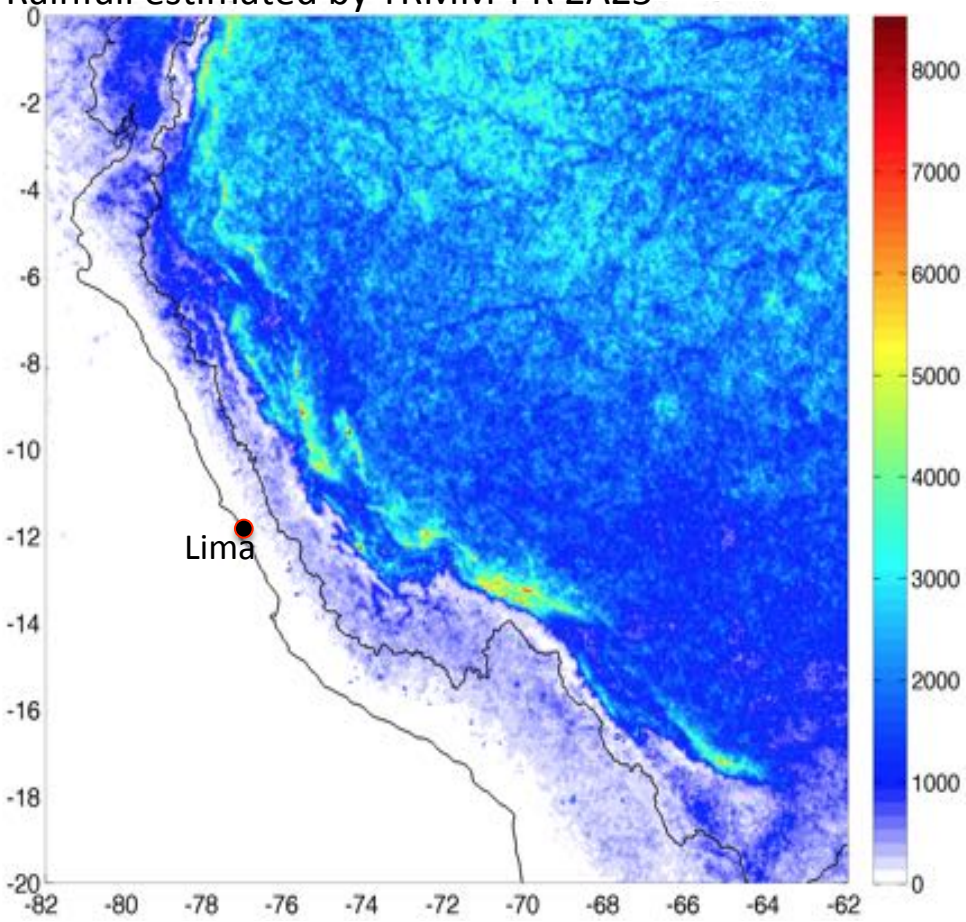
Understanding Amazon-Andes connectivity

Rainfall estimated by TRMM-PR 2A25



Jhan Carlo Espinoza

IGE – IRD
France

