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Diurnal Cycle of convection in the Peruvian Highlands

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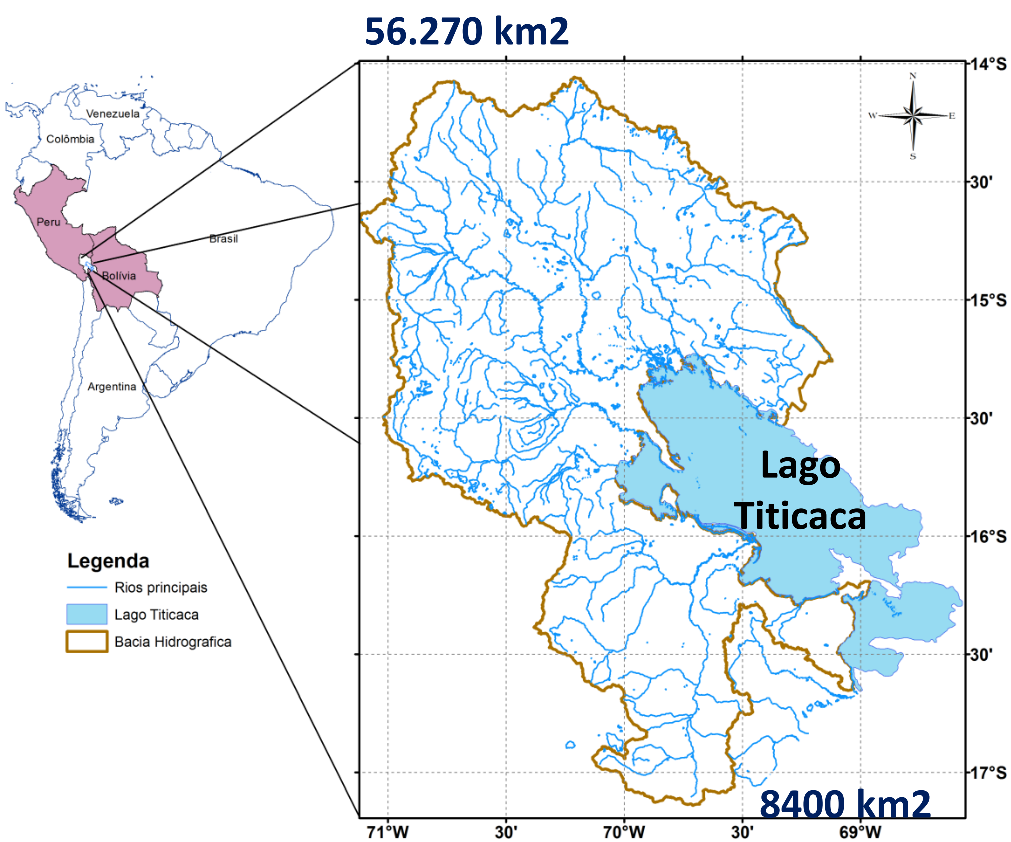
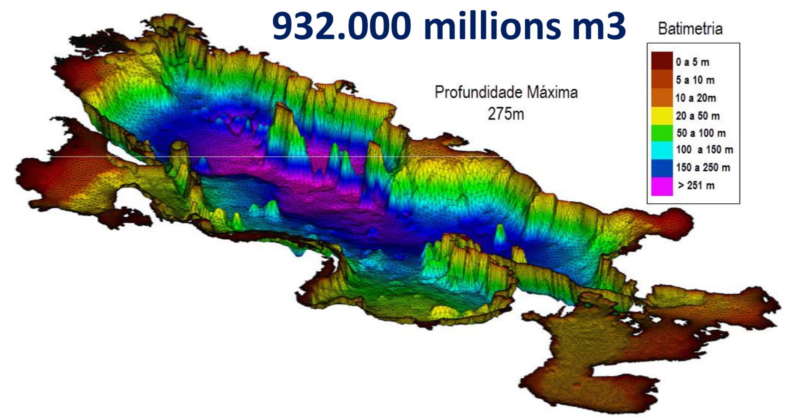
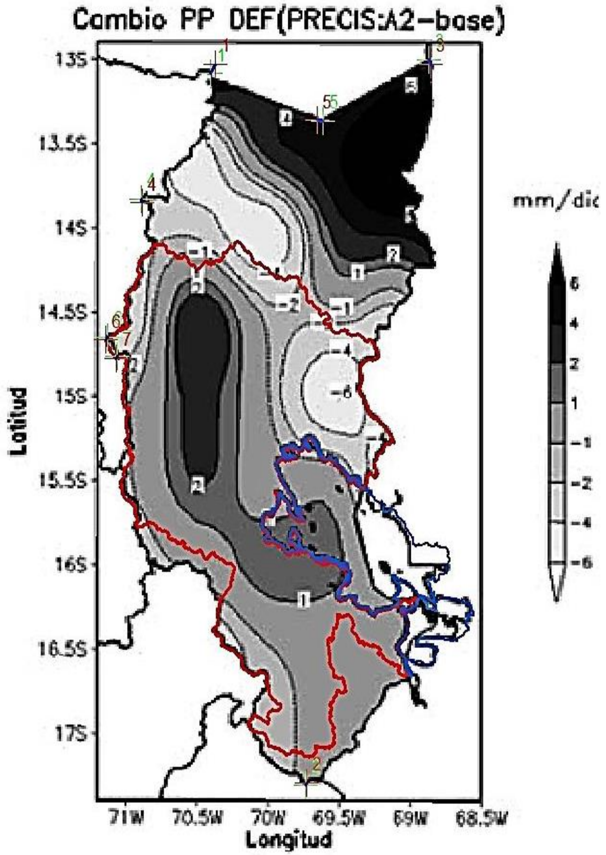
Introducción





