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# Evapotranspiration enhanced by air transport in the Atacama Desert

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In the Atacama Desert (>100,000 km2), evapotranspiration (ET) is confined to highly localized areas such as wetlands, irrigated areas and open water bodies with spatial scales of typically 10 km2 or smaller. In these regions characterized by heterogeneous land conditions and complex topography, ET is not only controlled by the local partition of the available net radiation in SH-LvE, but also it is largely driven by meso-scale atmospheric circulations. To understand which processes determine the ET diurnal evolution, it is necessary to apply a methodology that combines comprehensive field experiments with a hierarchy of models.

To quantify how the main physical processes drive ET in a shallow lake of a salt flat (Salar del Huasco) surrounded by extremely dry conditions, a two-week field experiment was performed during November 2018. The Salar del Huasco is located between 3790 and 4200 m ASL in the Atacama Andean Plateau, northern Chile (22,3°S - 68,8°W). The measurement strategy was based on spatially distributed surface measurements and upper atmospheric observations. First, we installed a network of Eddy Covariance stations and an Optical Microwave Scintillometer to characterize the surface turbulent energy balance under three different surfaces: desert, water and wet-salt. Second, to study the relevance of heat and moisture advection, two transects consisting of four meteorological stations each deployed along the North-South and East-West orientations following the predominant wind regimes. Simultaneously, vertical profiles of meteorological state variables were gathered by drone flights (up to 500 m above ground), radiosondes (up to 10 km) and tethered balloons (up to 600 m above ground). The analysis and interpretation of these observations is further supported by 1 x 1 km2 WRF simulations (Weather Research Forecasting) and the 1D mixed layer model CLASS (Chemistry Land-surface Atmosphere Soil Slab) that allows a more conceptual approach on land-atmospheric interactions.

Our preliminary analysis enables us to identify two meteorological regimes that govern ET: (a) Radiative-convective regime that occurs during the morning transition (<12:00 LT). During this period, the diurnal variability of the state variables is mainly controlled by surface processes and the subsequent development of a convective boundary layer (CBL) that drives entrainment. (b) Synoptic-mechanical regime driven by the entrance of up-valley moist and cold air masses characterized by strong winds (up to 20m/s at 2m) at around 12:00 LT which caps abruptly the development of the CBL. Whereas during the radiative-convective regime ET is small (<50W/m2 over water) with the changed of regime both ET and sensible heat flux increase dramatically (up to 500W/m2 and 100W/m2 over water). The study shows the sensitivity of the surface energy (im-)balance to the temporal transition between local scales and large-atmospheric scales in regions characterized by extreme surface contrasting conditions.