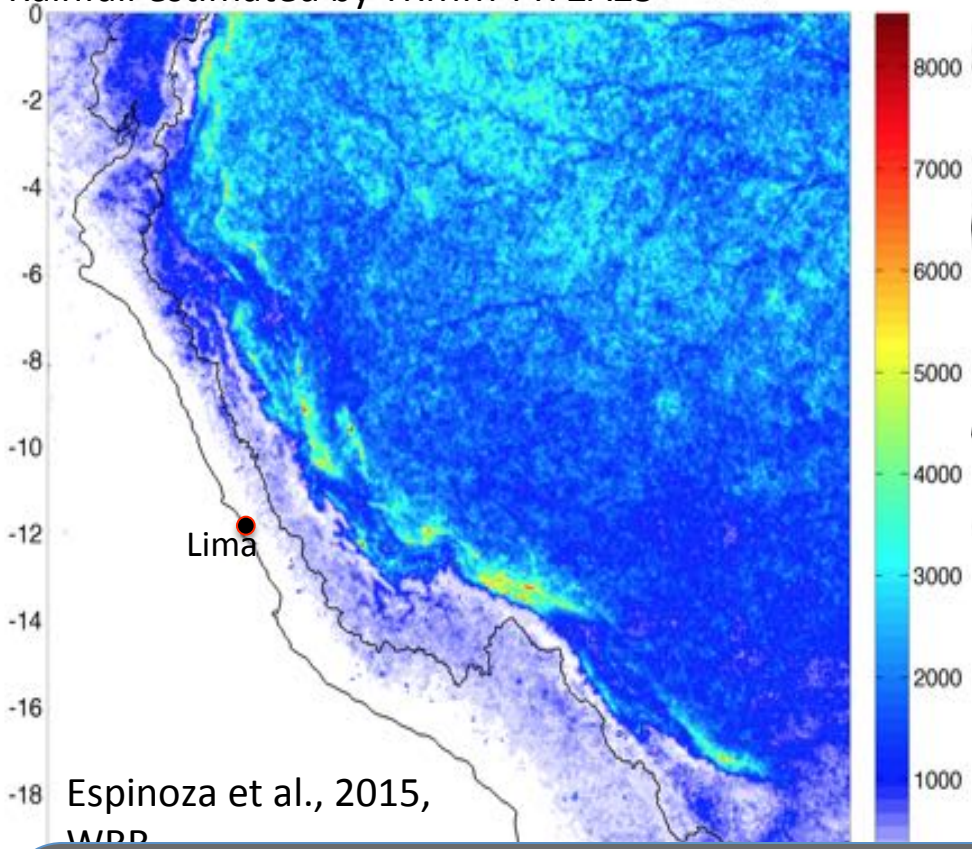
MAKE OUR PLANET GREAT AGAIN

IRD

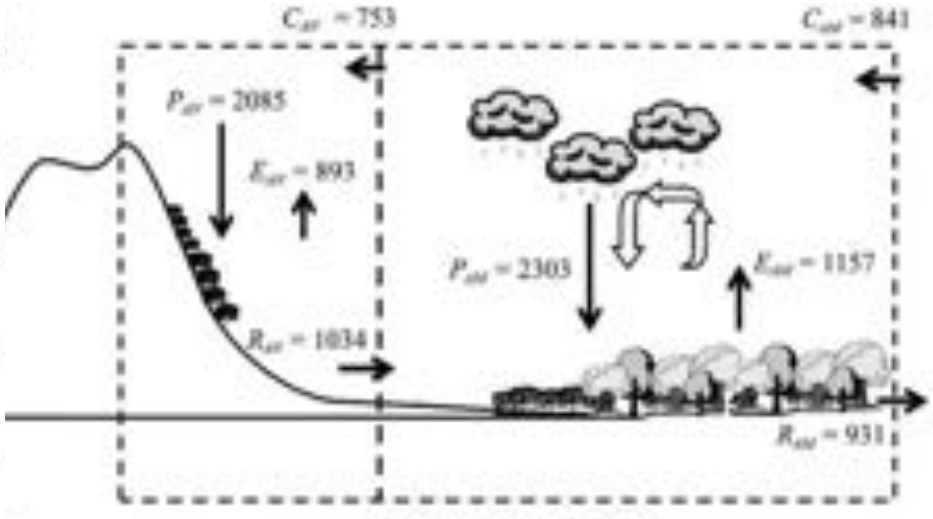
ANDEX Meeting
Santiago, Chile. October 2018

