Geophysical Research Abstracts
Vol. 15, EGU2013-8805, 2013
EGU General Assembly 2013

The Oxidant Production over Antarctic Land and its Export (OPALE) project: An overview of data collected in summer 2010-2011 at Dumont d'Urville and 2011-2012 at Concordia.

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The need to characterize the oxidative capacity of the atmosphere in the vast region of East Antarctica motivated the OPALE initiative with investigations both at the top of the high plateau (Concordia) and at the East coast (Dumont d'Urville). The top of the East Antarctic plateau is a region where processes are suspected to differ from those already identified at the South Pole, in particular the photo-denitrification of the surface snow. For instance, in contrast to the South Pole experiencing 24-hour sunlight, the solar irradiance at Concordia has a strong diurnal cycle. Concordia is also the inland site where the longest sulfur derived aerosol record has been extracted from deep ice cores. Regarding coastal site observations, it is suspected that the oxidative capacity of the atmosphere is different in Eastern Antarctica due to the frequent occurrence of katabatic flow. This has to be considered in studies dealing with year-round observations carried out at coastal Antarctic regions where large oceanic DMS emissions take place.

The first OPALE field campaign took place in January 2011 at the coastal site of Dumont d'Urville. Measurements of OH, the sum of HO_2+RO_2, HONO, O_3, H_2O_2, CH_3OOH, and HCHO, were done. Logistical problems, which followed a helicopter accident (occurred 28^{th}October 2010), obliged us to cancel NO_x measurement at the coast. The major finding of this campaign is related to the observed high HO_x levels. With 24 h means of 2 10^6 and 3 10^8 molecule cm^{-3} for OH and RO_2, respectively, the OH and RO_2 concentrations observed at DDU are the highest ever seen at the Antarctic coast. The OH level observed at DDU cannot be simply explained by the relatively high level of ozone observed at this site in relation with an efficient transport of air masses coming from inland Antarctica. The steady state calculations suggest a RO_2 to OH conversion mechanism equivalent to 30 pptv of NO to explain observed HO_x concentrations. Such rather high NO levels were confirmed by NO_2 measurements made in January 2012.

During the second campaign carried out at Concordia in December 2011-January 2012, investigations included OH and HO_2+RO_2 together with species relevant to discuss their sources and sinks (NO, NO_2, HONO, O_3, H_2O_2, HCHO), surface meteorological parameters and physic of the boundary layer, and photolysis rates. It has to be noted that HONO was measured for the first time in Antarctica by using the long path absorption photometer (LOPAP) technique. A few balloon experiments documented ozone and NO_x changes with height. These data for which a well-marked diurnal cycle was often observed will allow a better understanding of the role of snow-pack emissions on the oxidative properties of the atmosphere overlying the East Antarctic plateau.