The Peruvian Altiplano Region (PAR), is a geographical area of high plateau morphology, located on the 3810 meters of altitude. Ronchail et al. [1]

Introducción



Drought is an extreme global climate event with major societal and economic consequences for millions of people in the world, especially in arid and semi-arid regions[7,8]. How patterns of drought are changing as the climate changes has been the focus of several recent studies, but the answer remains unclear.

Rainfall may decrease slightly over the PAR, but the patterns are not clearly defined. For example, in austral summer, in the southwestern part of the TL, a decrease of the precipitation up to 6 mm / day is observed [2].

Introducción

The main objective of the study is to study and understand the development of the CDC in the Lake Titicaca basin in order to contribute to the prediction of severe precipitation events in regions that do not have weather stations. Based on high spatio-temporal resolution data from the CPC Morphing Technique – CMORPH, Joyce et al [9], for the period 2002-2014.

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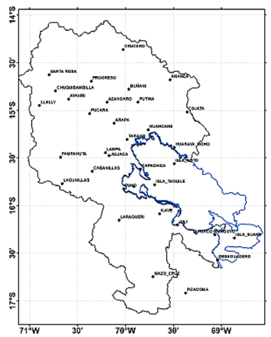
Experiments

Diurnal cycle of convection

Data

CMORPH



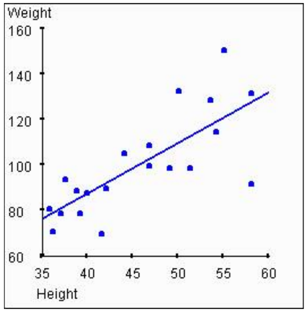
Observed Data*

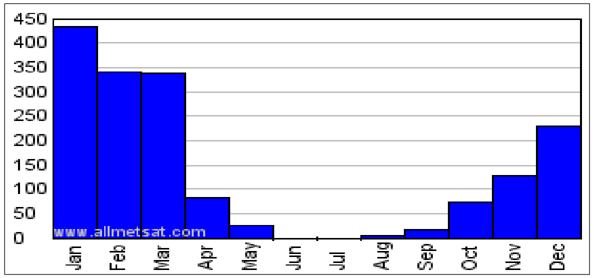
2002 - 2014

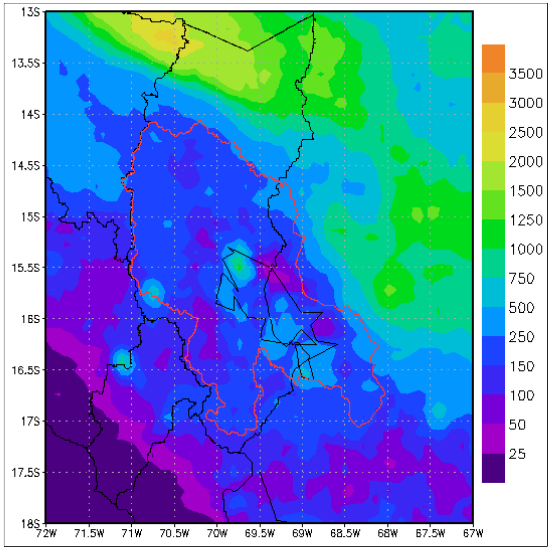
Statistics

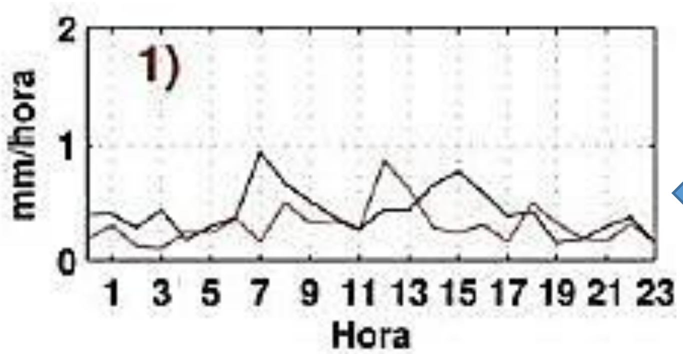
- Correlation
- BIAS
- Cuantitative statistics