Understanding Amazon-Andes connectivity

Rainfall estimated by TRMM-PR 2A25



Espinoza et al., 2015, WRR



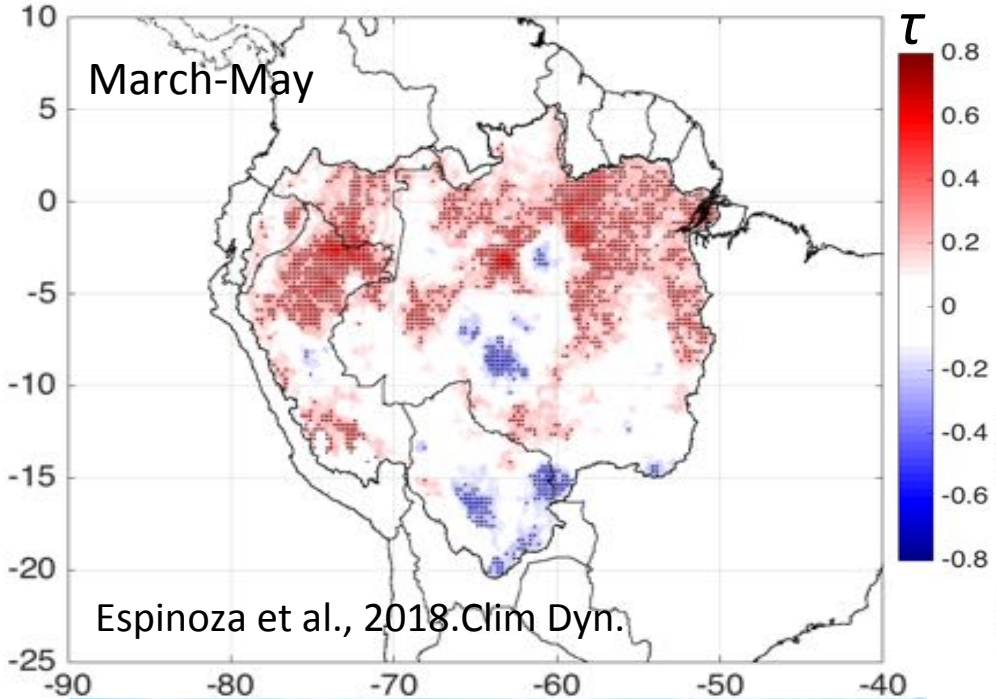
Builles-Jaramillo and Poveda, 2018, WRR

"E is one of the most complex variables for estimation and measurement"

Significant changes in rainfall intensity have been identified in Amazonia

Changes in rainfall intensity over the Amazon

Trend of very rainy days (>10 mm/d) for the 1981-2017 period



Red: Significant increase of very rainy days. A positive shift is detected after 1998

Before 1998, mean MAM rainfall in the northern Amazon exceeded **the threshold of 900 mm only four times.**
After 1998: 14 times

Climate Dynamics
https://doi.org/10.1007/s00382-018-4462-2

Contrasting North–South changes in Amazon wet-day and dry-day frequency and related atmospheric features (1981–2017)

