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Intraday evaporation and heat fluxes variation at air-water interface of extremely shallow lakes in Chilean Andean Plateau

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Salars are landscapes formed by evapo-concentration of salts that usually have extremely shallow terminal lagoons (de la Fuente & Niño, 2010). They are located in the altiplanic region of the Andes Mountains of Chile, Argentina, Bolivia and Peru, and they sustain highly vulnerable and isolated ecosystems in the Andean Desert.

These ecosystems are sustained by benthic primary production, which is directly linked to mass, heat and momentum transfer between the water column and the atmosphere (de la Fuente, 2014). Despite the importance of these transport processes across the air-water interface, there are few studies describing their intraday variation and how they are influenced by the stability of the atmospheric boundary layer in the altiplano.

The main objective of this work is to analyze the intraday vertical transport variation of water vapor, temperature and momentum between the atmosphere and a shallow water body on Salar del Huasco located in northern Chile (20°19’40"S, 68°51’25"W). To achieve this goal, we measured atmospheric and water variables in a campaign realized on late October 2015, using high frequency meteorological instruments (a sonic anemometer with an incorporated infrared gas analyzer, and a standard meteorological station) and water sensors.

From these data, we characterize the intraday variation of water vapor, temperature and momentum fluxes, we quantify the influence of the atmospheric boundary layer stability on them, and we estimate transfer coefficients associated to latent heat, sensible heat, hydrodynamic drag and vertical transport of water vapor.

As first results, we found that latent and sensible heat fluxes are highly influenced by wind speed rather buoyancy, and we can identify four intraday intervals with different thermo-hydrodynamic features: (1) cooling under stable condition with wind speed near 0 from midnight until sunrise; (2) free convection with nearly no wind speed under unstable condition from sunrise until midday; (3) forced convection with high wind speed (near 15 m/s) and unstable condition close to neutral condition from noon to sunset; and (4) cooling under unstable conditions with significant wind speed, from sunset until midnight.