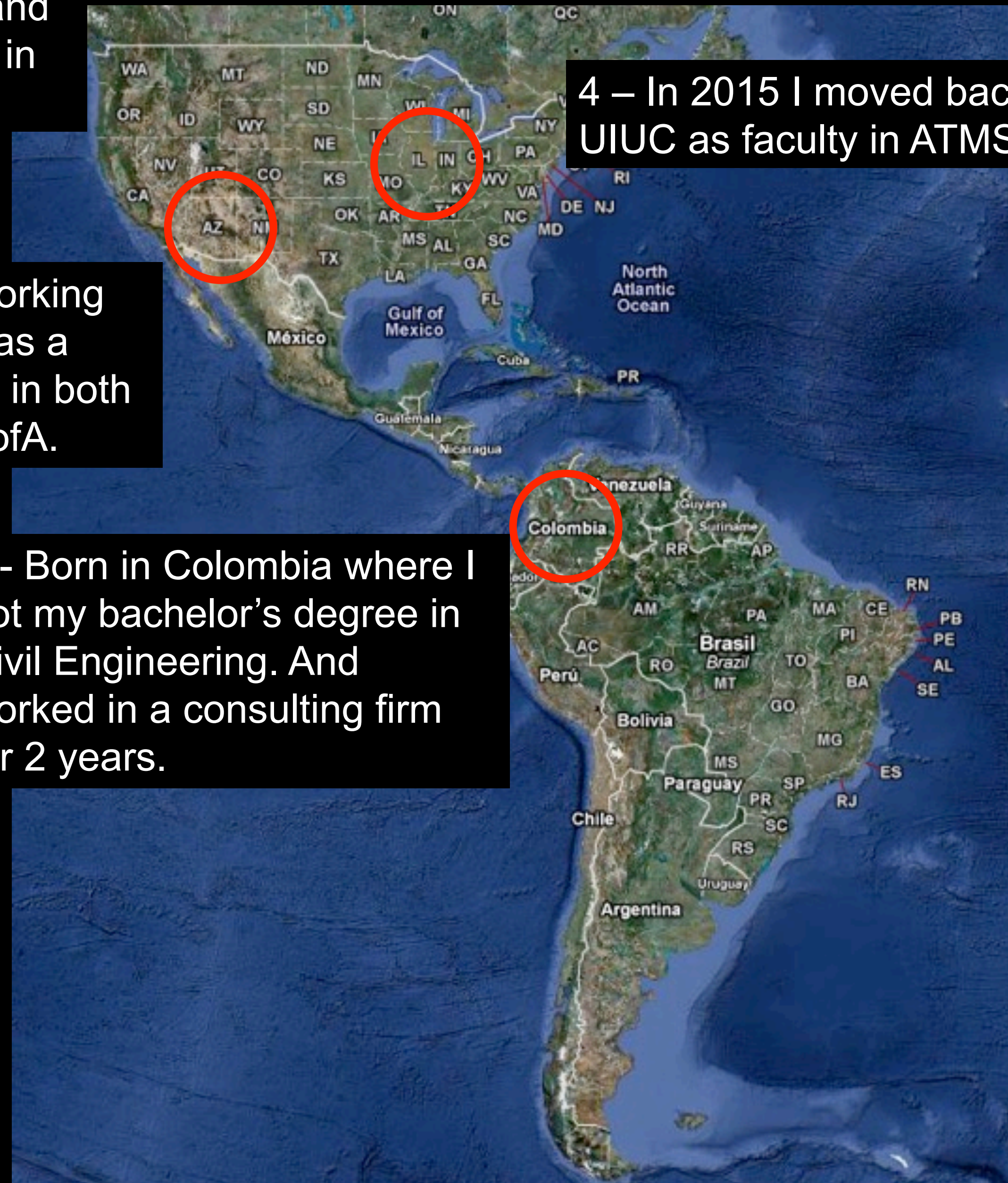
2 - I then got my Masters and PhD at UIUC - specialized in Hydrology.

4 – In 2015 I moved back to UIUC as faculty in ATMS.