Impacts on water level at Manaus considering the 1903-2015 period

SCIENCE ADVANCES | RESEARCH ARTICLE

EARTH SCIENCE

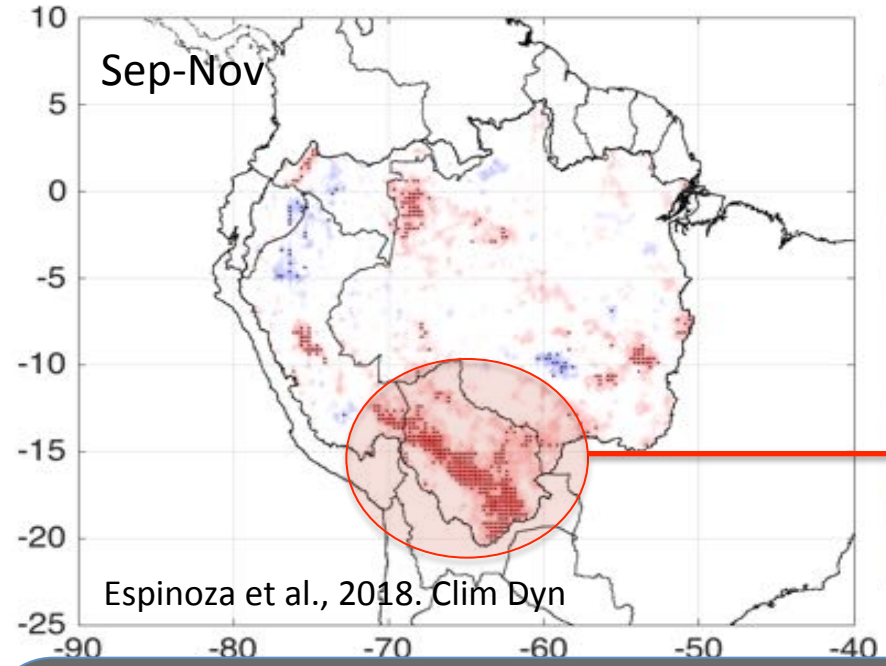
Recent intensification of Amazon flooding extremes driven by strengthened Walker circulation

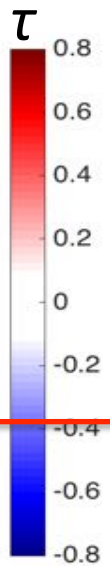
Barichivich et al., 2018. Science Adv.

Changes in rainfall intensity over the Amazon

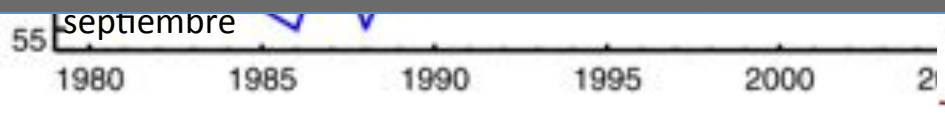
Trend of dry days (<1 mm/day). 1981-2017 period

