MODEL EVALUATION WITH RESPECT TO DEPOSITION PROCESSES

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Objective:

Correct dispersion model evaluation must consider all evaluable processes contributing to final air pollution concentrations like deposition processes as they are crucial in the air pollution budget. The aim of this work is to validate the contributing processes to modeled dry and wet deposition fluxes.

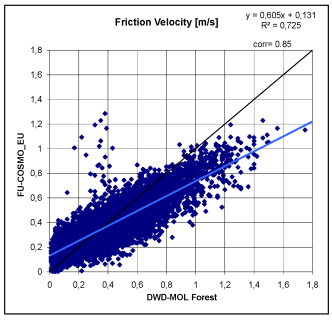
Dry deposition depends mainly on the
- good description of the surface
- **turbulent aerodynamic mixing**
- **airborne pollutants concentrations**

Wet deposition depends mainly on the
- description of **precipitation**
- **cloud liquid water content**
- **airborne pollutants concentrations**

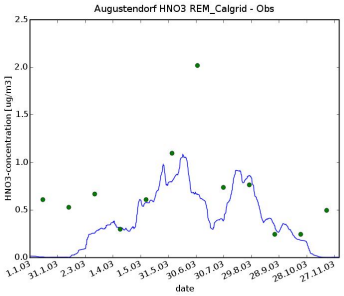
Data and Methods:

Off-line Eulerian grid model RCG has been used to simulate air pollution concentrations and depositions on a regular lat-lon-grid with a horizontal resolution of ca. 7x7 km² and up to 5000m height with 20 vertical layers. Dry deposition is parameterized following Erisman et al. (1994), wet deposition and scavenging processes are modeled following Seinfeld and Pandis (1998). Meteorological data has been provided by DWD's COSMO-EU. At Lindenberg (DWD-Station) friction velo-cities and liquid water contents have been measured, while precipitation and wet deposition data came from UBA-network (UBA, 2004). Air pollutants concentrations and dry deposition fluxes were measured at Augustendorf at a forest site.

Results:



Friction velocity as a parameter for mechanical turbulence was deduced from COSMO-EU-outputs and compared to measurements over a forest. The correlation coefficient is higher than 0.8 indicating a good description of temporal processes.



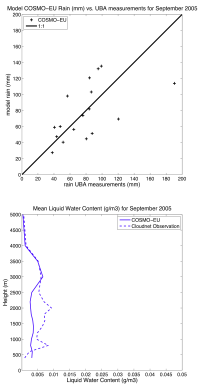
Airborne precursors pollutants concentrations over forest show a correct temporal behavior, but absolute values (green dots measurements, blue line simulations) are underestimated.

Final depositions

species [kg-N/ha-a]	obs	sim
NH_3-N	16.2	16.1
HNO_3-N	2.9	0.6
NO_2-N	1.5	1.9
HNO_2-N	0.8	0.0

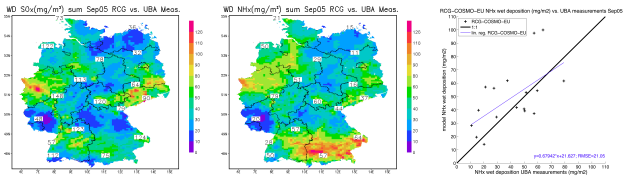
NH_3 and NO_2 are modeled well, while HNO_3 is underestimated partly due to too low deposition velocities.

COSMO-EU grid point precipitation sums (upper figure) and COSMO-EU mean cloud liquid water content (lower figure) compared to measurements for the investigation period September 2005. Measured precipitation sums are captured satisfyingly at most stations. Below 3000m COSMO-EU underestimates the mean liquid water content measurements by up to a factor of 3.



Final depositions

Underestimation of RCG SOx wet depositions due to the underestimation of modeled cloud liquid water content. NHx wet depositions are captured well by RCG. NHx depositions are less connected to liquid water content than SOx since NHx is less mixed in the vertical. NHx results demonstrate strong link to modeled precipitation.



Conclusions:

It has been shown that it is not sufficient to compare pollutants concentrations in air or in water with observations but a comprehensive evaluation of input meteorology is fundamental to obtain reliable predictions. The final simulation is only significant and can be used for regulatory purposes if all included processes are modeled correctly.

References and Acknowledgement:
Erisman et al. (1994). Atmos. Environ., **28**, 2595-2607.
UBA (2004). Texte 28/04, ISSN 0722-186X, Umweltbundesamt – Berlin, Fachgebiet II 5.6, 536 pp.
Seinfeld, J.H. and N. Pandis (1998). John Wiley and Sons, Inc., New York, 1326 pp.
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