3 - I moved to AZ I started working with Atmospheric Sciences as a Postdoc. And then as faculty in both ATMS and HYDRO at the UofA.



1 - Born in Colombia where I got my bachelor’s degree in Civil Engineering. And worked in a consulting firm for 2 years.

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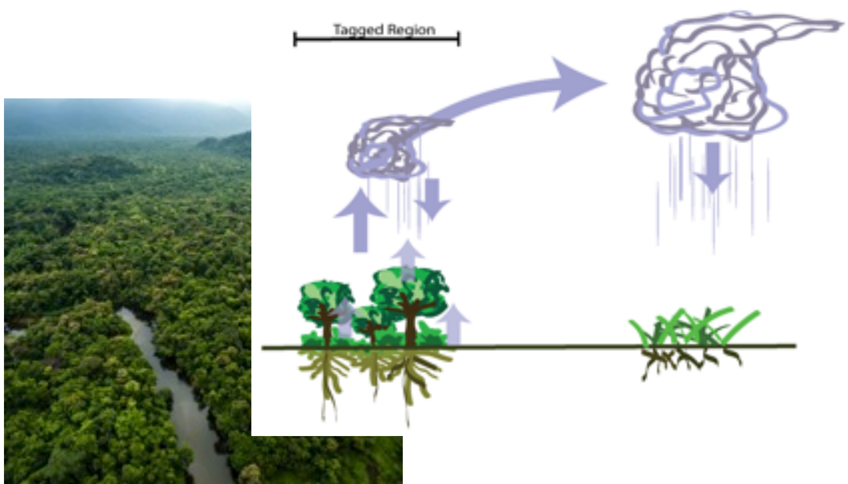
B.S.-M.S.- Ph.D: Civil Engineering – Hydrology (Universidad de los Andes -University of Illinois)

Land – Atmosphere Interactions

Effects of land on atmosphere

Hydrologic extremes



Land – Atmosphere Interactions

Hydrologic extremes

hydrologic extremes

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Earth System Dynamics
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EGU

Tracking an atmospheric river in a warmer climate: from water vapor to economic impacts

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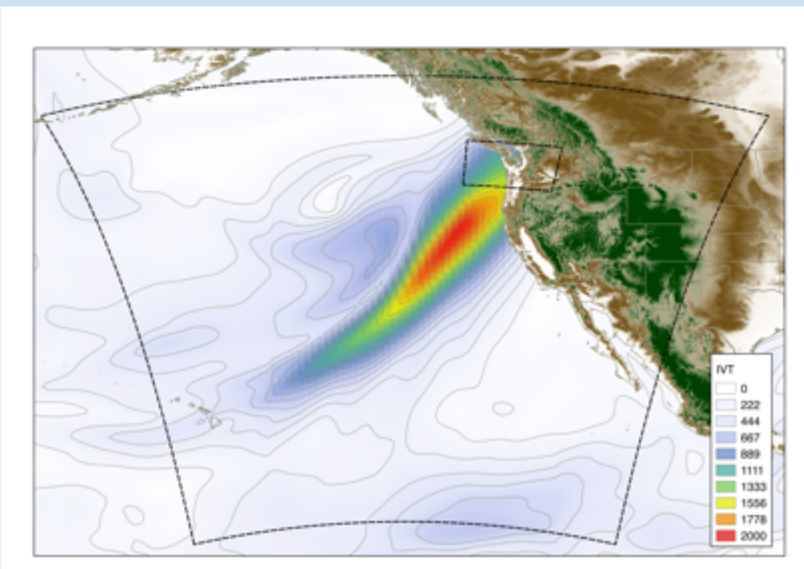
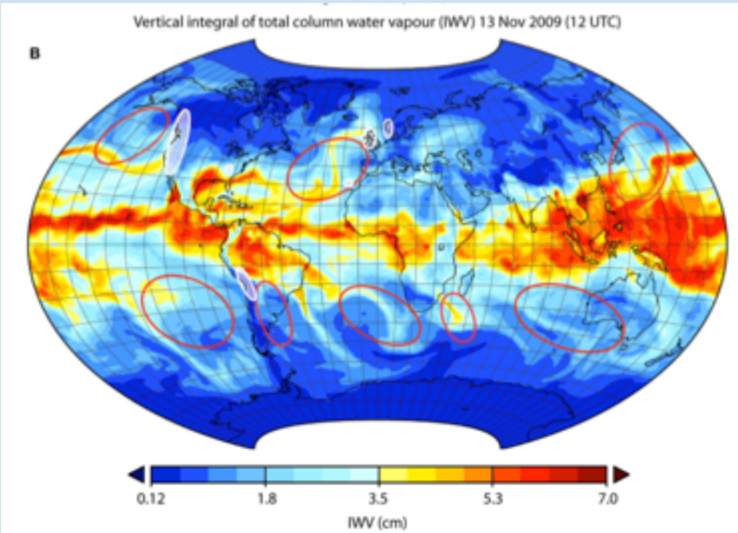
Abstract. Atmospheric rivers (ARs) account for more than 75 % of heavy precipitation events and nearly all of the extreme flooding events along the Olympic Mountains and western Cascade Mountains of western Washington state. In a warmer climate, ARs in this region are projected to become more frequent and intense, primarily due to increases in atmospheric water vapor. However, it is unclear how the changes in water vapor transport will affect regional flooding and associated economic impacts. In this work we present an integrated modeling system to quantify the atmospheric–hydrologic–hydraulic and economic impacts of the December 2007 AR event that impacted the Chehalis River basin in western Washington. We use the modeling system to project impacts under a hypothetical scenario in which the same December 2007 event occurs in a warmer climate. This



