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# Fire risk and air pollution assessment during the 2007 wildfire events in Greece using the COSMO-ART atmospheric model

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During 2007, Greece experienced an extreme summer and the worst natural hazard in its modern history. Soil dehydration, following a prolonged dry period in combination with hot temperatures and strong winds, yielded favorable conditions for the ignition and spread of wild fires that burnt approximately 200,000 ha of vegetated land (Founda and Gianakopoulos, 2009; Sifakis et al., 2011). The relationship between meteorology and fire potential can be provided by the Canadian Fire Weather Index (FWI), which is already found applicable in the fire activity of the Mediterranean region (Carvalho et al., 2008). However, lack of meteorological data or remote fire spots can be sources of uncertainties for fire risk estimation.
In addition to the direct fire damage, these fires produced large quantities of gaseous air pollutants and particles (PM10) dispersed over the area of Greece. Indeed, PM10 concentration measurements showed two pollution episodes over Athens during late August and early September, 2007 (Liu et al., 2009). Nevertheless, these measurements neither show the large spatial extent of fire effects nor reveal its important role on atmospheric chemistry.
In the current study, the application of the atmospheric model COSMO-ART is used to investigate the issues addressed above. COSMO-ART (Vogel et al. 2009) is a regional chemistry transport model (ART stands for Aerosols and Reactive Trace gases) online-coupled to the COSMO regional numerical weather prediction and climate model (Baldauf et al. 2011). The current simulations are performed between August 15 and September 15 over Greece with a horizontal resolution of 2.8 km and a vertical extend up to 20 km. The initial and boundary meteorological conditions are derived from a coarser COSMO simulation performed by the German Weather Service. Fire emissions are retrieved from the Global Fire Emissions Database version 3 (van der Werf et al., 2010). The anthropogenic emission database used is the TNO/MACC (Kuenen et al. 2011), while biogenic emissions are calculated online (Vogel et al. 1995).
The FWI is calculated from air temperature, relative humidity, wind speed, and precipitation data obtained from the Hellenic National Meteorological Service for several sites in proximity to the fire event areas. In parallel, these data serve as evaluation for the respective model predictions. The satisfactory comparison results enable the FWI calculation using the model data over the burnt areas, where observations are missing.
The effect of these fire events on atmospheric chemistry is estimated by analyzing the predictions not only for the mainly affected primary species (carbon monoxide, methane, non-methane hydrocarbons, nitrogen oxides and elemental carbon), but also for the secondary pollutants (ozone, organic and nitrate aerosol). The competence of COSMO-ART mass predictions is evaluated by comparing PM10 outputs with published literature results.
The weather conditions during the 2007 wildfire events have already been assessed as a typical summertime meteorological regime during the latter part of the century (Founda and Gianakopoulos, 2009). Therefore, the results presented here can be viewed as representative of a fire event likely to occur by then.
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