A major task of the MiKliP's subproject LiCoS is to investigate the interactions between meteorology and air chemistry with a focus on extreme events and long time scales. However, the computation of gas phase chemistry in a global model like EMAC takes between 80 and 90% of the total CPU time, when aerosol chemistry is not included (Jöckel *et al.*, GMD 2010). Therefore, the speedup of the chemical calculations is critical to the progress pace of the LiCoS subproject. Yet any speedup technique must be general enough in order to transcend model boundaries and be finally implemented in the not yet cristallized MiKliP modeling system.

One such technique is the implementation of an efficient time-step controller for the ODE solver. Another technique is the stiffness reduction of the ODE system in which, for instance, very short-lived species are adjusted to their “instantaneous” equilibrium concentration before the ODE integration starts. By implementing the above mentioned techniques in the chemistry-climate model EMAC a speedup factor of 4-5 has been attained for the gas-phase chemistry alone. The losses in accuracy for 1-week test simulations are minimal (max 1-2 %) . The speedup factor attained for the whole model depends on the chemical mechanism size and is always higher than 2.

Test simulations for longer time periods, e.g. 10 years, are needed to thoroughly assess the impact of these techniques on speedup and accuracy. Therefore, we plan to run two groups of three 10-year simulations (reference, standard and fast setup) in which chemical mechanisms of different sizes (about 100 and 170 species) are used.

List of acronyms

ODE = Ordinary Differential Equations

MiKliP = Mittelfristige Klima Prognose (BMBF)

LiCoS = Linking Composition and Circulation on Intermediate Spatio-temporal Scales (sub-project of MiKliP)

EMAC = ECHAM/MESSy for Atmospheric Chemistry