hydrologic extremes

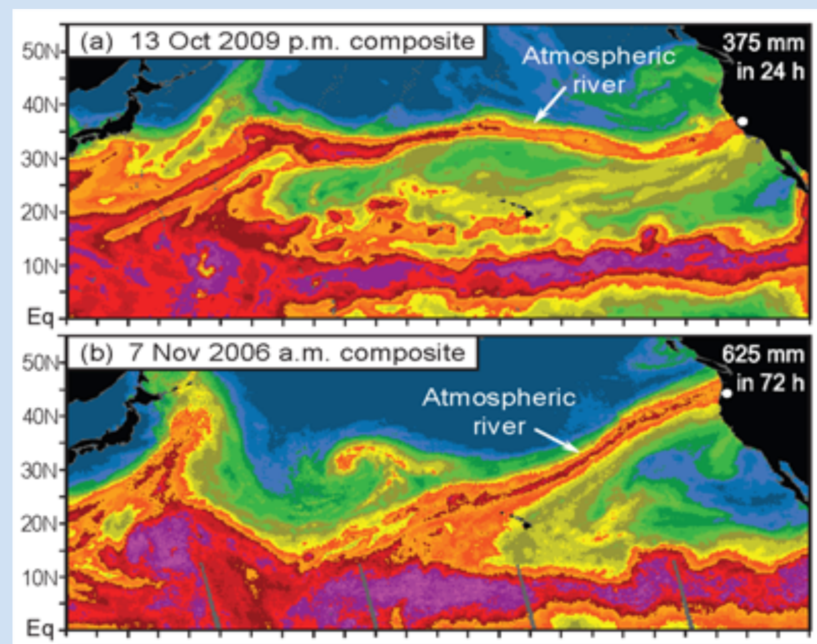
ARs are long and narrow corridors of concentrated water vapor transport in the atmosphere



Very important for bringing water vapor from the Tropics.

30-50% of precipitation in the west coast occurs in just a few AR events (Pinneaple Express is a subset).

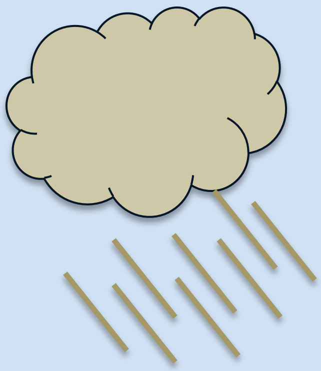
Can transport approx 7.5–15 times the average flow of liquid water at the mouth of the Mississippi River.



