Comparing peasants' perceptions of precipitation change with precipitation records in the tropical Callejón de Huaylas, Peru

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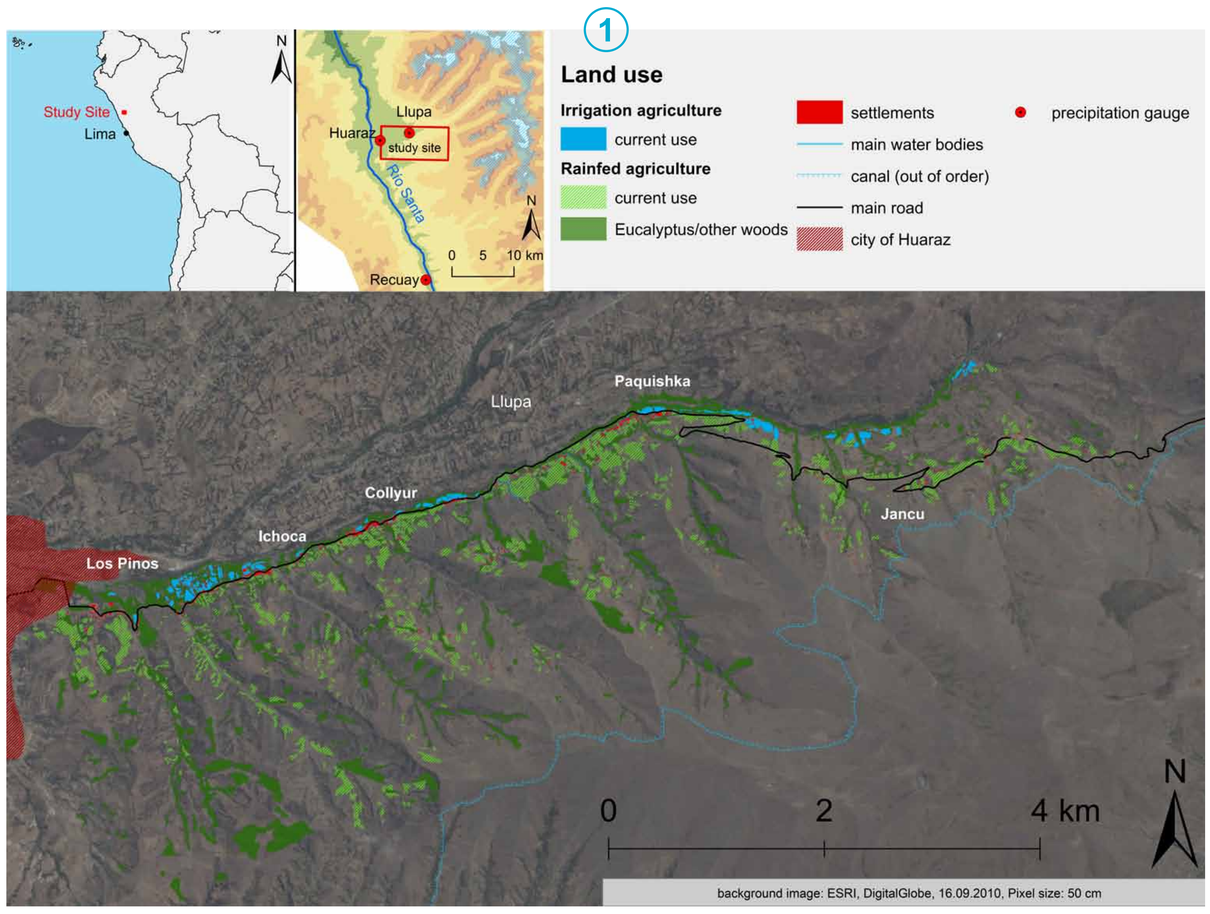

We are working in an interdisciplinary framework on the interface of water availability and water demand in the tropical Cordillera Blanca (Peru), famous for its strongly glaciated mountains. Surprisingly, we found that many farmers in the small, rural settlements on the eastern slopes above the city of Huaraz (see Figure 1) have no access to (glacier) river-fed irrigations systems. Most peasants totally depend on rain-fed agriculture and thus, are very sensitive to any potential changes in precipitation regimes. Generally, the hygric seasonality is very strong in the region with very little rain from June to the end of August (see Figure 2), when precipitation gets more frequent again and farmers traditionally prepare their fields and start sowing (see Figure 3). In the past decade(s), farmers experience increasing troubles in agricultural production (see farmer on the right), which they mainly atribute to changed precipitation patterns.

