Seamless Meteorology-Chemistry Modelling: Status and Relevance for Numerical Weather Prediction, Air Quality and Climate Research

Alexander Baklanov (1) and and EuMetChem team (2)

(1) World Meteorological Organization (WMO), (2) EuMetChem.info

Online coupled meteorology atmospheric chemistry models have undergone a rapid evolution in recent years. Although mainly developed by the air quality modelling community, these models are also of interest for numerical weather prediction and climate modelling as they can consider not only the effects of meteorology on air quality, but also the potentially important effects of atmospheric composition on weather. Two ways of online coupling can be distinguished: online integrated and online access coupling. Online integrated models simulate meteorology and chemistry over the same grid in one model using one main timestep for integration. Online access models use independent meteorology and chemistry modules that might even have different grids, but exchange meteorology and chemistry data on a regular and frequent basis. This paper is an overall outcome of the European COST Action ES1004: European Framework for Online Integrated Air Quality and Meteorology Modelling (EuMetChem) and conclusions from the recently organized Symposium on Coupled Chemistry-Meteorology/Climate Modelling: Status and Relevance for Numerical Weather Prediction, Air Quality and Climate Research. It offers a review of the current research status of online coupled meteorology and atmospheric chemistry modelling, a survey of processes relevant to the interactions between atmospheric physics, dynamics and composition; and highlights selected scientific issues and emerging challenges that require proper consideration to improve the reliability and usability of these models for the three scientific communities: air quality, numerical meteorology modelling (including weather prediction) and climate modelling. It presents a synthesis of scientific progress and provides recommendations for future research directions and priorities in the development, application and evaluation of online coupled models.