Geophysical Research Abstracts
Vol. 13, EGU2011-11579, 2011
EGU General Assembly 2011

Biosphere-atmosphere exchanges on a Mediterranean downy oak forest

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The Mediterranean area is place for intense summer photochemistry with high levels of atmospheric pollutants (e.g. ozone). Anthropogenic activities in this region are a significant source of hydrocarbons for the atmosphere. However natural vegetations also contribute to ozone and secondary organic aerosol production through biogenic volatile organic compound (BVOC) emissions. BVOC are a large family of molecules with a relatively short lifetime in the gas phase and whose oxidation leads to secondary pollutant formation. Therefore careful quantification of BVOC fluxes is required to asses these biosphere-atmosphere interactions. Very few studies report canopy scale measurements of BVOC emissions from Mediterranean vegetation. The present work, carried out in the frame of the Chemistry-Aerosol Mediterranean Experiment (CHARMEX), starts with tower-based BVOC flux measurements performed on a field site located south-east of France. A new prototype, called MEDEE, was built in the "Observatoire Midi-Pyrénées" in Toulouse (France) to perform trace gas flux measurements with the disjunct eddy covariance (DEC) technique. This system, coupled on-line to a Fast Isoprene sensor (Hills scientific), was deployed for a first field campaign during summer 2010 to estimate isoprene fluxes, whereas carbon dioxide and water vapor fluxes were concurrently estimated using the conventional eddy covariance (EC) technique. Other environmental parameters like ozone concentration, air temperature and moisture, atmospheric pressure, photo synthetically active radiation and radiation balance were also recorded. The various instruments were installed on a scaffolding tower with turbulence sensors and inlets for MEDEE at a height of 9.5 m above the ground and 4.5 m above the canopy. The field site was a downy oak forest at the "Oak Observatory at OHP" (O3HP, http://www.obs-hp.fr/O3HP/O3HP.shtml) where ecology studies are also conducted. Downy oak is a strong isoprene emitter and is one of the dominant tree species in the Mediterranean area.
We will present preliminary results from this field campaign along with the perspectives of the project. Our goal is to combine, in a Neural Network (NN) approach, the above canopy measured fluxes and concurrent environmental parameters, with previous available data sets, in order to derive a BVOC emission algorithm. According to the CHARMEX scientific strategy, this algorithm will be refined in the forthcoming years with the data obtained from complementary fields campaigns planned in the 2011-2013 period, and will be applied to the Mediterranean vegetations to build a more accurate BVOC emission inventory. The final step of the project is to implement this emission parameterization in coupled chemistry-dynamics models, in order to study the impact of BVOC emission on the atmospheric chemistry at the scale of the Mediterranean basin.