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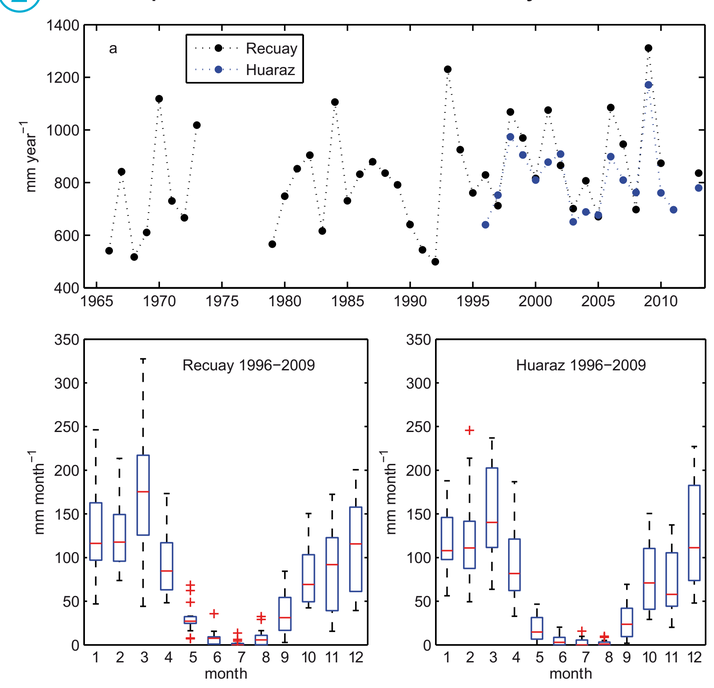


We were able to build time series of daily precipitation sums from two nearby sites (Recuay, 1964-2013; Huaraz, 1996-2013), mainly calculated from half-daily measurements.

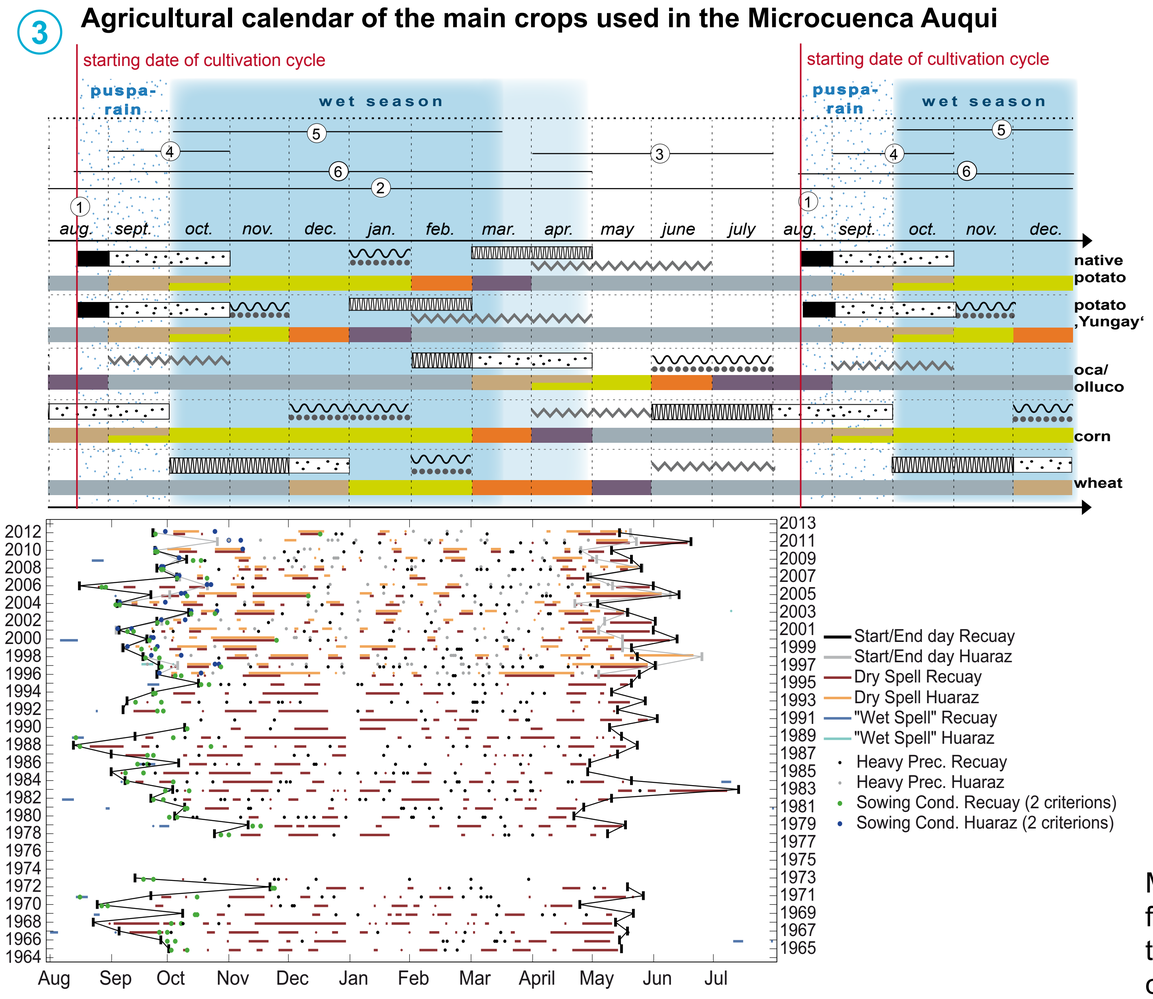
We also tried to use precipitation output from „classical" atmospheric model products (e.g. ERA-interim) but found, that the day-to-day variability in local rainfall is not well represented (compared to the measurements). Given the complex topography and the coarse model resolution, this might not be surprising but worth for future efforts, e.g. applying limited area modelling strategies combined with automatic, high resolution ground measurements.

