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Four years of atmospheric oxygen and carbon dioxide record at Ivittuut, southern Greenland

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Since September 2007, the atmospheric monitoring station of Ivittuut, southern Greenland (61.21°N, 48.17°W), has continuously recorded the atmospheric CO_2 mixing ratio, O_2/N_2 ratio and a set of meteorological parameters (temperature, pressure, relative humidity, wind speed and wind direction). Regular flask sampling provides an additional record of CO_2, CH_4, CO, N_2O, H_2, SF_6, O_2/N_2mixing ratio and CO_2 isotopes ($\delta^{18}O$ and $\delta^{13}C$), which is also used to control the quality of the CO_2 and O_2/N_2 continuous measurements.

Four years of atmospheric CO_2 and O_2/N_2 (a proxy for O_2 concentration) measurements will be presented. The seasonal and inter-annual variability will be compared with the results from other high latitude sites (Alert and Point Barrow). From 2007 to 2011, our measurements show a multi-annual trend of +2.0 ppm/year and -12.7 perMeg/year respectively for CO_2 and O_2/N_2, with annual peak-to-peak amplitude of 16.8 +/- 0.5 ppm and 135 +/- 13 perMeg. We will investigate the implications of our data in terms of APO (Atmospheric Potential Oxygen), a tracer of the oceanic component of the O_2 cycle, invariant to exchanges in the land biota, pointing out the role of the ocean in CO_2 and O_2 variability, with a special emphasis on the Atlantic ocean in our case.

Selected synoptic events associated with short term changes in atmospheric composition will be analysed in relationship with air mass origins. For this purpose, local meteorological information is completed by large scale backward simulations of air masses transportation, using the semi-Lagrangian particle dispersion model Flexpart. This analysis allows characterising the influence zones crossed by the air masses versus local contamination. The temporal variability in greenhouse gases concentration at Ivittuut is then compared and analysed with respect to changes in air masses origin, and potential charge or discharge of atmospheric greenhouse gases. We therefore perform a systematic classification of air masses by origin and regions of influence, in relationship with large scale modes of climate variability.