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# Shrinkage of Tropical Glaciers in Peru

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# Shrinking of Tropical Glaciers in Perú

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## Abstract

Over the past few decades, global atmospheric temperatures have increased at an alarming rate, which has a significant impact on glaciated regions of the world. Tropical glaciers represent 1/6<sup>th</sup> of all the glaciers in the world and provide key water sources for many millions of inhabitants, including the Andes region of South America. Increasing temperatures and humidity due to anthropogenic climate change means there will be more rain and less snow, causing glaciers in the tropics to shrink – without the key inter-seasonal snow accumulation, many are expected to disappear within the next 60 years. Advances in satellite imagery allow us to study the shrinking glaciers remotely. We use GIS software (ArcGIS) and satellite imagery (Landsat missions) over the past 20 years to delineate glacial areas change over time – affording us the opportunity to generate a first-attempt trend in glacier size. We use acquired satellite imagery from the Landsat missions at regular intervals beginning in 1985. Our preliminary results reveal an overall decrease in glaciated area over the past few decades.

## Methodology

- Access Landsat imagery through earthexplorer.gov data clearinghouse
- Identify study area and select image dates
- Using the Red and SWIR bands, generate a composite image

### Glaciated Area

Where Red/SWIR is >0, but <30.  
The average range being 1-20.

- set NULL values that are not ice
- Reclassify Raster-grouping values that are ice as one
- Create shape file overlay and extract by mask
- Calculate glaciated area