Seasonal (DJF) y Annual









(*) 34 stations

Experiments

Diurnal cycle of convection

↓

ARPS

↓

Study of cases

- **15 – 19 January 2014**
- 27 – 31 January 2014
- 11 – 15 January 2015

Variables explicitly simulated by the ARPS. Source: Vemado, 2012

Variable	Units
Zonal Component of the Wind (u)	ms^{-1}
Southern Component of the Wind (v)	ms^{-1}
Vertical Component of the Wind (w)	ms^{-1}

Variables calculated in the post processing

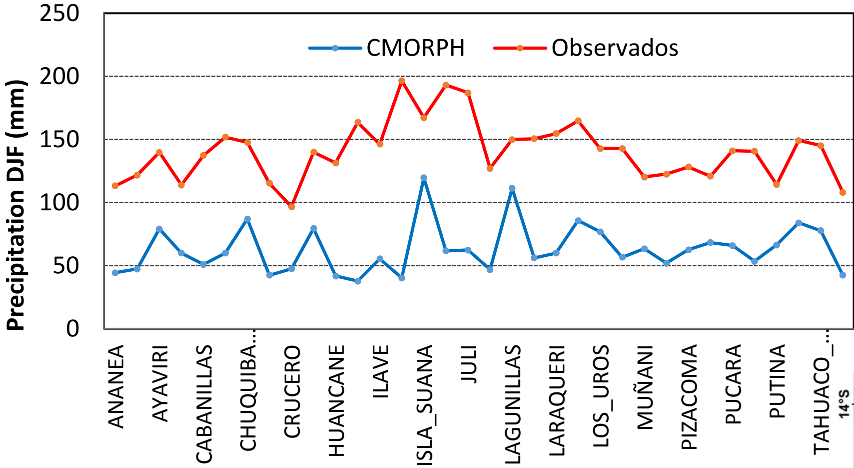
Variable	Units
Relative humidity (UR)	%

The ARPS system foresees the time with up to 48 hours in advance. The ARPS uses a high performance computer system in parallel processing.

