Interdisciplinary analysis of perceived precipitation variability and temperature trends in the agricultural Cochabamba region, Bolivia

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Introduction

Changing climatic conditions pose a major threat to continuity of agricultural production in the Bolivian Cochabamba region, along with the processes of rapid urbanization and soil erosion. Local perceptions of global environmental change are increasingly acknowledged in the scientific discussion. Yet, studies comparing local knowledge with precipitation and temperature data analyses in the Andean mountain regions are scarce.

Data and methods

The qualitative analysis of human perceptions is based on 51 semi-structured interviews with small-scale farmers, which were conducted in three peri-urban communities located outside the cities of Cochabamba and Sacaba in 2013, 2014, and 2016. Additional data was collected during workshops using participatory techniques.

The climatic analyses were conducted by using daily precipitation and temperature records from the station of Cochabamba Airport (1949 to 2016). Following the above-mentioned perceptions, daily (highest available resolution over the measurement period) precipitation sums, trend analyses of minimum and maximum temperatures as well as relative humidity were conducted.

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Study area

Results and conclusions

Farmers' perceptions

	Perceived changes in weather conditions	Observed impacts caused by the changes
Temperature	- In general, temperatures are warmer during days - Sunshine and heat is stronger - There are colder temperatures at nights	- Crops are dried out - There are more pests and diseases, requiring more frequent use of pesticides - Harvests might be lost because of frost
Precipitation	- Amount of precipitation is decreasing - During the rainy season, rainfalls appear in a less regular pattern - Rainy season onset is often delayed from September/October even until December/January - Rainy season may end earlier than before	- Irrigation is required more often - Rain-fed fields are left fallow more often due to lack of water - Crops might be dried out after planting, and it is therefore difficult to plan when to plant
Wind	- Slightly stronger winds	- Maize, wheat, and barley may be falling over

Annual precipitation cycles

The peasants have experienced decreasing amount of precipitation, less regular patterns of rainfalls, and delays in rainy season onset. They also report warmer temperatures and stronger heat during days and colder temperatures at nights.

Trend analyses of the precipitation data show no significant trend on annual scales and over the entire time period (1949 - 2016) but we found some interesting patterns and significant trends (increasing as well as decreasing) for individual months and shorter time periods. Measured min. and max. temperatures are increasing throughout the entire period and in all months.

All climatic analyses are expected to be subject to considerable uncertainty due to changed sensors and measurement methods. There may be potential other reasons besides climate affecting smallholder agriculture, such as environmental degradation, the proximity of growing cities, increasing household involvement in transnational migration, and decreasing plot sizes through inheritance.

Monthly temperature evolution

Monthly precipitation evolution

Further information

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