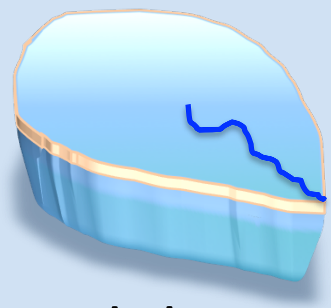
hydrologic extremes

We developed an modeling system to simulate ARs - from their formation to the resulting flooding and economic impacts.

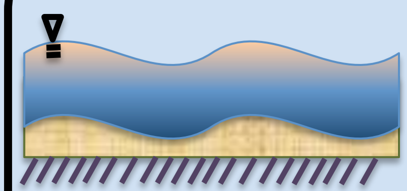
- **Historical (Control)**
- **Future (Pseudo-Global Warming)**



Atmosphere
WRF



Hydrology
HEC-HMS
DHSVM

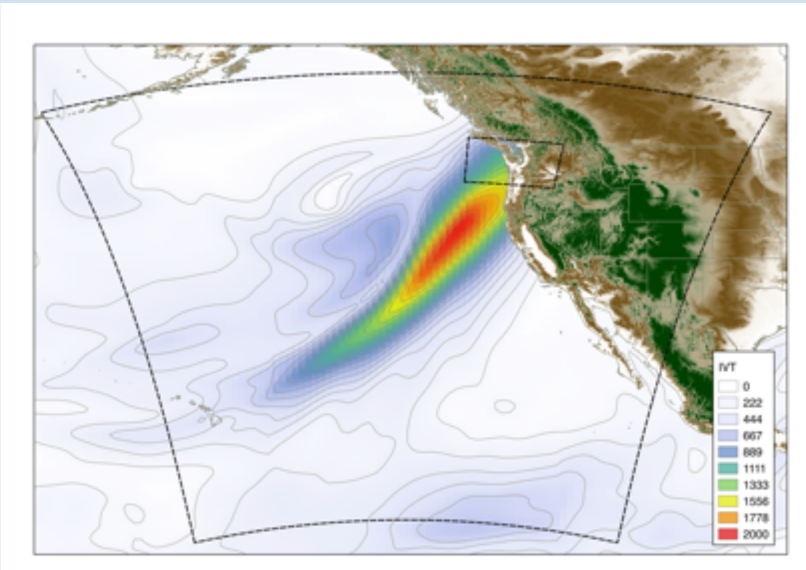


Hydrodynamics
HEC-RAS

Socioeconomics
HAZUS + IO

hydrologic extremes

With this model, we can understand how changes in ARs (warmer climate), could translate into flooding and economic impacts.

