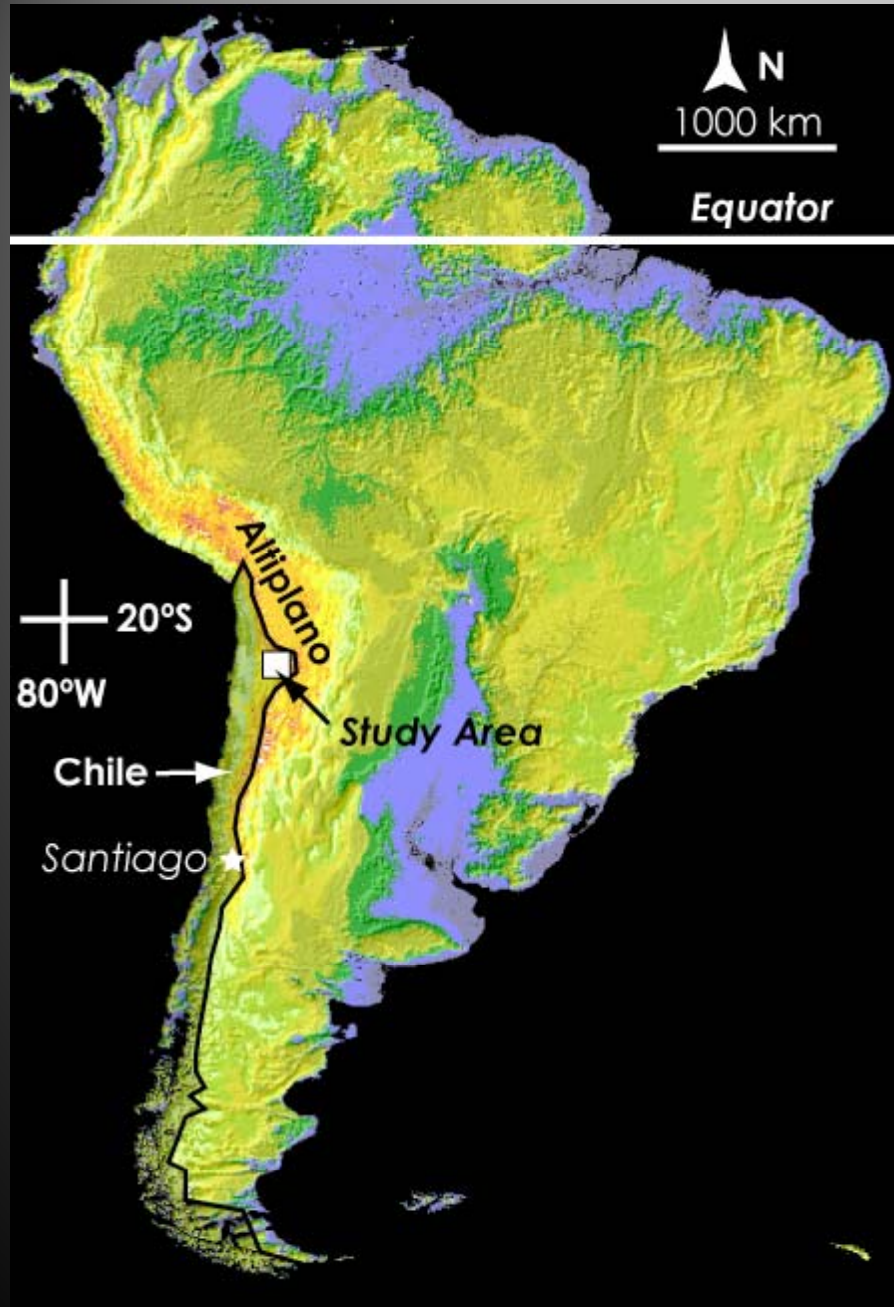




Last glaciation of the subtropical Chilean Andes

An arid landscape's record of past
climate change

*Dylan Ward, Joseph Galewsky, and Kimberly Samuels
University of New Mexico, Dept. of Earth and Planetary Sciences*