Results

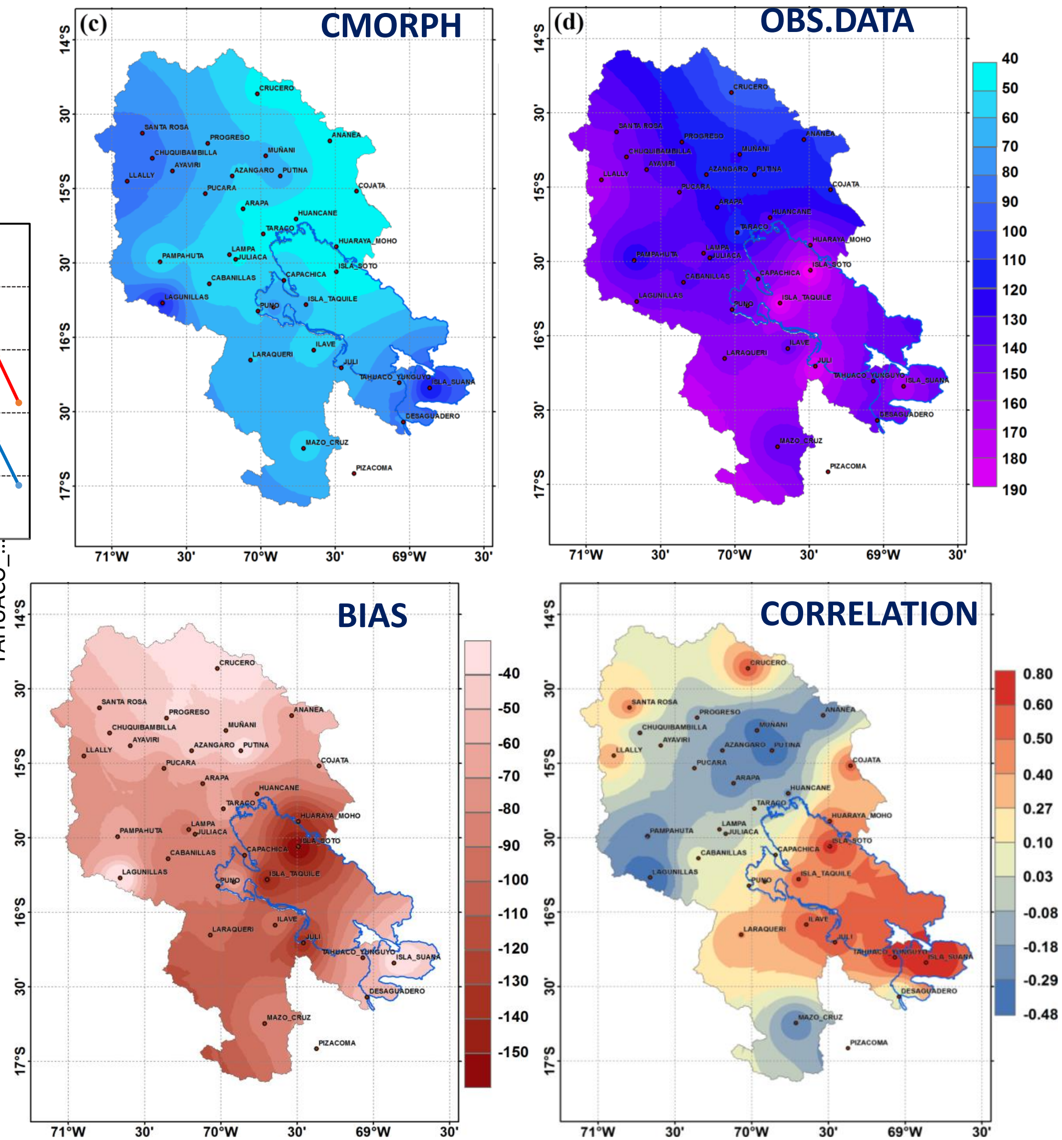
CMORPH vs Observed data

Austral summer



- In general, CMORPH presented a high percentage of underestimation for the austral summer (78% on average).

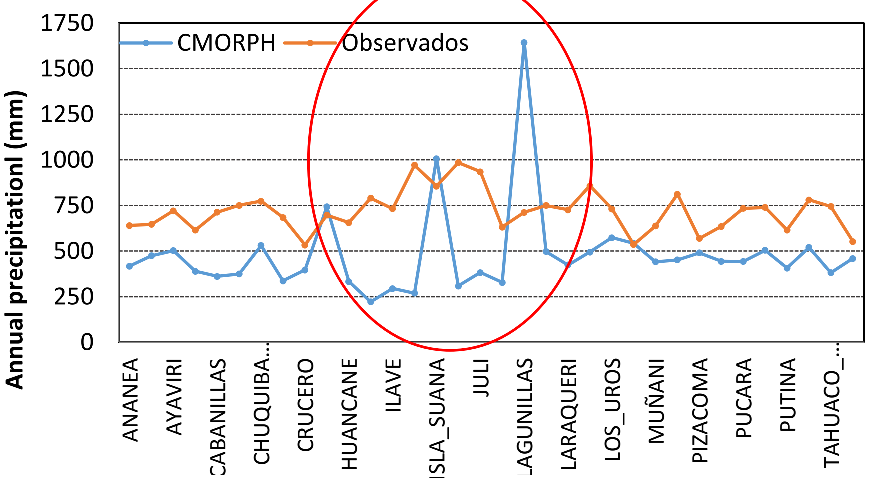
Spatial distribution of average rainfall for the austral summer