A comparison of the precipitation measurements in Huaraz and Recuay with a 10 year period of overlapping, weekly „onside" records yielded satisfying similarity.

- *In former times rainy season started in August.*
- *The beginning, duration, and end of the wet and dry seasons have become more variable and, in general, rainfall has become more irregular, which complicates successful farming overall.*
- *The occurrences of hail and heavy rain events have become more frequent during September and October, when corn and potato are in their sensitive phase of germination and initial growth, but also throughout the entire wet season, causing high surface runoff and increased soil erosion*
- *Ground frost has become more frequent during September and October, damaging the crops in the early vegetation period.*

The statements were derived from 81 interviews with peasants and local stakeholders

3 **Agricultural calendar of the main crops used in the Microcuenca Auqui**



To simplify the analysis of the annual precipitation cycles from an agricultural perspective, we defined several criterions to derive features from daily precipitation records. Such features are e.g. the onset of the wet/dry season, the first period with good sowing conditions after the dry season or dry spells during the wet season, the latter ones marking periods were germination and plant growth might be threaten due to water scarcity.

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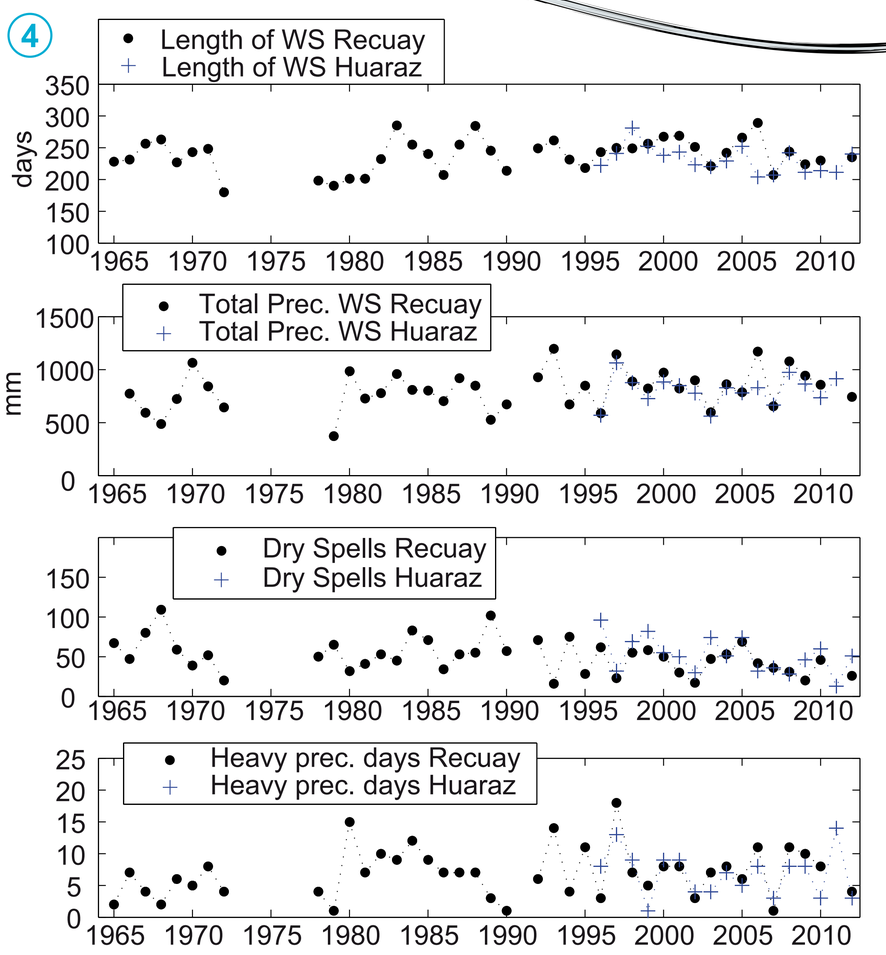

Motivated by the perceived changes (see statements above), we analyzed all agricultural features derived from the available precipitation data and found pronounced year-to-year variability (see Figure 4) but no trends in the dates (e.g. in the onset day of the wet season or the day with the first good sowing conditions) or frequencies (e.g. heavy precipitation day). We neither found robust evidence for increased year-to-year variability in any feature during the last decade.

The accuracy, temporal and spatial resolution of our measurements could partly explain the difference between human perceptions and our results (especially for heavy precipitation events or very light rain fall events in August). However, there are also other reason like deforestation or changes in crop types which could impact soil water availability/demand and thus, agricultural success. To better deal with the pronounced rainfall variability, farmers would very likely benefit from improved weather forecast.

FWF Der Wissenschaftsfonds.

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