Molina-Carpio et al., 2017. IAHS



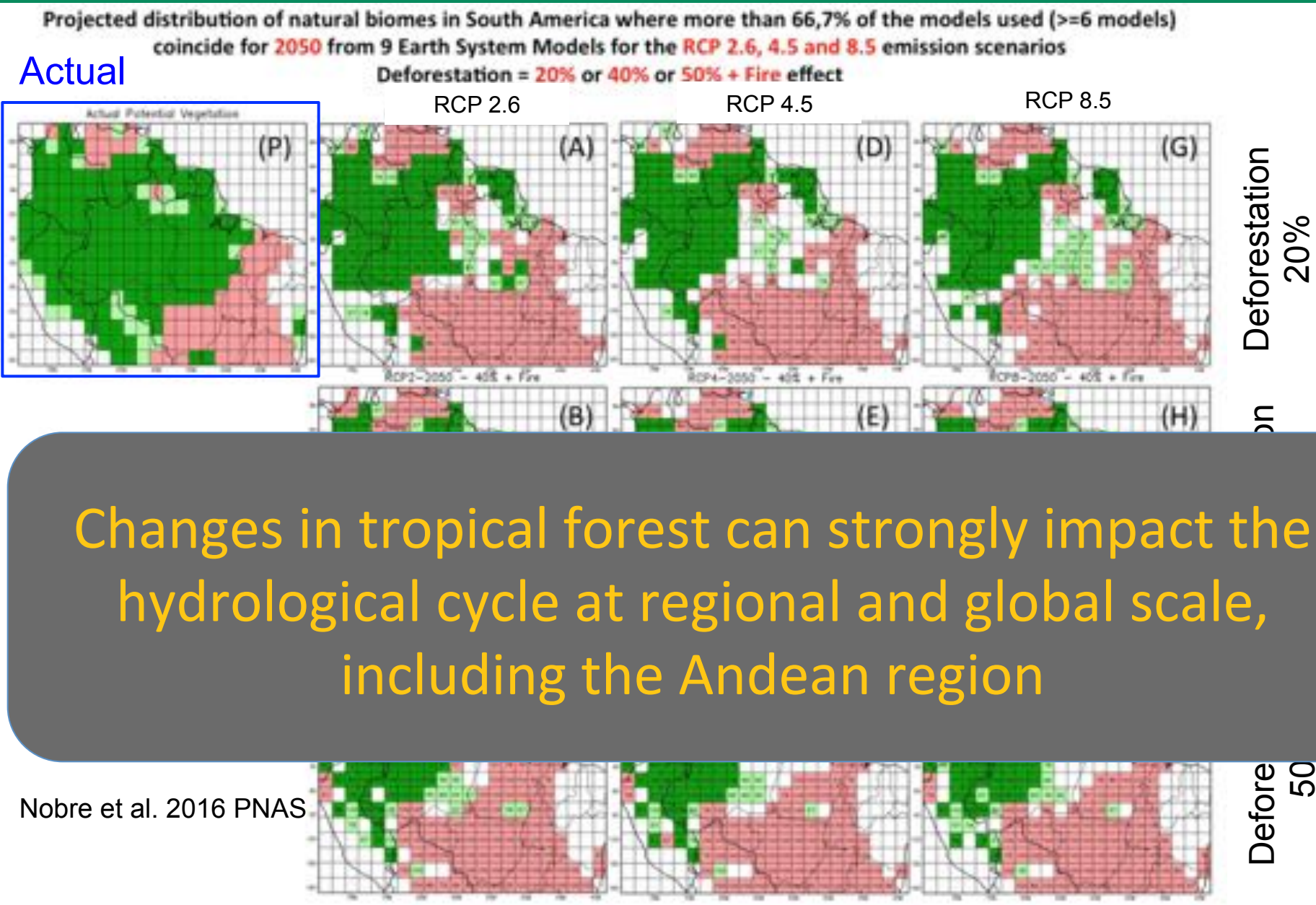


Gauging station	Test	Trend analysis Qmax	Qmean	Qmin
Puerto Villarroel	I	−0.05	−0.01	−0.10
	II	−0.10	−0.04	−0.15
	III	−0.04	0.00	−0.22
Camiaco	I	−0.06	−0.19	−0.33
	II	−0.10	−0.27	−0.44
	III	−0.10	−0.33	−0.47
Puerto Siles	I	−0.11	−0.30	−0.34
	II	−0.12	−0.45	−0.48
	III	−0.08	−0.42	−0.49
Guayaramerin	I	−0.09	−0.28	−0.34
	II	−0.12	−0.40	−0.50
	III	−0.14	−0.40	−0.51
Principe da Beira	I	−0.06	−0.23	−0.35
	II	−0.05	−0.32	−0.48
	III	−0.04	−0.33	−0.51
Cachuela Esperanza	I	0.00	−0.13	−0.25
	II	−0.02	−0.17	−0.36
	III	−0.05	−0.15	−0.41
Rurrenabaque	I	−0.07	0.02	0.16
1967–2013	II	−0.11	0.06	0.23
	III	−0.13	0.03	0.21



Increasing of the dry season lenght is also expected in the future in relation to the climate change (e.g Boisier et al., 2015)