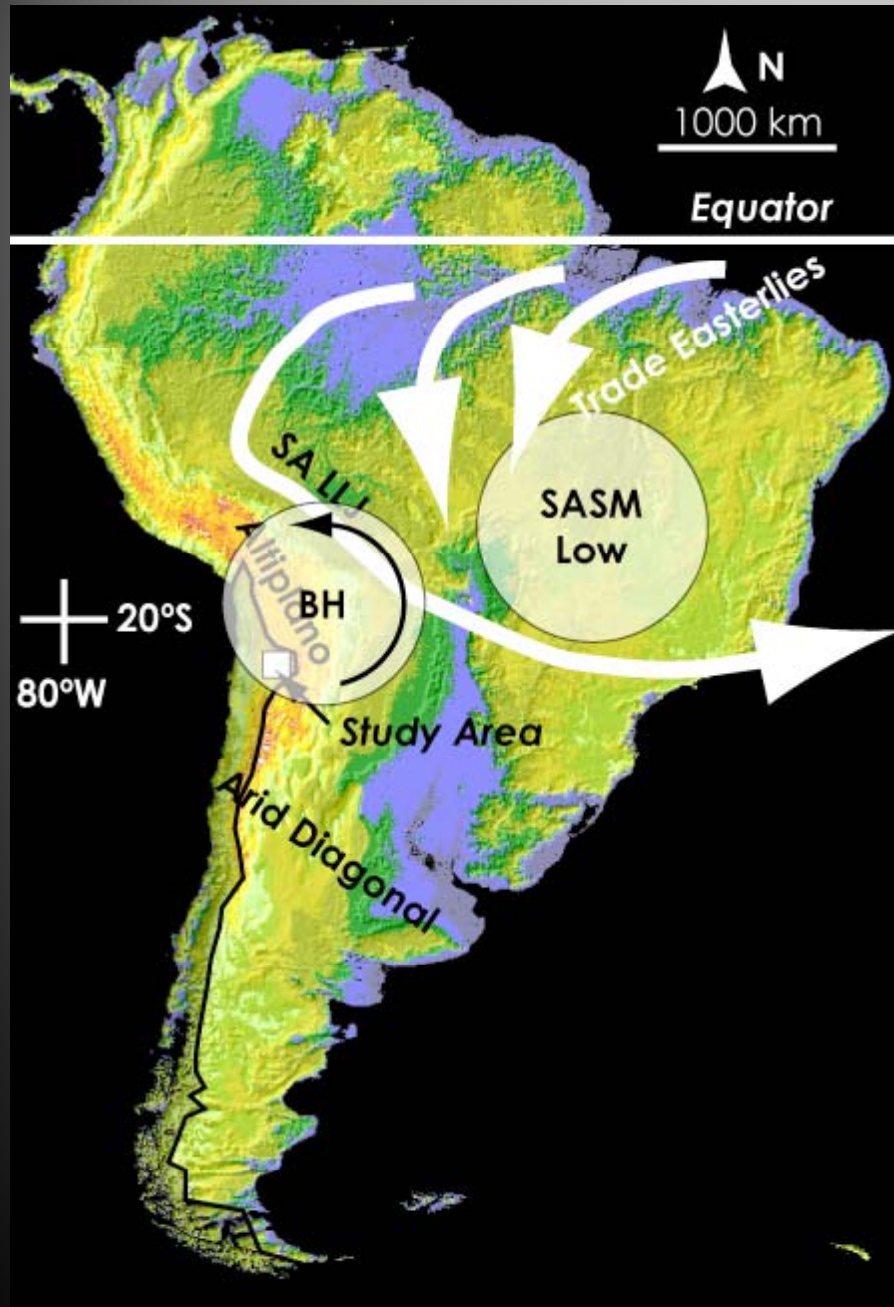
The subtropical Andes at 22°S

Adjacent to Atacama Desert, the driest on Earth

~ 200 – 350 mm/yr annual precipitation