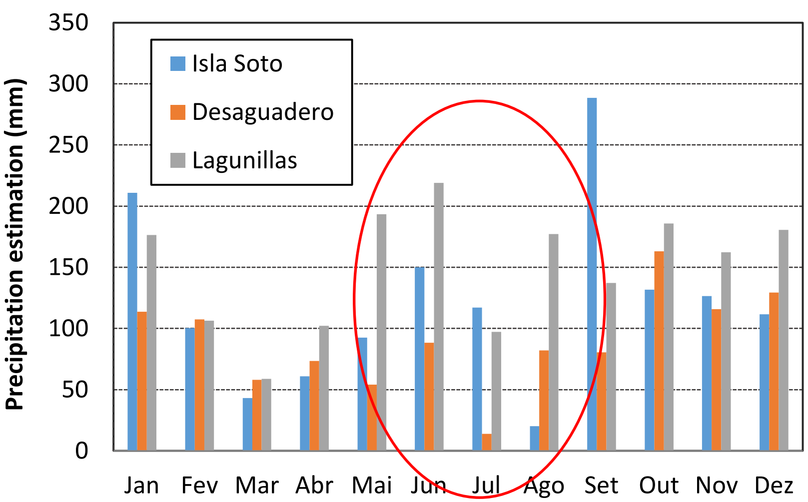


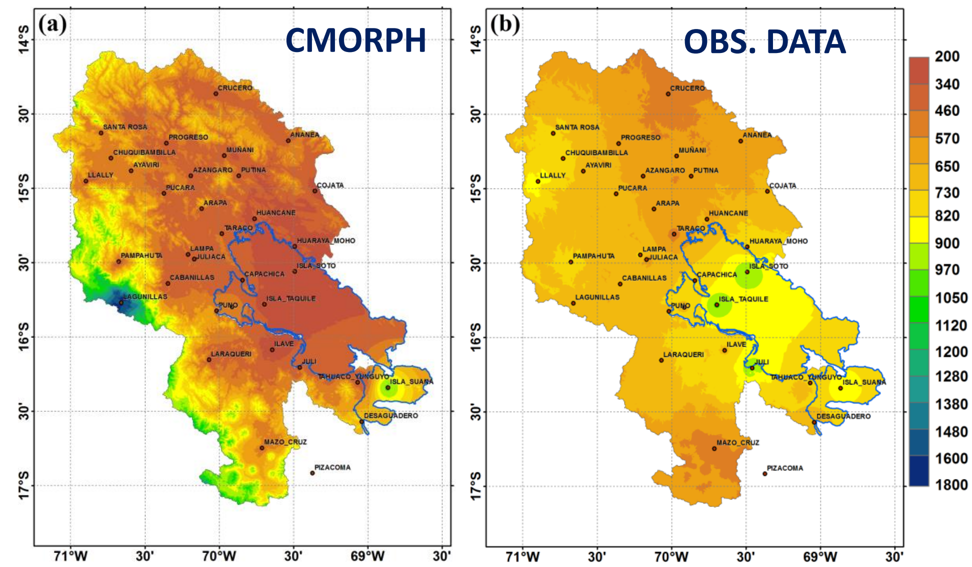
Results

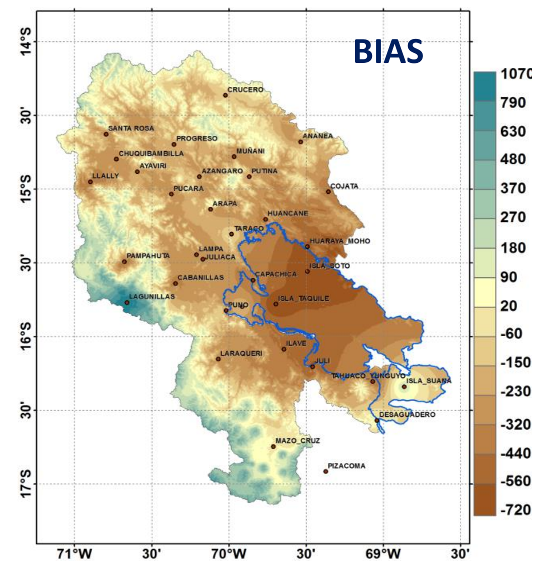
CMORPH vs Observed data

Annual





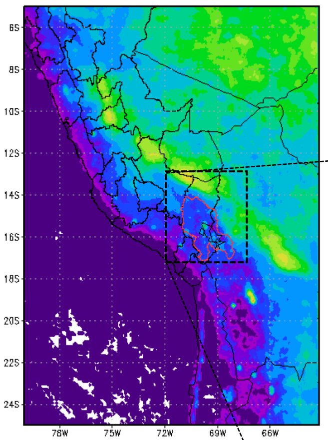




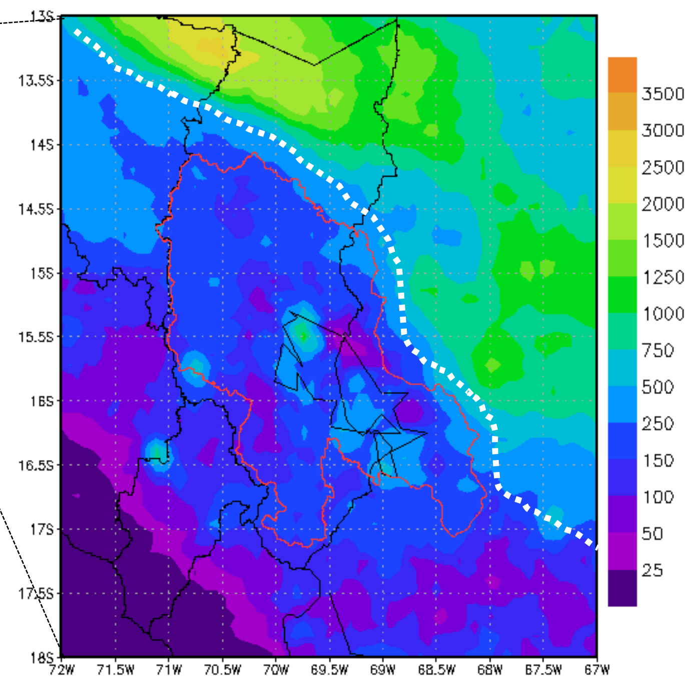
Underestimation for the annual cycle (300% on average)