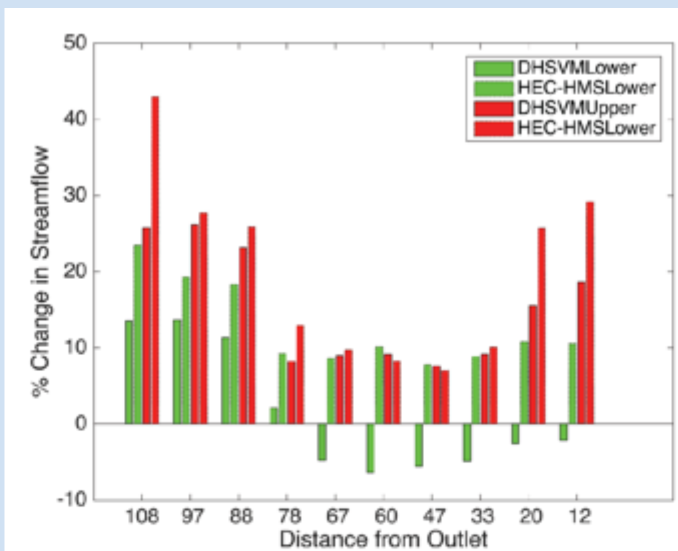


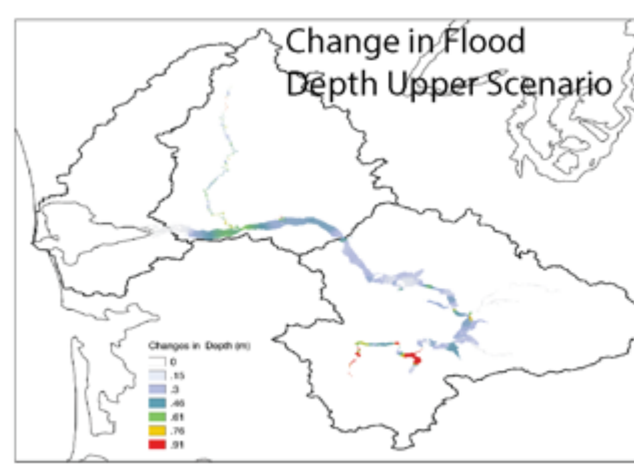
More water vapor

More rainfall

More flooding

More losses to the local economy – including impacts to trade.





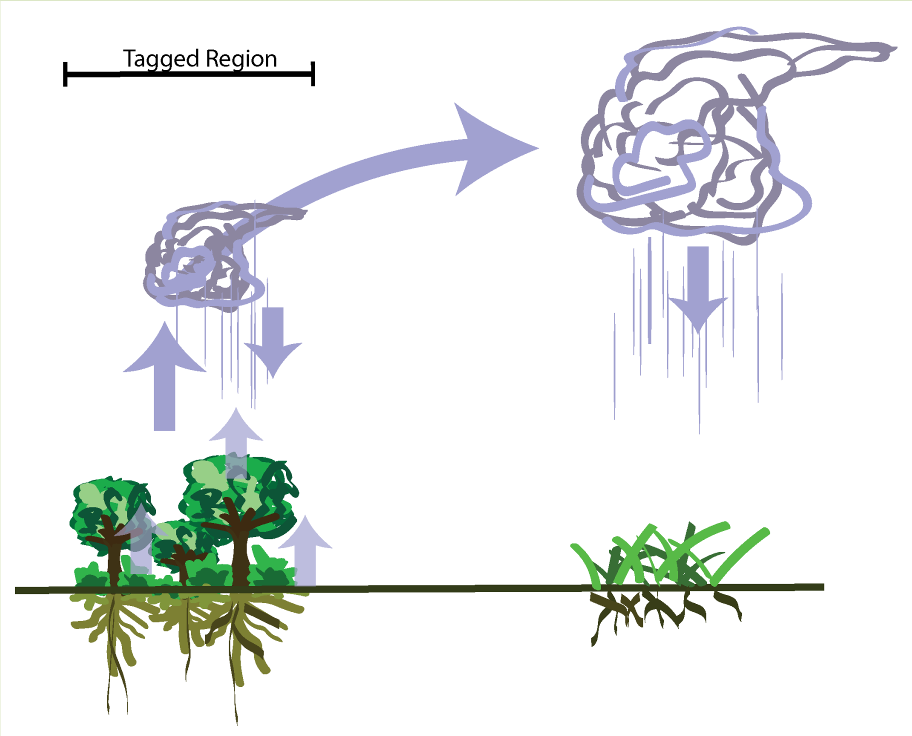
Land – Atmosphere Interactions

Effects of land on atmosphere

Effects of land on atmosphere

We have enabled water vapor tracers within the WRF numerical weather model (the same model used for the weather forecast).

