Intercontinental forest fire plume observations at Mt. Cimone High Elevation Station (Italy)

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Atmospheric pollutants produced by forest fires and biomass burning can be transported over long distances thus affecting air-quality, atmospheric background conditions and climate of regions far away from emission source areas. Boreal wildfires play an important role in influencing the variability of tropospheric black carbon, carbon monoxide, ozone and other aerosol and trace gases are emitted or related to these events, able to influence directly and indirectly the earth climate. Large amounts of aerosol particles produced by boreal wildfires accounts for 10% of the annual anthropic black carbon emissions in the northern hemisphere and due to its direct impact on radiation, black carbon was recognised as a contributing factor of global warming. For these reasons, measurements carried out at High Mountain stations, representative of the free troposphere conditions, can provide useful information for better evaluating the role of this class of processes in affecting the climatic system. They also provide experimental data useful to support and verify Global Climate Model experiments.

In Europe, the Mediterranean basin can be affected by large plumes of forest fires and biomass burning especially during summer seasons. In this work, by analysing the observations (i.e., surface ozone, CO, black carbon, aerosol size distribution, scattering and chemical composition) carried out at the GAW-WMO Mt. Cimone station, we investigate the impact of a strong event of North African forests fire on atmospheric background composition over the Mediterranean basin. Mt. Cimone (2165 m a.s.l.), the highest peak of the Italian Northern Apennines, part of SHARE network, is one of the first prominent mountains that North African air masses, often rich of absorbing aerosol (e.g. carbonaceous particles and mineral dust) encounter during their move northward toward Europe.

During August 2007, wildfire emissions from Mount Atlas and mineral dust from Sahara were transported above the Mediterranean Sea toward North Italy and Po Basin, as confirmed by satellite data and three dimensional back-trajectory analyses. In particular, from 28 to 31 August 2007 a cloud composed by smoke and mineral dust strongly influenced the concentrations of trace gases and the properties of aerosol at Mt. Cimone, a measurement site which is considered representative for the background conditions of the South Europe. In fact. in respect to August 2007 average values, significant increases of black carbon (+147%), carbon monoxide (+46%) and ozone (+16%) concentrations were recorded during this event. The mixing of absorbing aerosol (balck carbon and mineral dust) strongly affected the atmospheric optical properties over Po Basin, thus possibly affecting the atmosphere radiative budget at the surface in the underlying Po-Basin. This was suggested by the analysis of solar radiation measurements and Aerosol Optical Properties retrievals carried out in the west Mediterranean - Tyrrhenian area. The results achieved permitted to better clarify the role of wildfires as possible source for aerosol particles, carbon monoxide and ozone in the troposphere. Since in the future it is expected that wildfire could increase in the Mediterranean basin due to more frequent and severe droughts, similar events will possibly play an important role in influencing the climate and the tropospheric composition over South Europe.

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