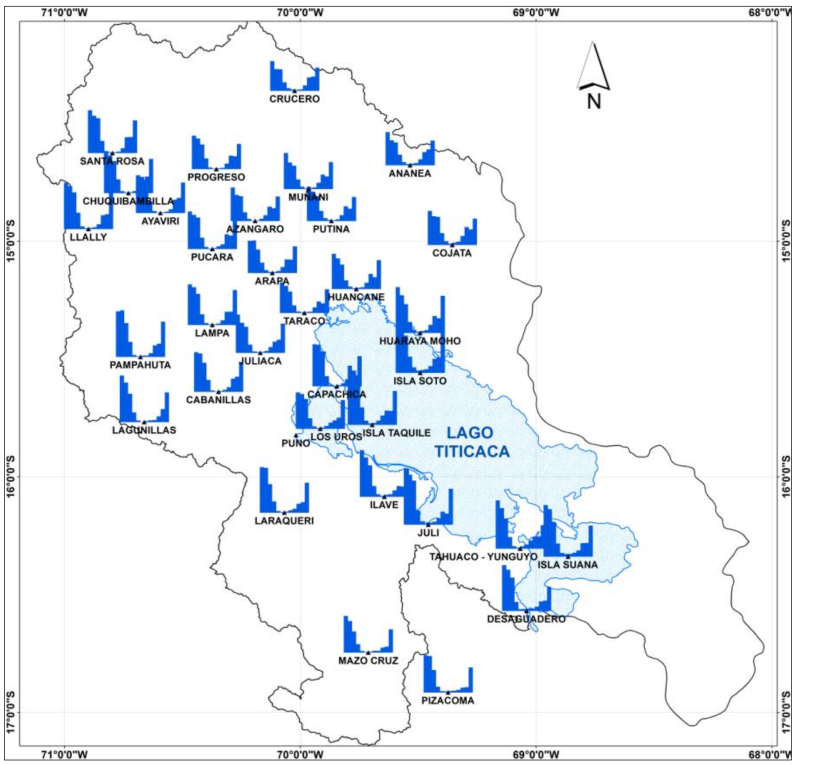
Results

CMORPH vs Observed data (Climatology)