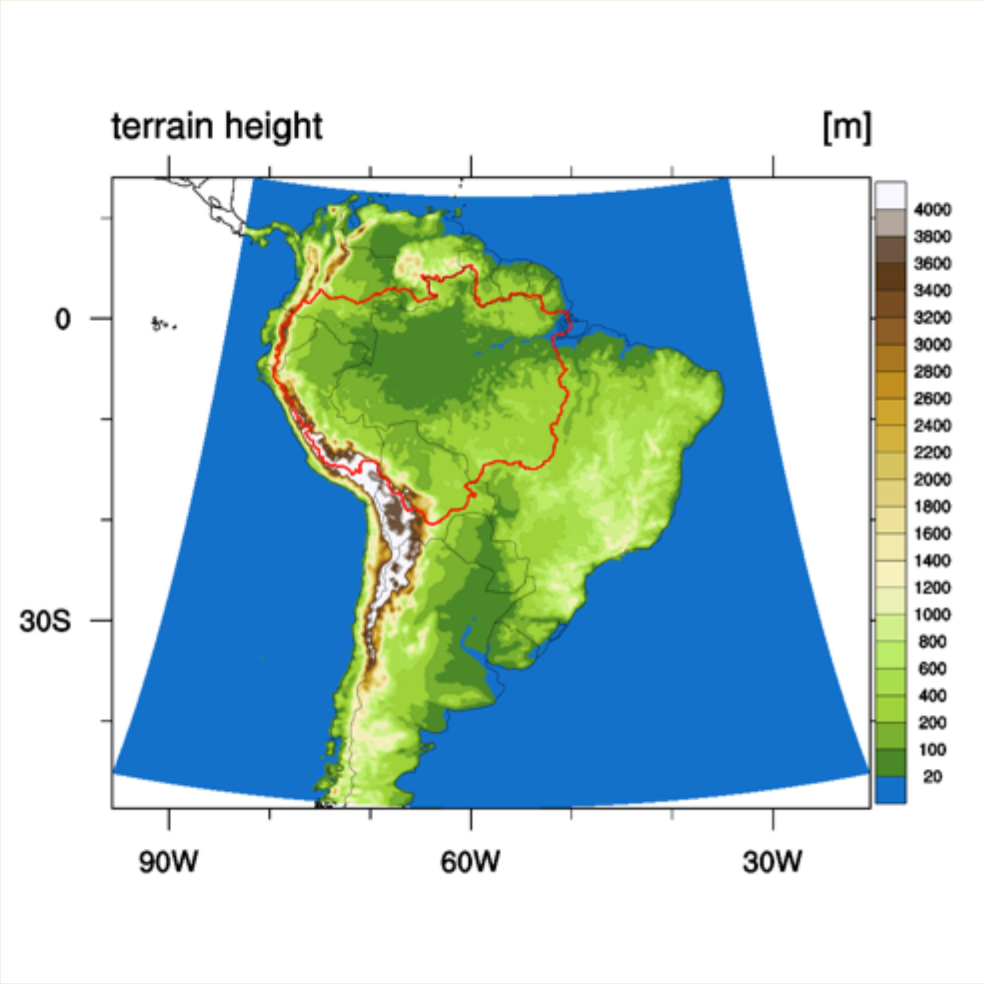
Water vapor tracers within the model is like putting "dye" in the model's water cycle.



