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# Large-scale distribution of surface ozone mixing ratio in southern Mongolia: A survey

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For the first time, measurements of surface ozone mixing ratio have been performed from semi-arid steppe to arid/hyper-arid southern Mongolian Gobi desert. During 12-29 August 2009, ozone mixing ratio was continuously measured from a mobile platform (4x4 Furgon SUV). The survey (3060 km / 229171km2) started at the Mongolian capital Ulaan-Baatar (47.9582˚N, 107.0190˚E ), heading to south-west (Echin Gol, 43.2586˚N, 99.0255˚E), eastward to Dalanzadgad (43.6061˚N, 104.4445˚E), and finally back to Ulaan-Baatar.

Ambient air was sampled (approx. 1 l/min) through a 4 m long PTFE-intake line along a forward facing boom mounted on the roof of a 4x4 Furgon SUV. Ozone mixing ratio has been measured by UV-spectroscopy using a mobile dual-cell ozone analyzer (model 205, 2BTechnologies, Boulder, U.S.A.). While ozone signals were measured every 5 seconds, 1 minute averages and standard deviations have been calculated on-line and stored into the data logger. The latter are used to identify and to discriminate against unrealistic low or high ozone mixing ratios which have been due to occasionally passing plumes of vehicle exhaust and/or biomass burning gases, as well as gasoline (at gas filling stations).

Even under desert conditions, the temporal behaviour of ozone mixing ratio was characterized by considerable and regular diel variations. Minimum mixing ratios (15-25 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 (45-55 ppb) were reached. Daily amplitudes of the diel cycle of ozone mixing ratio were in the order of 30 ppb (steppe), 20 ppb (arid desert), to approx. 5 ppb (hyper-arid Gobi desert (Shargyn Gobi)).

Ozone surface measurements were compared to gridded ozone mixing ratios calculated by the global ECHAMMESSy model. Despite the model data's nature and the rather coarse spatial resolution (approx. 220 km) of the MESSy model, the agreement between (late afternoon) measured data and modelled data is surprisingly good.

The attempt is made to estimate the (night-time) dry deposition of ozone to steppe and desert soils from the observed diel cycles of ozone mixing ratio by application of the "Nocturnal Boundary Layer Mass Balance Technique".