Glaciated in the past but far too dry now

Timing of past glaciation poorly constrained

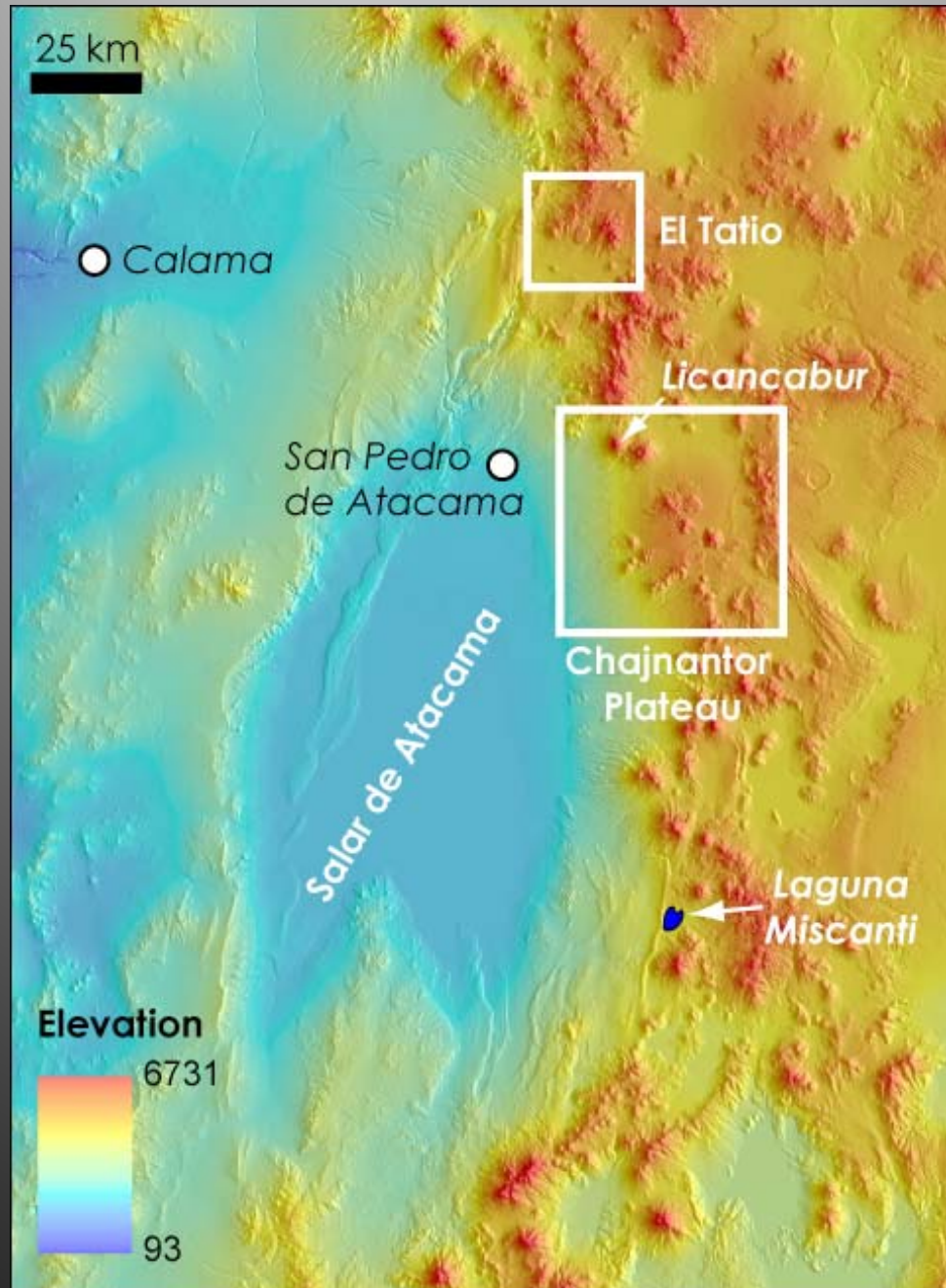


