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A model study of the Eastern Mediterranean ozone and PM levels during the hot summer of 2007

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The hot and polluted summer of 2007 in south-east Europe has been studied using two regional atmospheric chemistry models. Three distinct heat waves combined with large emissions from forest fires led to elevated ozone and PM levels in the Eastern Mediterranean region. It is important to study such heat waves as these kinds of episodes may occur more frequently in a future climate. This study has been performed within the framework of the EC FP7 project CityZen.

The Eulerian non-hydrostatic WRF-Chem (Weather Research and Forecasting with chemistry) model is extensively used for atmospheric research, and consists of a dynamical part which is fully coupled with a chemistry module. In this study, WRF-Chem version 3.2 has been used with the RADM2 chemistry scheme. The other model that has been applied is the Unified EMEP (European Monitoring and Evaluation Programme) model, which is a regional Chemistry-Transport Model driven by meteorology from the ECMWF (European Centre for Medium-Range Weather Forecasts) reanalysis data. Both models have used a horizontal resolution of 25 km $\times$ 25 km, and have been run for three summer months of 2007; June, July and August. Anthropogenic emissions are based on EMEP 50 km $\times$ 50 km data, but have been regridded to finer scale. Forest fire emissions are taken from the Global Fire Emission Database (GFED) and from the newly developed Fire INventory from NCAR (FINN), while biogenic emissions are calculated online in each of the models.

The models have been validated against both ground-based measurements and satellite observations. Ozone measurements from two stations within the EMEP measurement network have been compared, namely Finokalia and Ayia Marina located on Crete and Cyprus, respectively. Additionally, tropospheric columns of ozone precursors have been compared with the model results. Sensitivity runs have been performed in order to assess the impacts of different meteorological and chemical processes on the ozone levels, more specifically, to estimate the ozone impact from fire emissions, biogenic emissions, dry deposition, elevated temperatures and reduced humidity. Preliminary model results show that ozone formation was strongly affected by isoprene during the heat waves and by the forest fires in Greece, with maximum impacts occuring in late July 2007.