

EGU21-8330

<https://doi.org/10.5194/egusphere-egu21-8330>

EGU General Assembly 2021

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Vegetation indices as a proxy for spatio-temporal variations in water availability in the semi-arid Rio Santa valley (Callejón de Huaylas, Peru)

Lorenz Hänen¹, Cornelia Klein², Fabien Maussion², Wolfgang Gurgiser², and Georg Wohlfahrt¹

¹University of Innsbruck, Department of Ecology, Austria (lorenz.haenchen@uibk.ac.at)

²University of Innsbruck, Department of Atmospheric and Cryospheric Sciences

In the semi-arid Peruvian Andes, the agricultural growing season is mostly determined by the timing of the onset and cessation of the wet season, to which annual crop yields are highly sensitive. Recently, local farmers in the Rio Santa valley (Callejón de Huaylas) bordered by the glaciated Cordillera Blanca to the east and the unglaciated Cordillera Negra to the west, reported increasing challenges in the predictability of the onset, more frequent dry spells and extreme precipitation events during the wet season. Previous studies based on time-series of local rain gauges however did not show any significant changes in either timing or intensity of the wet season. Both in-situ and satellite rainfall data for the region lack the necessary spatial resolution to capture the highly variable rainfall distribution typical for complex terrain, and are often of questionable quality and temporal consistency. As in other Andean valleys, there remains considerable uncertainty in the Rio Santa basin regarding hydrological changes over the last decades. These changes are of a great concern for the local society and the lacking knowledge about changes in water availability (i.e. rainfall) and water demand (i.e. land use practices) hinder the assessment of relevant factors for the development of adaption strategies.

The over-arching goal of this study was to better understand variability and recent changes of plant growth and rainfall seasonality and the interactions between them in the Rio Santa basin. Specifically, we aimed to illustrate how satellite-derived information on vegetation greenness can be exploited to infer a robust and highly resolved picture of recent changes in rainfall and vegetation across the region: As the semi-arid climate causes water availability (i.e. precipitation) to be the key limiting factor for plant growth, patterns of precipitation occurrence and the seasonality of vegetation indices (VIs) are tightly coupled. Therefore, these indices can serve as an integrated proxy of rainfall. By combining a 20 year time series of MODIS Aqua and Terra VIs (from 2000 to today) and datasets of precipitation (both remote-sensing and observations) we explore recent spatial and temporal changes in vegetation and water availability by combining VIs timeseries and derived land surface phenology (LSP) with measures of wet season onset and cessation from rainfall data. Furthermore, we analyse the interaction of El Niño Southern Oscillation (ENSO) and the wet and growing season.

We find spatially variable but significant greening over the majority of the Rio Santa valley domain.

This greening is particularly pronounced during the the dry season (Austral winter) and indicates an overall increase of plant available water over time. The start of the growing season (SOS) is temporally highly variable and dominates the variability of growing season length over time. Peak and end of season (POS, EOS) are significantly delayed in the 20 year analysis. By partitioning the results into periods of three stages of ENSO (neutral, Niño, Niña) we find an earlier onset of the rainy and growing season and an overall increased season length in years associated with El Niño.