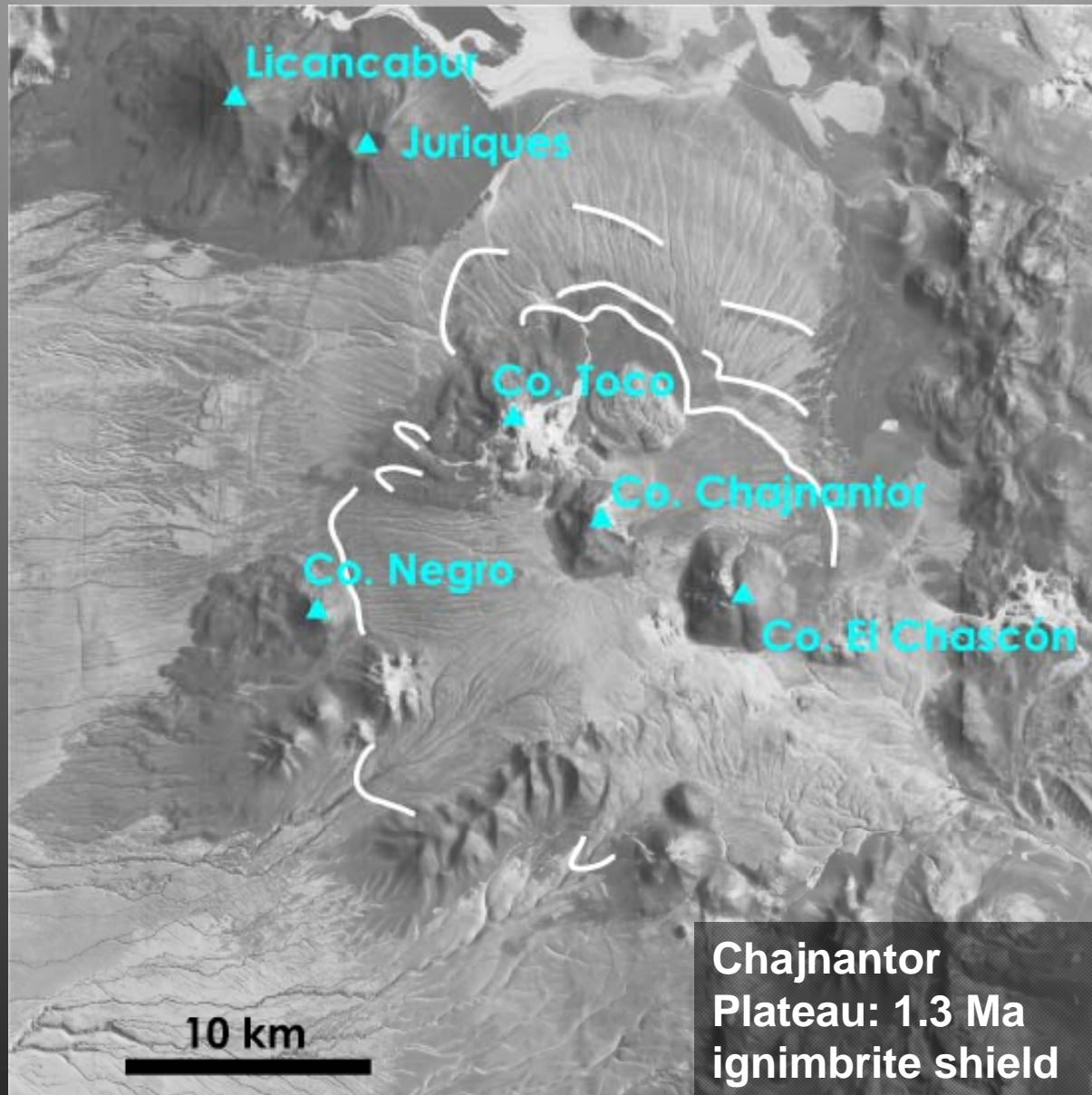
Major climate features

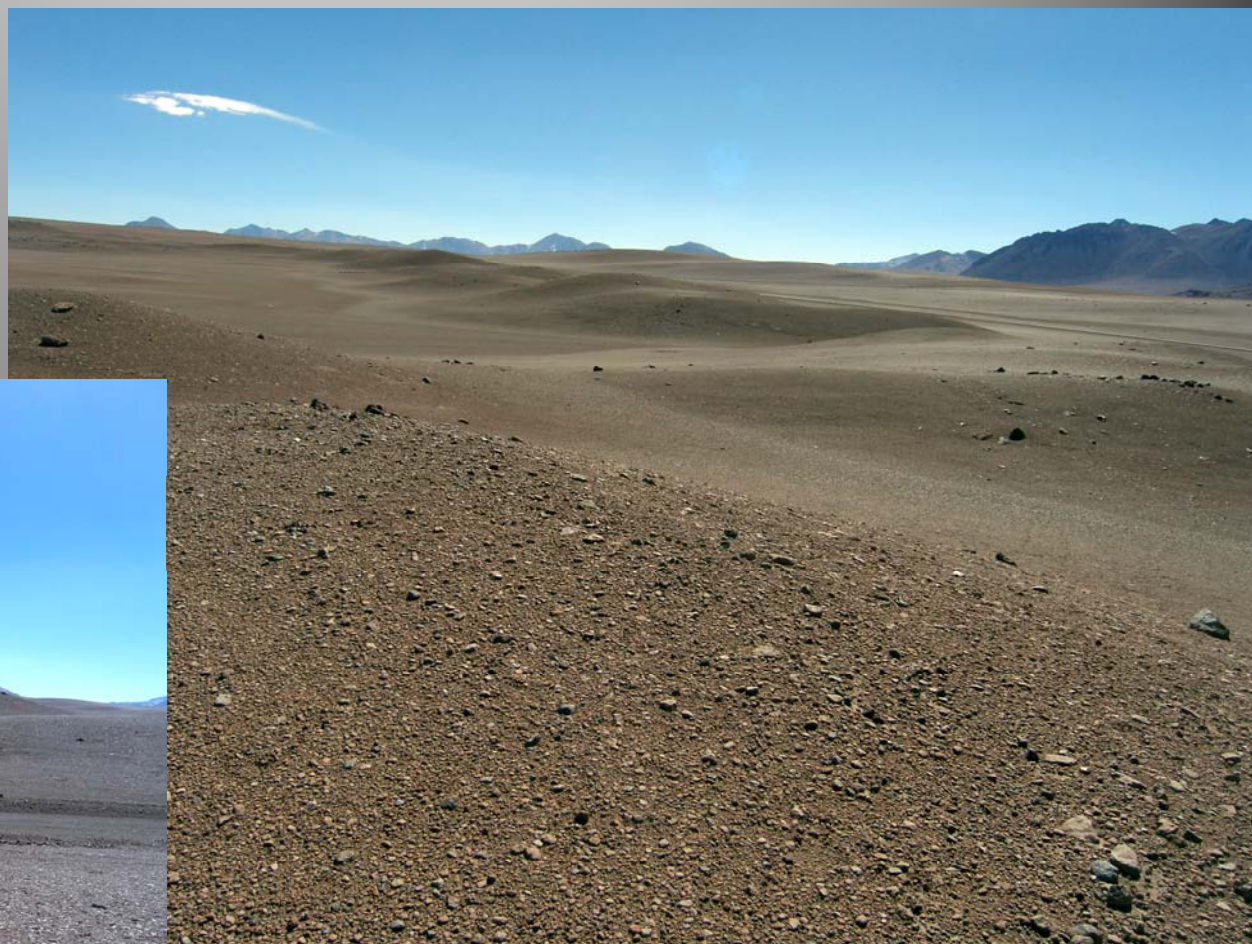
During SH summer, sensible heating in the eastern lowlands generates a monsoonal low

Latent heat release above this feature leads to a corresponding high pressure zone over the Altiplano – the “Bolivian High”