Figure1: Glaciated area (in blue) 2018, overlain on 2018 truecolor



Figure 2: Glaciated area (in blue) 1985, overlain on 1985 truecolor



Figure3: Glaciated area (light blue). 1995 overlain on 1995 truecolor

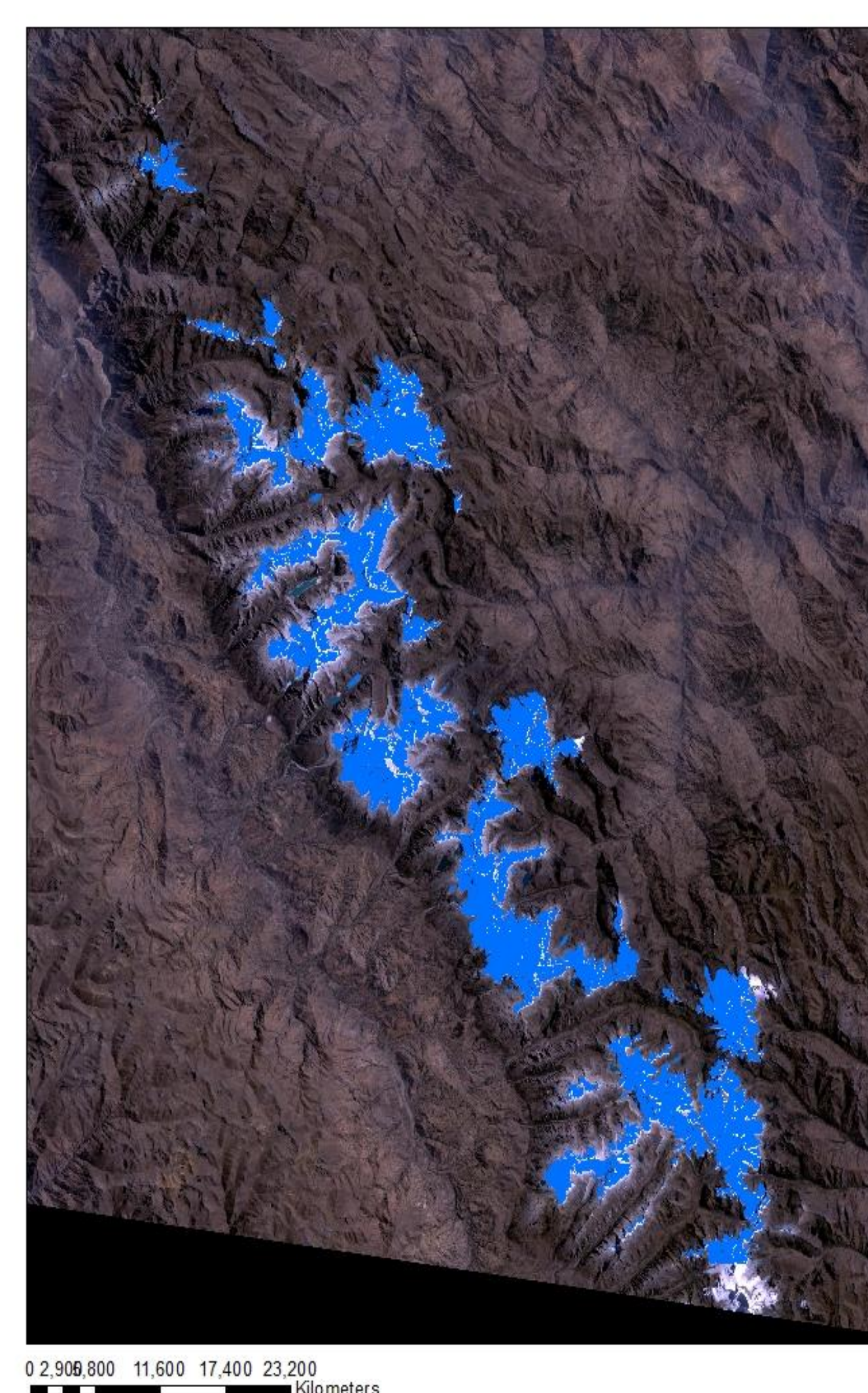
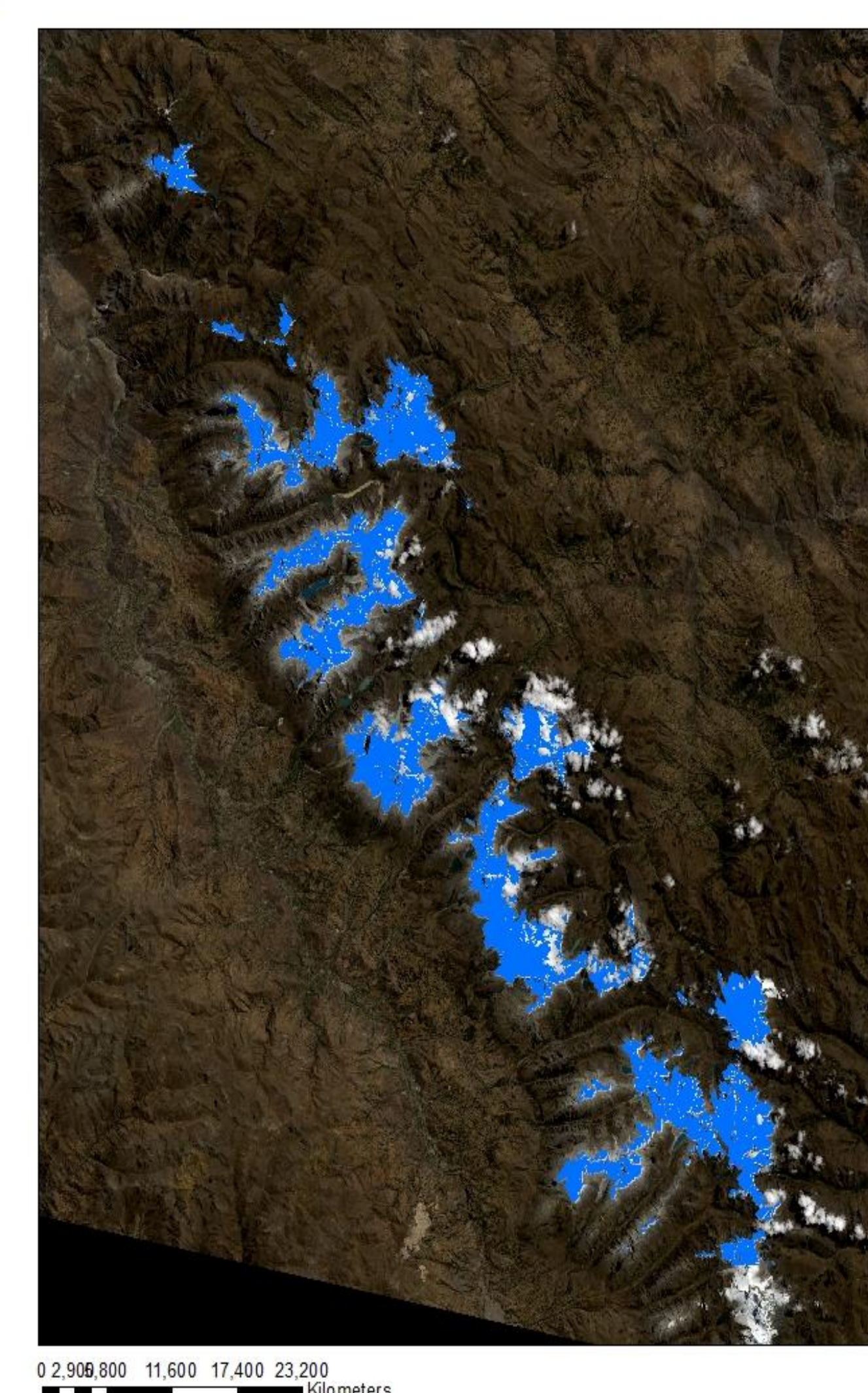


