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On the coupling of chemistry transport models to an integrated numerical weather forecasting system with data assimilation

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Atmospheric chemistry is an integral part of the Earth system, and atmospheric trace constituents can constitute important drivers for climate change. Integrating atmospheric chemistry models (CTMs) into an Earth system modelling framework is a challenging task due to the large number of components which must be transported, emitted, and deposited, and the even larger number of reaction equations which must be solved for at frequent time intervals. Different coupling approaches of atmospheric chemistry models have been developed in recent years, and these will be reviewed in a general fashion. More specifically, we will present the specific coupling strategies developed for three different global CTMs in the framework of the EU project GEMS. Here, the CTMs are being linked to an operational numerical weather forecasting system with data assimilation, and they shall then be used in the context of operational predictions of chemical weather. We will highlight the difficulties of this complex undertaking and present first results of the coupled system including some performance measures. The GEMS coupling strategy will also be compared to a direct coupling approach adopted in the chemistry-general circulation model MOZECH developed at MPI-M.