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Evaluation of surface ozone simulated by the WRF/CMAQ online modelling system

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n this work we evaluate the online model WRF/CMAQ with respect to surface ozone and compare its performance with an off-line modelling system (WRF/CAMx) that has been operationally used by Aristotle University of Thessaloniki (AUTH) for chemical weather forecasting in the Mediterranean. The online model consists of the mesoscale meteorological model WRF3.3 and the air quality model CMAQ5.0.1 which are coupled in every time-step. The modelling domain covers Europe with a resolution of 30 Km (identical projection for meteorological and chemistry simulations to avoid interpolation errors) and CMAQ has 17 vertical layers extending up to 15 Km. Anthropogenic emissions are prepared according to the SNAP nomenclature and the biogenic emissions are provided by the Natural Emission Model (NEMO) developed by AUTH. A 2-month simulation is performed by WRF/CMAQ covering the time period of June-July 2010. Average monthly concentration values obtained from the MACCII service (IFS-Mozart) are used as chemical boundary conditions for the simulations. For the WRF simulations boundary conditions are provided by the ECMWF. The same boundaries, chemical mechanism (CBV), emissions and model set up is used in the off-line WRF/CAMx in order to allow a more direct comparison of model results. To evaluate the performance of the WRF/CMAQ online model, simulated ozone concentrations are compared against near surface ozone measurements from the EMEP network. he model has been validated with the climatic observational database that has been compiled in the framework of the GEOCLIMA project (http://www.geoclima.eu/). In the evaluation analysis only those stations that fulfill the criterion of 75% data availability for near surface ozone are used. Various statistical metrics are used for the model evaluation, including correlation coefficient (R), normalized standard deviation (NSD) and modified normalized mean bias (MNMB). The final aim is to investigate whether the state-of-the-art WRF/CMAQ online model is successful in representing in an acceptable way a key atmospheric pollutant like ozone. Preliminary results indicate that WRF/CMAQ captures relatively well the spatial patterns of surface ozone over Europe. Its results are compared to the extensively tested offline modelling system WRF/CAMx, which runs with similar configuration in an identical domain over the same time slice. The aim is to assess the differences in surface ozone between the off-line and online model and try to find the mechanisms underlying these differences. Conclusively, this study aims in quantifying the differences in the results of the off-line WRF/CAMx and the online WRF/CMAQ modelling systems, in order to decide which can more adequately address the needs of emerging assessment for air quality-climate interactions and provide dynamically consistent predictions, ultimately justifying the choice of online versus off-line approaches.This work has been developed in the framework of the NSRF project: Development of a Geographical Information System for Climate information (Geoclima).