Impacts on tropical forest



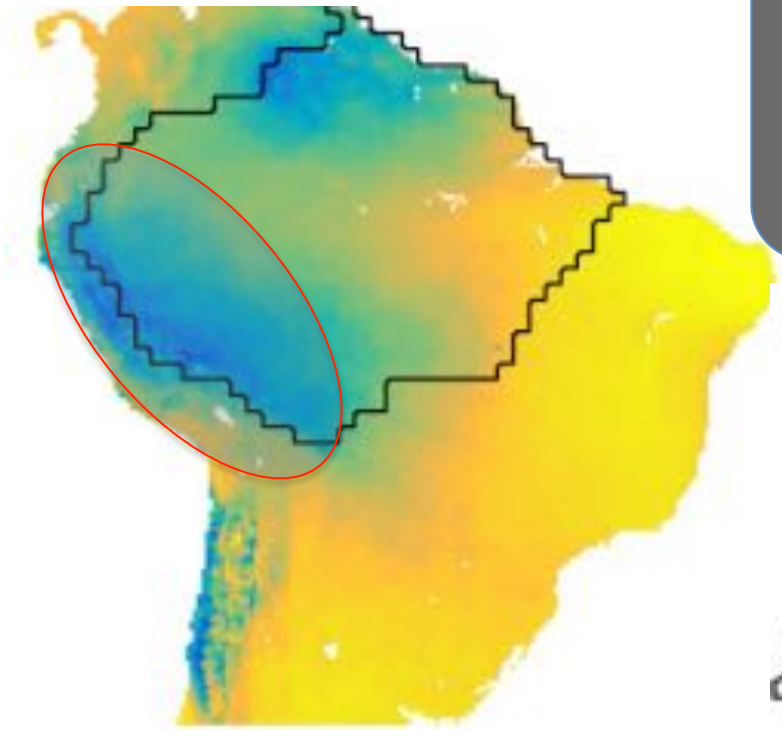
Changes in tropical forest can strongly impact the hydrological cycle at regional and global scale, including the Andean region

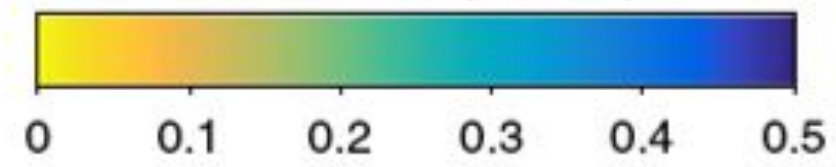
Nobre et al. 2016 PNAS

Biosphere-Atmosphere interaction: Impacts on the Andes?

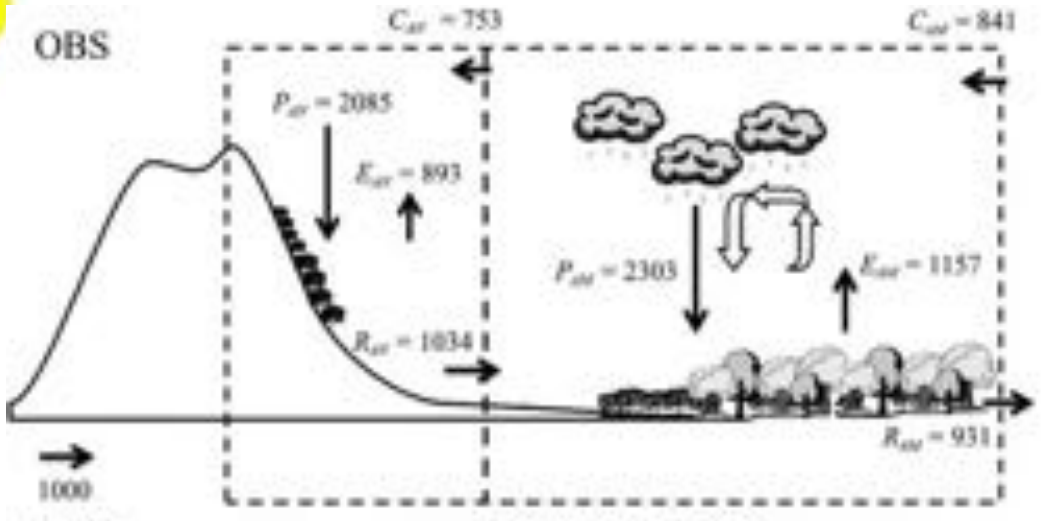
Fraction of mean annual rainfall that has been transpired by trees in the Amazon basin