Figure 4: Glaciated area (in blue) 2007, overlain on 2007 truecolor



Figure 5: Glaciated area (in blue) 2015, overlain on 2015 truecolor



Glaciated Area and Precipitation

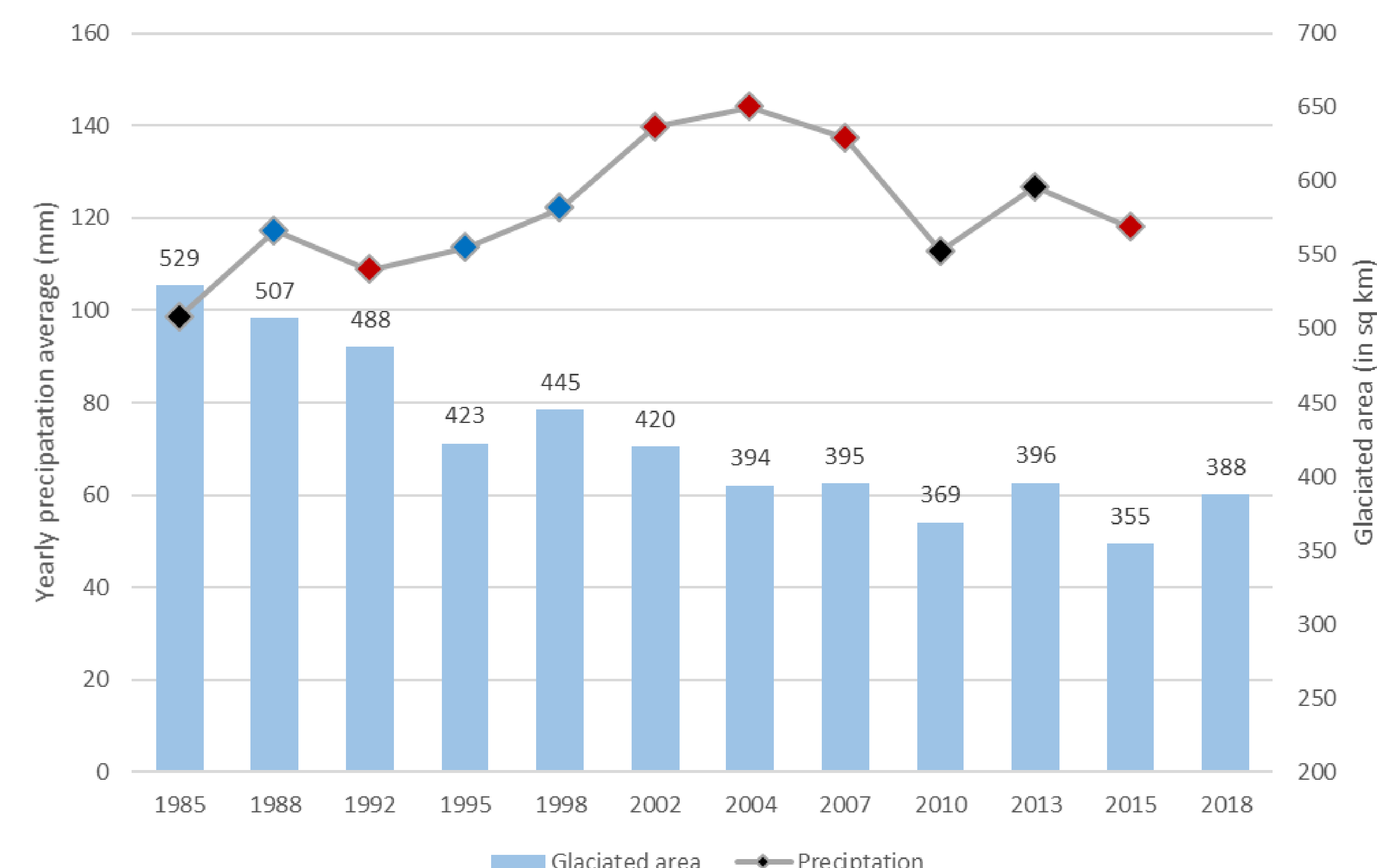


Figure 6: Change in glacier surface area (km<sup>2</sup>) across an average of three year intervals beginning in 1985 -- to present day. On the secondary axis yearly average rainfall is denoted and identified by El Niño (red), La Niña (blue), or Neutral (black) markers.

## Conclusions

The tropical glaciers of the Cordillera Blanca in Peru are shrinking at an accelerating rate (26 km<sup>2</sup> per year). Although prior research has shown such decreases in glaciated mass in the tropical regions, the work is typically done at the individual glacier scale. This work seeks to aggregate the findings over an entire mountain range. This information would prove extremely valuable for future research and endeavors and can be validated using in-situ data gathered at each individual glacier.

## Acknowledgements

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## Selected References

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