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Using multi-temporal Sentinal-2 imagery for mapping Andean meadows and surface soil moisture in central Chile

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In the Rio Maipo watershed, situated in central Chile, mining activities are the main factor impacting Andean meadows, through the consumption and exploitation of water and land. As wetlands are vulnerable and particularly susceptible to changes of water supply, alterations and modifications in the hydrological regime have direct effects on vegetation cover. In order to better understand this ecosystem, as well as for conservation planning and resource management, there is a strong need for spatially explicit and update wetland ecosystem assessment. However, there is a lack of baseline dataset and state of knowledge on these habitats.

During the last decades remote sensing as evolve as an efficient tool for mapping and monitoring wetland ecosystems at different temporal and spatial scales. Accurate and up-to-date mapping and assessment of wetlands allows monitoring the changes in wetlands' vegetation due to natural and/or anthropogenic disturbances. New freely available spaceborne imagery, like Sentinel-2, supports long term monitoring on a high spatial resolution (10 m).

The main aim of this work was to evaluate the potential of multi-temporal Sentinel-2 images in the detection and monitoring of water status of Andean meadows with anthropic disturbances. For these tasks we used bias support vector machines (BSVM), a one-class classifier to map and monitor meadow areas, and the support vector machines regression (SVMR) to estimate surface soil moisture (i.e. top 30 cm). BSVM produces probability maps of the class of interest, were only data of this class is needed as input of the model. One-class classifiers are well suited for situations where the numbers of the training samples from the class of interest is small and/or cover a small fraction of the area to be classified.

We found that BSVM was capable to classify the meadow areas with an overall accuracy between 65% and 96%. Meanwhile, surface soil moisture prediction using SVMR reached r^2 values between 0.2 and 0.62, while the root mean square errors were between 2.19 g/g and 4.8 g/g.

We concluded that BSVM and SVMR are suitable for Andean meadow and surface soil moisture mapping, producing reliable results with few samples. Moreover, Sentinel-2 allows a good understanding of variability within the meadows, and gives a high spatial and temporal resolution to assess future changes and establish whether the site is effectively drained or still maintains the wetness require to preserve these ecosystems.