Staal et al., 2018 Nature CC





Tropical Andes are potentially most vulnerable to changes in Amazon rainforest



Builles-Jaramillo and Poveda, 2018, WRR

PCRaster Global Water Balance hydrological model (PCR-GLOBWB) at 0.5° resolution

Starting activity: Amazon-Andes connectivity

AMazon-**AN**d**E**s **C**onn**E**ctivity**:** impacts of climate-vegetation changes on the hydrology of the Amazon-Andes transition **R**egion (**AmAneCeR**)

Duration: October 2018 – September 2022 (4 years). 1M€. PI JC Espinoza (IRD/IGE)

Objectives:

Diagnose the impacts of extreme drought events on vegetation conditions (mainly in the Bolivian and Peruvian Amazon)

Quantify the Amazon-Andes connectivity in terms of Amazonian evapotranspiration, moisture transport and precipitation in the Andes

Provide realistic scenarios of climate-related changes in Amazonian vegetation and their implications for precipitation in the Andes

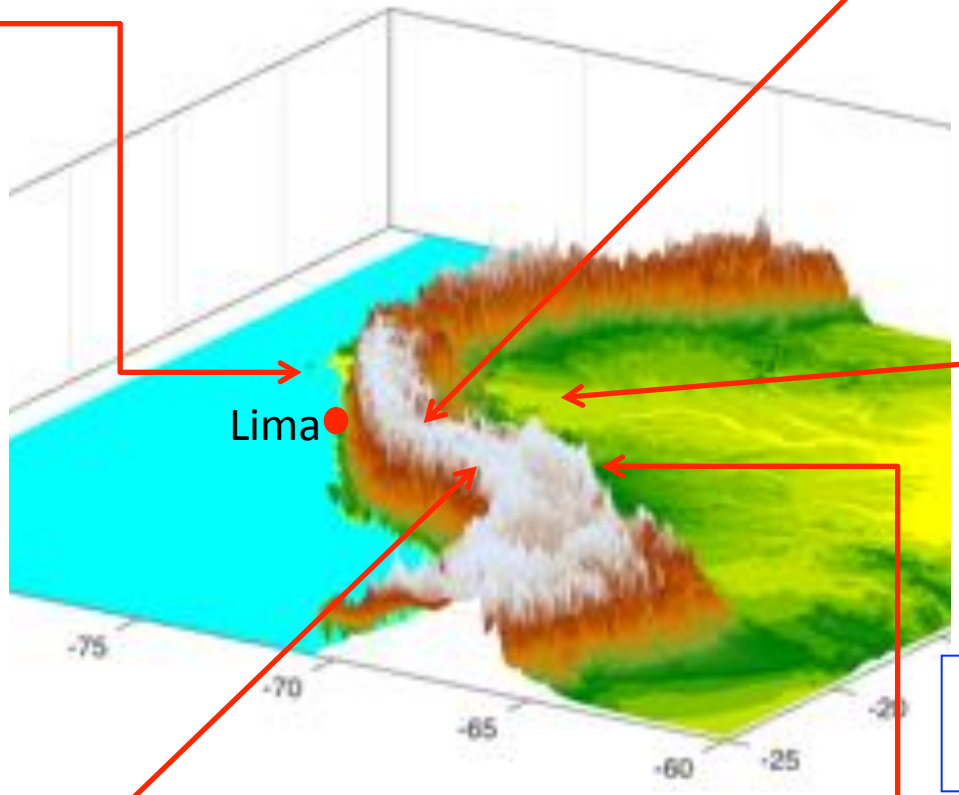
ANDEX Meeting in 2020 – Cusco, Peru ?

