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Closing the water budget of a shallow lake and the eco-hydrological interactions and responses in a semi-arid catchment

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In semi-arid regions, ecology of shallow lakes is particularly sensitive to any rapid changes in the water fluxes that affect the water level of the lake. Water level fluctuations may have an overriding effect on the physical (underwater light conditions, residence time) and the chemical characteristics (pH, salinity, nutrients) of shallow lakes which in turn, would be reflected in the ecology of shallow lakes, especially on the submerged plant development.

Therefore, understanding how the change in the water level of a shallow lake is controlled by hydrological processes at the catchment scale is of particular importance. Such an understanding would not be easily achieved by only defining the water balance for the lake itself but rather necessitates getting insight into the processes governing the water fluxes at the catchment scale and finally establishing and testing a water balance model for the whole catchment.

In this research, our first aim is getting insight into the hydrological fluxes and processes together with their spatio-temporal dynamics in the semi-arid catchment of Lake Beysehir through the help of a novel synergy between water balance modelling and remote sensing approaches. Then, a closer look at the eco-hydrological feedbacks among climate-vegetation and groundwater in the catchment is targeted at a local scale to understand the responses of natural biota to the changing hydrological (groundwater) conditions and vice versa in the semi-arid context.

We would like to investigate the challenges and uncertainties to be faced when closing the water budget in this semi-arid catchment, such as how to handle the difference in the sub-surface and surface water catchment borders and its significance for estimating the groundwater contribution in a karst dominated geology, and also the implications on the surface water dynamics. Besides, some initial findings on the main controlling mechanisms and fluxes for the lake's water balance would be shown. Finally, the role of eco-hydrological feedbacks at the local scale in affecting the water balance of the catchment would be elaborated, while also considering the responses of biota to the changing hydrological conditions in water limited areas.

The study area, Lake Beysehir catchment, is a meso-scale catchment with a surface area of 4,100 km2 located in a transition area between Mediterranean region and inner Anatolia of Turkey, and characterized by a long term average of around 400 mm/yr precipitation and karst geological conditions, while Lake Beysehir itself covers approximately a surface area of 650 km2 (changing between 550 – 750 km2), with an average depth of 6m (fluctuating between 5 – 10 m).