Austral summer

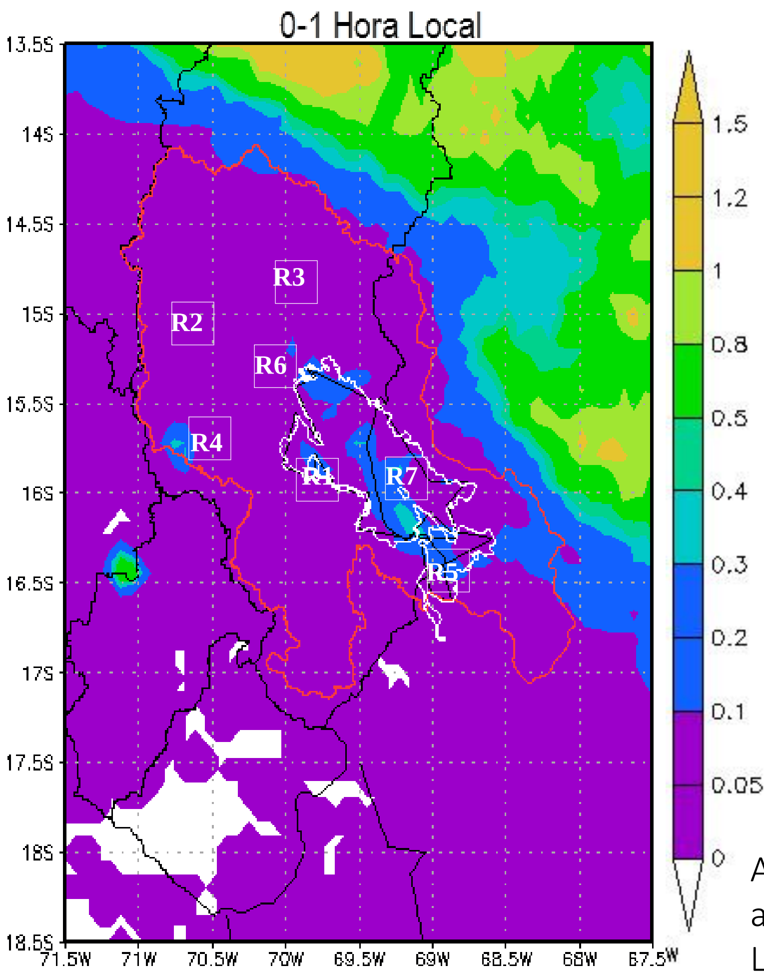


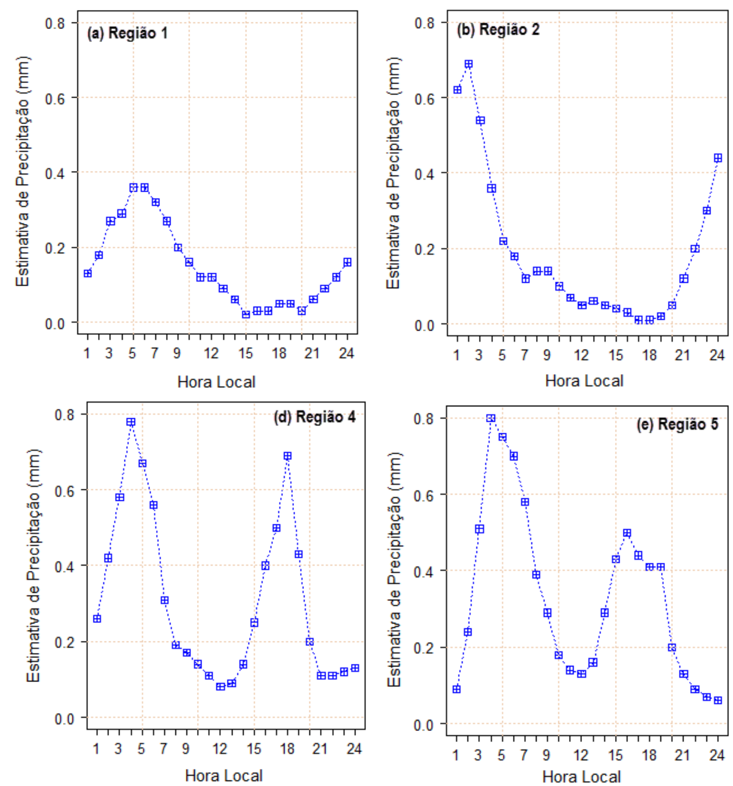


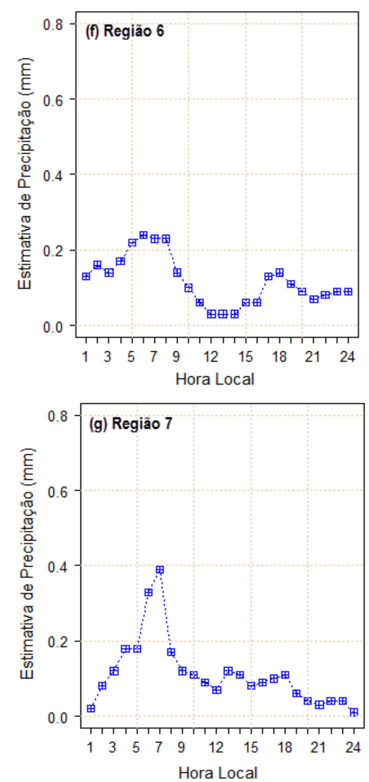
- A non-uniform distribution of precipitation estimates over the region of our interest, due to the presence of the Andes
- Annual mean rainfall distribution

