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Climate of a high altitude lake basin and lake-atmosphere interactions – observations and atmospheric modelling

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Large lakes and inland water bodies have a significant influence on their local climate. The hydrometeorological effect of inland water bodies is varying greatly between seasons, years and contrasting climatic conditions. It is generally hypothesised that the cool air above the lake will inhibit convection in summer; conversely, the relatively warm lake in late-autumn will initiate convective instability that may generate strong snowfalls. In this study we focus on the lake Nam Co (2'000 sq.km, 4700 m a.s.l). Located in a transition zone between the continental climate of Central Asia and the Indian Monsoon system, the Nam Co lake is covered by ice from mid-January to end of April and reaches surface temperatures of 13 °C in summer.

We address three main research questions: (i) what is the influence of the Nam Co lake on local meteorological variables over the course of the year, (ii) what is the impact of the timing of the lake freezing on late-autumn and winter precipitation fields and (iii) how will the influence of the lake evolve in the context of a changing climate?

In order to answer these questions, we combine satellite observations of lake surface temperatures from the ARC-Lake product and atmospheric modelling using the WRF model. The spatio-temporal variability of temperature, wind and precipitation fields during the last decade are analyzed using high-resolution (up to 2 km) simulations. The positive impact of the assimilation of the lake surface temperatures for the initialization of the model is analysed and discussed, as well as the combined influences of the large scale (westerlies, monsoon) and local (orographic) forcings.

Our results are of relevance for any regional climate or hydrological modelling study and bring new insights in our understanding of the complex hydrometeorological processes taking place on the Tibetan Plateau.