Effects of land on atmosphere

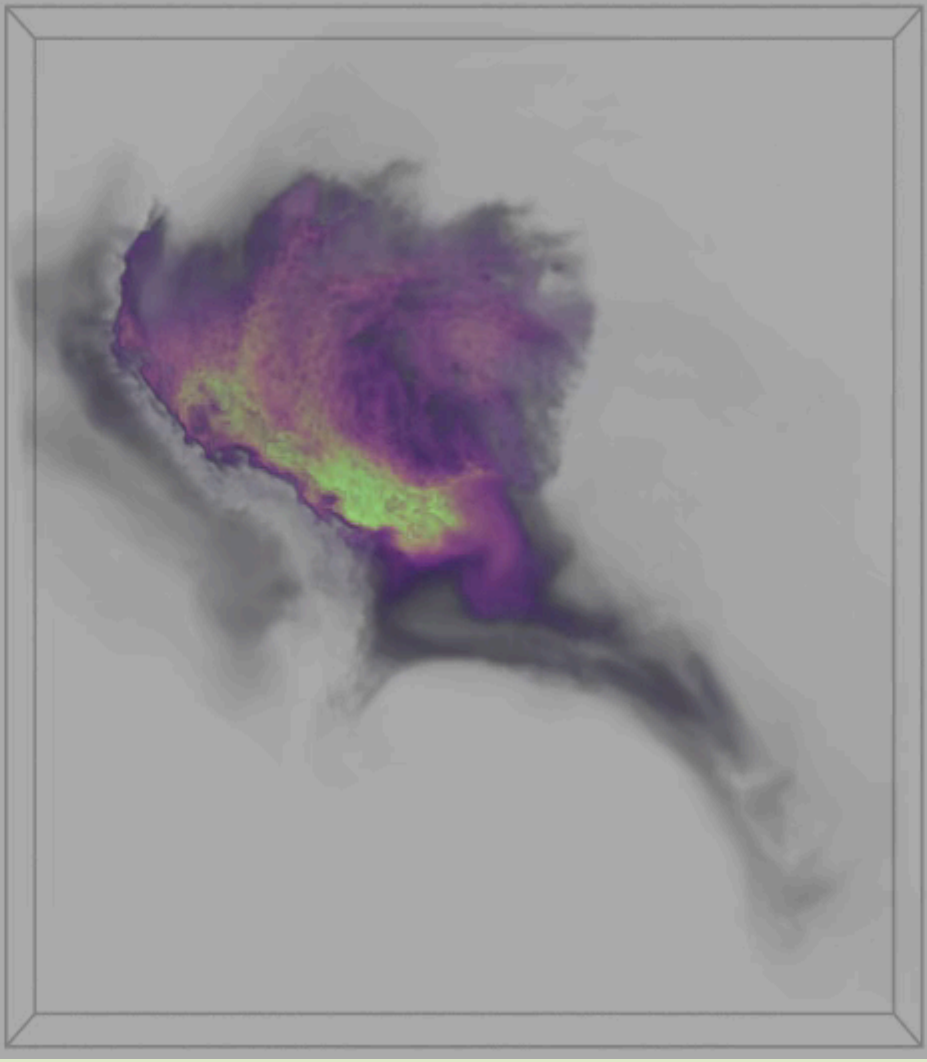
Does evaporation from the Amazon Forest contribute to precipitation over the South American continent?

We are running WRF with Water Vapor Tracers over South America and tagging the moisture that originates from the Amazon Forest.