Results

Diurnal cycle of convection derived from CMORPH





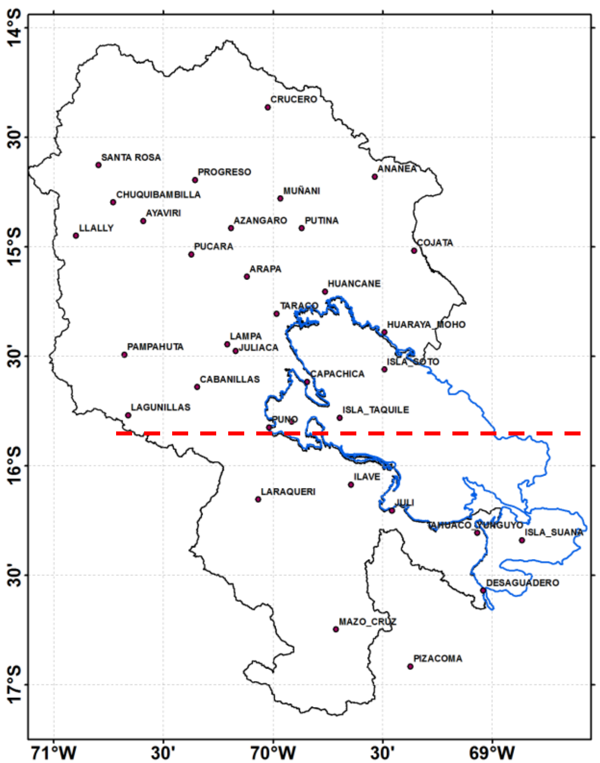


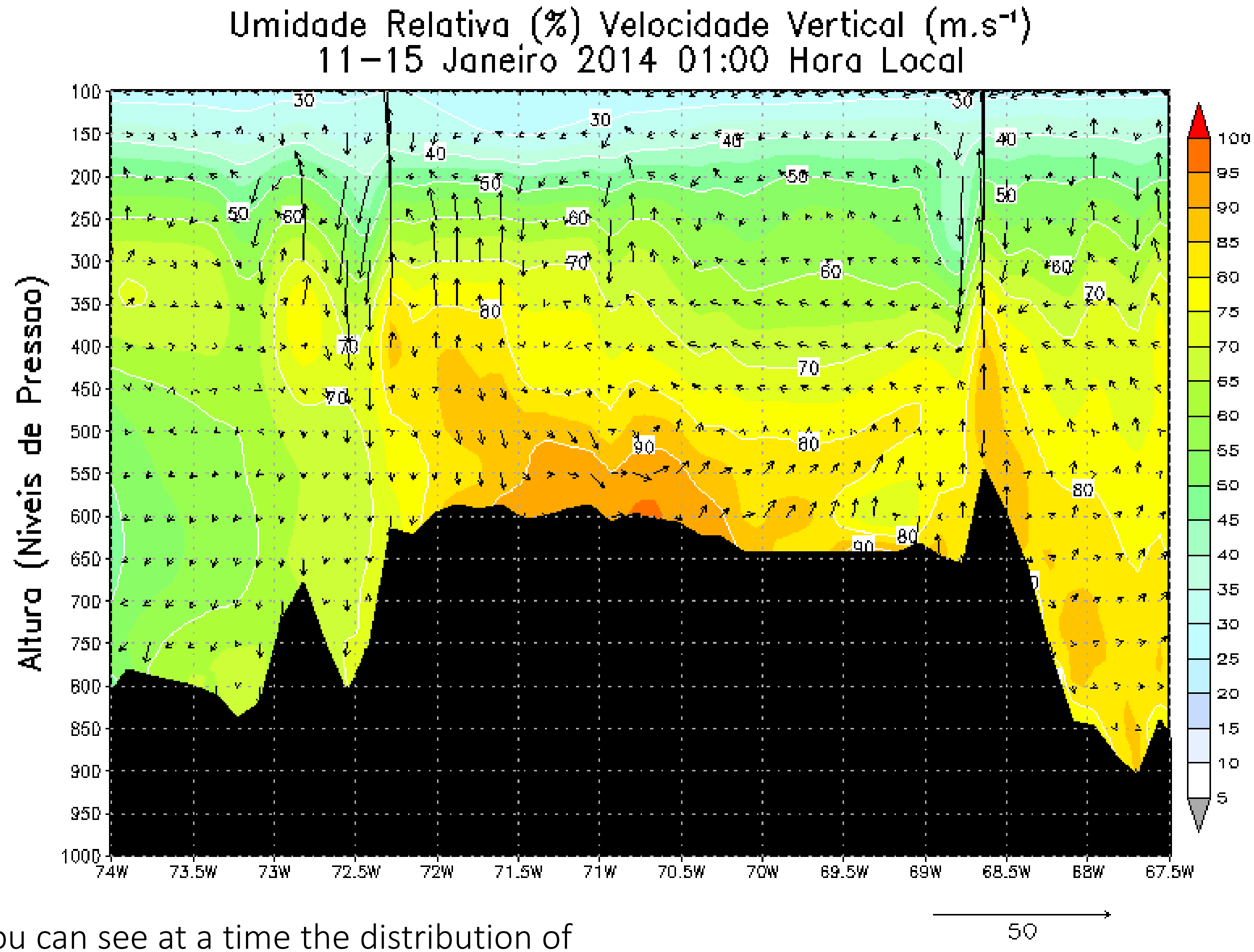
Animated image for 24 hours, where you can see at a time the distribution of precipitation over the Lake Titicaca basin.

Results

Diurnal cycle of convection derived from ARPS

- **15 – 19 January 2014**





animated image for 24 hours, where you can see at a time the distribution of precipitation, humidity, wind over the Lake Titicaca basin.

Discussion

The rainy weather patterns in both the continent and the lake were explained better by the outputs of the ARPS model, where it is clear to see that the convective events are influenced by local circulations (terrestrial-lake breeze and valley-mountain breeze). Similar results were obtained by Xin-xin [13].

In the analysis of the event from January 11 to 15, 2014 it was observed that the greatest source of humidity is Lake Titicaca and local circulation valley - mountain generated in the western mountain range of moisture in smaller quantities which helps in the formation and development of convective systems in the beginning of the afternoon.

Conclusions

The estimated annual average precipitation, for the selected period, was 481.8mm representing 33% less than the observed value (719.5mm), the value of the Pearson correlation for the average monthly precipitation was 0.89, thus, it is observed a high relation between the observed value and CMORPH. For a better understanding, pluviometrically homogenous regions were obtained by means of climatological analysis.

The results indicate that the CDC presents high variability in the Titicaca watershed and is associated with lake (day), terrestrial (night) and valley - mountain breeze circulation patterns. The CDC starts at 0200 LT (local time) in the northern region of Lake Titicaca, lasting from 2 h to 6 h, and maximum at 0600 LT. in the terrestrial surface (ST) of the Lake the CDC starts earlier around the 1200 HL, with duration from 4 h to 7 h, and maximum at 1800 LT.

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