011
EGU General Assembly 2011

Assimilating remotely sensed cloud optical thickness into a mesoscale model

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The Advanced Regional Prediction System (ARPS), a mesoscale atmospheric model, is applied to simulate the month of June 2006 with a focus on the near surface air temperatures around Paris. To improve the simulated temperatures which show errors up to 10 K during a day on which a cold front passed Paris, a data assimilation procedure to calculate 3D analysis fields of specific cloud liquid and ice water content is presented. The method is based on the assimilation of observed cloud optical thickness fields into the ARPS model and operates on 1D vertical columns, assuming that there is no horizontal background error covariance. The rationale behind the method is to find vertical profiles of cloud liquid and ice water content that yield the observed cloud optical thickness values and are consistent with the background (simulated) profile. An a priori assumption like this is required as the observed cloud optical thickness does not contain any height information. Afterwards, a latent heat adjustment is applied to the temperature in the vertical column, based on the added or subtracted amounts of cloud liquid and ice water. Data from 5 meteorological surface stations around Paris are used to verify the model simulations. Preliminary results show that the presented assimilation procedure is able to improve the simulated 2 m air temperatures significantly during cloudy days.

Acknowledgements:
This research is supported by the agency for Innovation by Science and Technology in Flanders and is part of the Climate and Air Quality Modelling for Policy Support (CLIMAQS) project.