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Surface ozone at Mongol Els (Mongolia): Mixing ratios and surface exchange

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Measurements of surface ozone mixing ratio have been performed at a very remote temporally established field site (Mongol-Els (47.3596°N, 95.9145°E, 1462 m a.s.l.)) in a semi-arid steppe environment of western Mongolia. During 21-26 August 2009, ozone mixing ratio was continuously measured at 2 m above ground, complemented by measurements of carbon dioxide and water vapor mixing ratios, global radiation, air and soil temperatures, relative humidity, barometric pressure, wind speed and wind direction.

Ambient air was sampled (approx. 1 l/min) through a 4 m long PTFE-intake line, ozone mixing ratio has been measured by UV-spectroscopy using a mobile dual-cell ozone analyzer (2B Technologies, Boulder, U.S.A.), carbon dioxide and water vapor by a mobile non-dispersive IR-analyser (LICOR, Model 840, U.S.A.). While ozone, carbon dioxide and water vapor signals were measured every 5 seconds, 5 minute averages and standard deviations have been calculated online and stored into the data logger. The latter are used to identify and to discriminate against unrealistic low or high mixing ratios which have been due to occasionally passing plumes of vehicle exhaust and/or biomass burning gases.

Even under the remote semi-arid conditions, the temporal behavior of ozone, carbon dioxide and water vapor mixing ratios was characterized by considerable and regular diel variations. Minimum ozone mixing ratios (8-28 ppb) occurred early in the morning (approx. 06:00 local), when surface depletion of ozone (by dry deposition) can not be compensated by supply from the free troposphere due to thermodynamic stability of the nocturnal boundary layer. Late in the afternoon (approx. 17:00 local), under conditions of a turbulently well mixed convective boundary layer, maximum ozone mixing ratios (49-53 ppb) were reached.

By application of the “Nocturnal Boundary Layer Mass Balance Technique” the (night-time) dry deposition of ozone to the sparse steppe vegetation and the respiration of carbon dioxide from steppe soil will be estimated from the observed diel cycles of ozone and carbon dioxide mixing ratio, respectively.