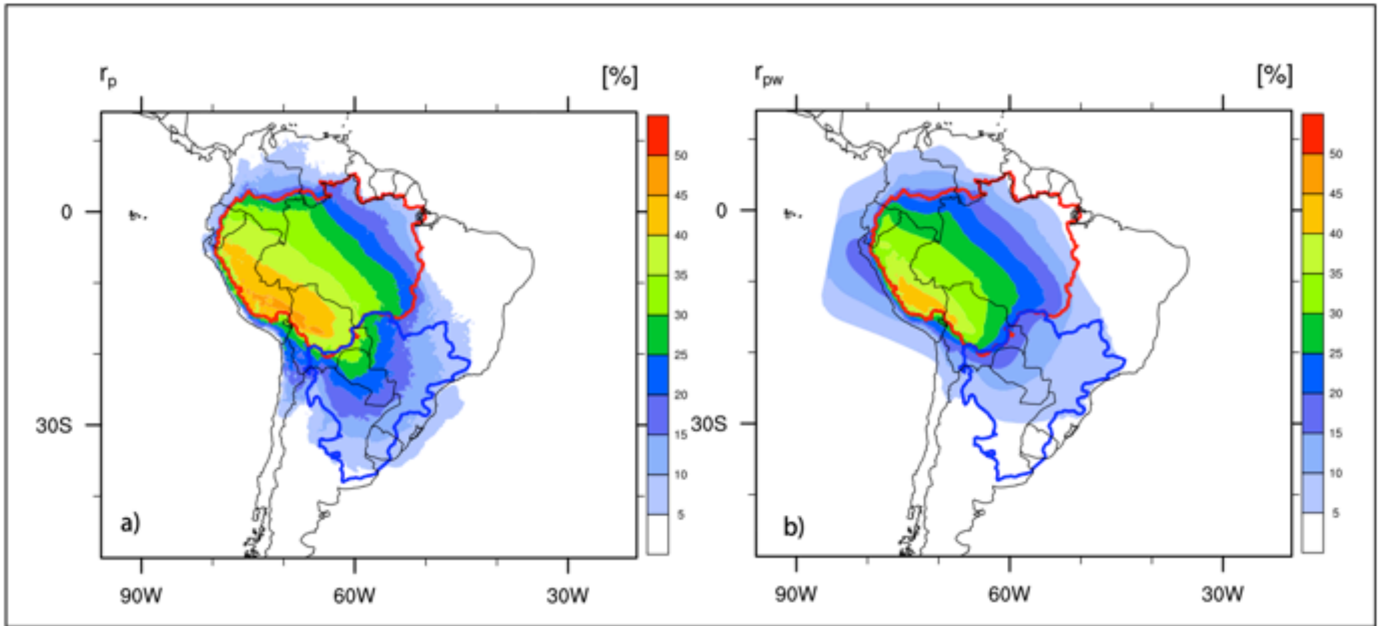
Effects of land on atmosphere

Using the tracers, we can quantify the amount of water vapor that originates in the Amazon and travels through the continent.



Effects of land on atmosphere

Amazon ET contributes to around 30% of the total precipitation over the Amazon and 16.5% over the LPRB. Analyzing moisture transport from the Amazon to the LPRB

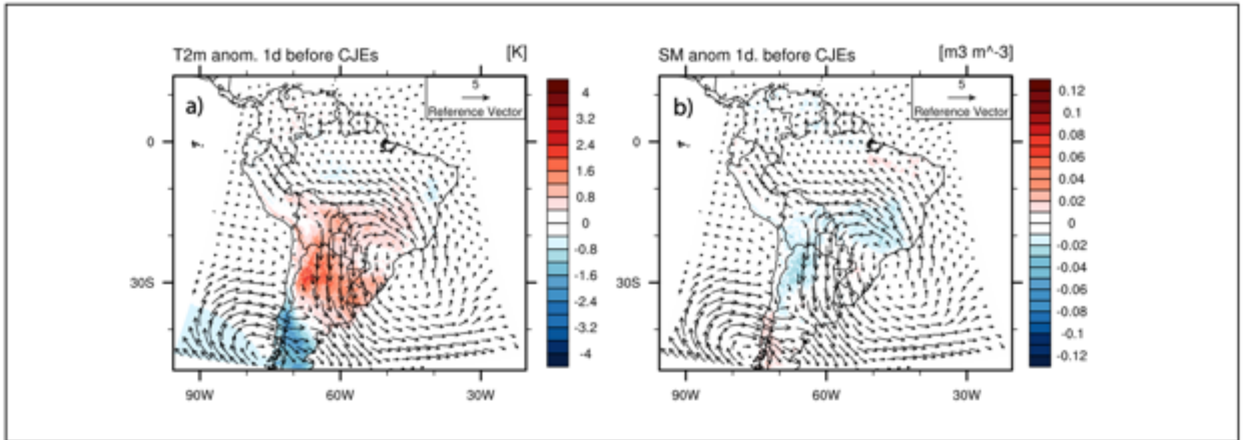


a) Spatial pattern of tracer precipitation ratio (r_p) for 2004-2013. b) Spatial pattern of the integrated tracer water vapor ratio (r_{pw}).

Ratio of precipitable water that originates from the Amazon is less than the ratio of precipitation that originates from the Amazon

Effects of land on atmosphere

Warm surface air temperature over the northwestern Argentine is linked to low level winds and likely to induce northerly winds that intensify moisture transport by changing continental-scale circulation patterns.



a) Surface air temperature (T_{2m}) anomaly (shaded) 1-day before the Chaco jet events. Arrow indicates the associated wind anomalies at 850 hPa. b) Soil moisture (SM) anomaly (shaded) 1-day before the Chaco jet events.

Surface fluxes are only partly responsible for the high temperature anomalies

Land – Atmosphere Interactions

Effects of land on atmosphere

Effects of climate change on hydrologic extremes