Hydrological differentiation and spatial distribution of high altitude wetlands in a semi-arid Andean region derived from satellite data

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High Altitude Wetlands of the Andes (HAWA) are a unique type of wetlands within the semi-arid high Andean region. Knowledge about HAWA has been derived mainly from studies at single sites within different parts of the Andes at only small time scales. On the one hand HAWA depend on water provided by glacier streams, snow melt or precipitation. On the other hand, they are suspected to influence hydrology through water retention and vegetation growth altering stream flow velocity. We derived HAWA land cover from satellite data at regional scale and analysed changes in connection with precipitation over the last decade. Perennial and temporal HAWA subtypes can be distinguished by seasonal changes of photosynthetically active vegetation (PAV) indicating the perennial or temporal availability of water during the year. HAWA have been delineated within a region of 11000\,\unit{km^{2}} situated in the Northwest of Lake Titicaca. The multi temporal classification method used Normalized Differenced Vegetation Index (NDVI) and Normalized Differenced Infrared Index (NDII) data derived from two Landsat ETM+ scenes at the end of austral winter (September 2000) and at the end of austral summer (May 2001). The mapping result indicates an unexpected high abundance of HAWA covering about 800\,\unit{km^{2}} of the study region (6\,\%). Annual HAWA mapping was computed using NDVI 16-day composites of Moderate Resolution Imaging Spectroradiometer (MODIS). Analyses on the reletation between HAWA and precipitation was based on monthly precipitation data of the Tropical Rain Measurement Mission (TRMM~3B43) and MODIS Eight Day Maximum Snow Extent data (MOD10A2) from 2000 to 2010. We found HAWA subtype specific dependencies to precipitation conditions. Strong relation exists between perennial HAWA and snow fall (\unit{r^{2}}:\,0.82) in dry austral winter months (June to August) and between temporal HAWA and precipitation (\unit{r^{2}}:\,0.75) during austral summer (March to May). Annual spatial patterns of perennial HAWA indicated spatial alteration of water supply for PAV up to several hundred metres at a single HAWA site.