With the sponsorship of the AmAneCeR – Project and LMI GREATICE

Major hydroclimatic features in Peru

Pacific drainage: Extreme rainfall related to **Costal El Niño**

Extreme droughts related to **Central El Niño**



Intensification of the hydrological cycle in the Amazon-Andes transition region (**extreme droughts and floods**) in the last three decades

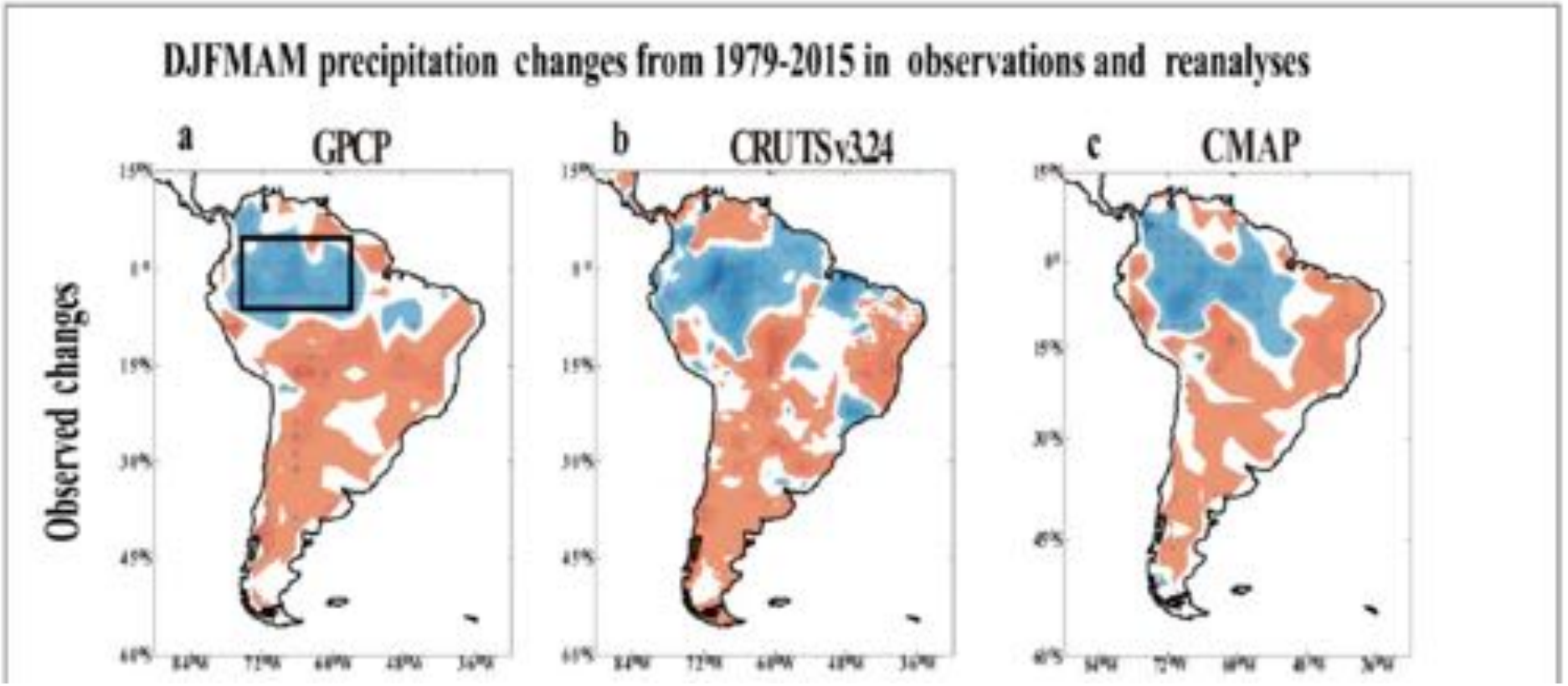
"Optimum" rainfall precipitation zones (7-8 m/yr) in 'hotspots' of biodiversity

Glacier retreat, particularly since 1970s

The south tropical Andes (Peru)

What is the role of the atmospheric dynamics on the water resources in high-mountain basins, in particular through (a) localized orographic mechanisms and (b) climate teleconnection processes between global, regional and local scales?

What is the moisture contribution from the Pacific vs the Atlantic Ocean and vs the Amazon rainforest in the central Andes? How is the spatio-temporal variability of these contributions and its interactions?



Wang et al., ELR 2018