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Temperature changes impact on summer time air quality in the Eastern Mediterranean

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Changes in temperature due to variability in meteorology and climate change are expected to significantly impact atmospheric composition. The effect of temperature changes on air pollutant levels in the Eastern Mediterranean, including the megacities like Istanbul and large urban agglomerations such as Athens, is here investigated in the frame of the EU project CityZen. The WRF/CMAQ mesoscale modeling system is used, coupled with the MEGAN model for the processing of biogenic volatile organic compound emissions. Temperature perturbations (spanning from 1 to 5 degrees) are applied on a base case simulation for July 2004. The results indicate that the Eastern Mediterranean basin acts as a reservoir of pollutants and their precursor emissions from large urban agglomerations [1]. The precursors transported downwind within the boundary layer are accumulated in the basin. Results show that during summer, local chemistry is a major sink for ozone at these urban areas near the surface, and a minor contributor downwind. Particulate matter levels are associated with primary emissions at urban areas, whereas sea-salt and dust are important contributors at downwind areas. On average, the atmospheric processes are more effective within the first 1000 meters. Sulfate aerosol levels decrease with increasing temperatures due to significant decreases in cloud production. On the other hand, temperature increases result in elevated sea-salt emissions that lead to increase in nitrate aerosol levels. SOA levels increased domain-wide, due to the increase in biogenic emissions and enhanced photochemistry. The sensitivity runs show that ozone concentrations respond almost linearly to the changes in temperature up to 5 K. Increases in temperature lead to about 1 ppb/K of ozone increase for all studied urban and receptor stations except for Istanbul, where a 0.4 ppb/K increase is calculated, which is almost half of the domain-averaged increase of 0.91 ppb/K [2].

[1] Kanakidou et al., 2010. Megacities as hot spots of air pollution in the East Mediterranean. Atmospheric Environment, doi:10.1016/j.atmosenv.2010.11.048

[2] Im et al., 2010. The impact of temperature changes on summertime ozone and its' precursors in the Eastern Mediterranean. Submitted to ACPD.