Observations and modelling of energy fluxes above Nam Co lake and the surrounding grassland on the Tibetan Plateau

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Spatial heterogeneity poses a major challenge for modelling and upscaling of energy and matter exchange between the atmosphere and the underlying surface. For this task high quality flux measurements from different surface types are a prerequisite, but these are scarce on the Tibetan Plateau. Therefore Eddy Covariance (EC) and energy balance measurements were conducted from June 27th to August 8th, 2009 at the shoreline of the Nam Co lake (Fig. 1). According to wind direction, the measurements cover a more humid grassland (land) and the lake surface (lake), providing the first EC data over lake on the TP as far as we know.

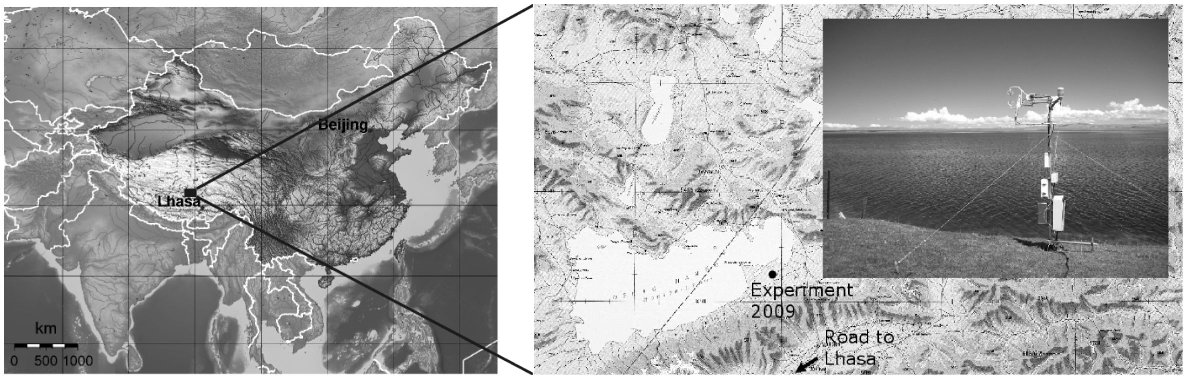

Figure 1: Location of the NamCo-2009 experiment and setup of the EC station

Additionally four component radiation measurements and soil measurements were conducted for the grassland as well as one lake temperature sensor at 20cm depth near the EC devices. Data processing includes state-of-the-art flux corrections, quality filtering and footprint analysis. Furthermore the fluxes were separated into land and lake fluxes, for the land surface the energy balance closure (EBC) was estimated. Covering 70% of the available energy, the EBC is in a range, which can be expected for a system influenced by a local land–sea circulation. Therefore the fluxes were corrected for closure by preserving the Bowen ratio [1]. For the lake surface an hydrodynamic multilayer (HM) model [2] is utilized, including a correction term for shallow water [3]. As a representative of the soil-vegetation-atmosphere transfer models the one-dimensional Surface Energy and Water Balance scheme SEWAB [4] was conducted to simulate the turbulent fluxes over the land surface. The respective parameter were estimated by a combination from the in-situ measurements, laboratory

investigation of soil characteristics and literature values. Both models were forced with standard meteorological in-situ measurements.
Land surface model simulations show good performance, although there are only few observations left after quality filtering, separation and energy balance closure correction. Lake surface modelling was handicapped by a lack of detailed water temperature and lake depth data, prohibiting a proper energy balance estimate of the observations and a reliable water depth for the shallow water term in HM. A realistic, but rough guess of 2m depth within the footprint of the EC measurements yields reasonable coherence to the observations with a slight bias for Q_E. The diurnal cycles of simulated and observed fluxes underpin sharp difference in fluxes between both surfaces and the ability of the simulations to resemble the fluxes and to serve as high standard gapfilling schemes (Fig. 2).

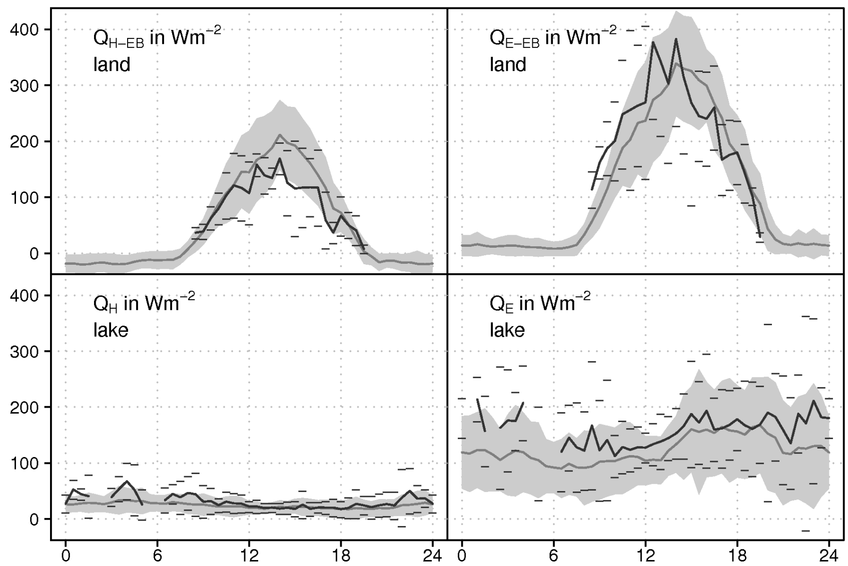

Figure 2: Mean daily cycles of the sensible heat flux Q_H and the latent heat flux Q_E for the whole measurement period, the observations are energy balance corrected (EB) in case of land surface (*Upper panel*). Observed fluxes are denoted by black solid lines, the horizontal bars indicate the respective standard deviation; Grey lines show the modelled fluxes with standard deviations given by the grey shaded area.

The surface separated and gapfilled turbulent fluxes provide essential information for modelling within the DFG SPP 1372, Tibetan Plateau (TiP) and for upscaling within the CEOP-AEGIS project (EU-FP7, grant nr: 212921).

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