Precipitation in the Altiplano is correlated with southward displacements of the Bolivian High and with easterly winds in the upper troposphere

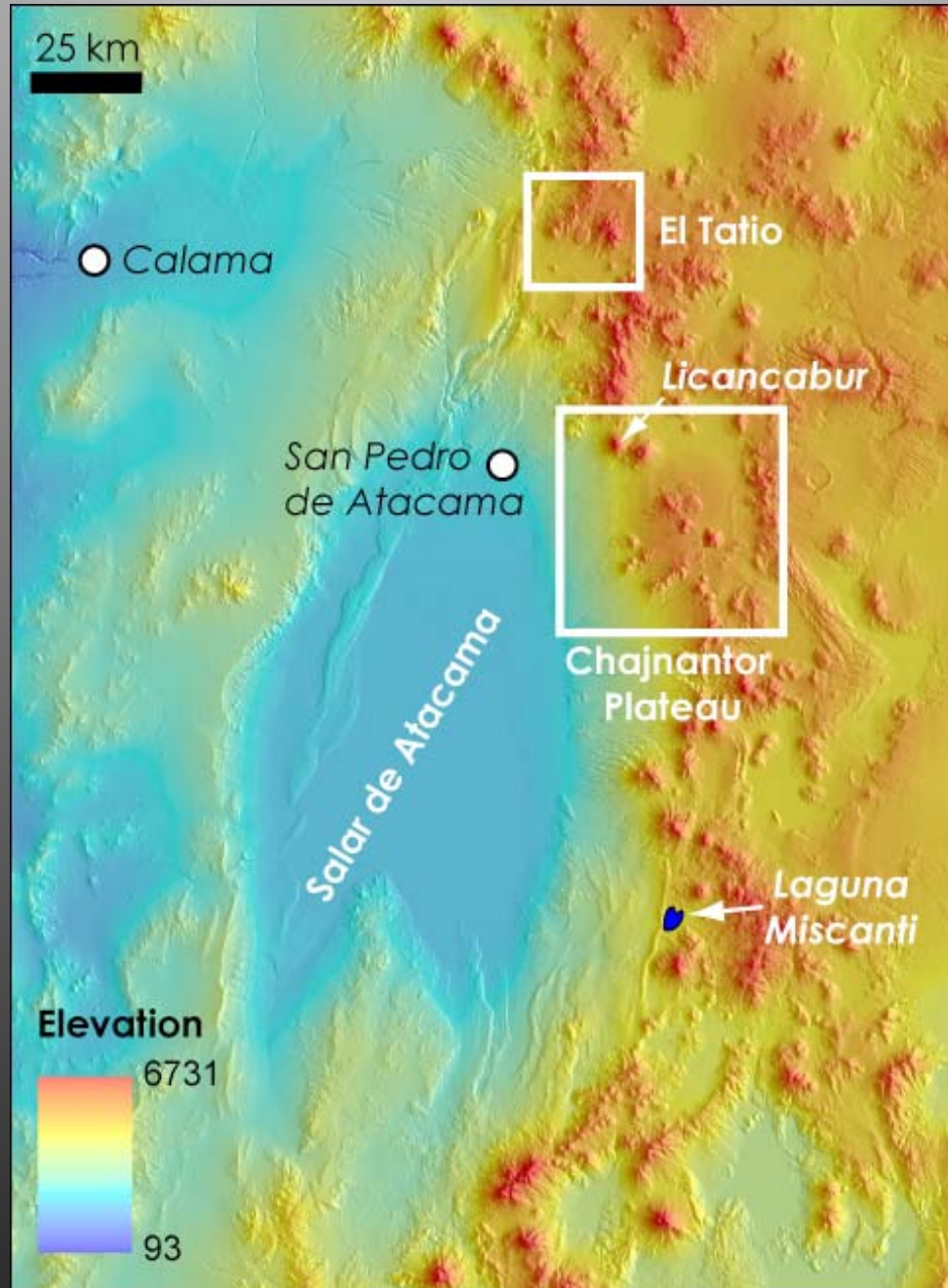






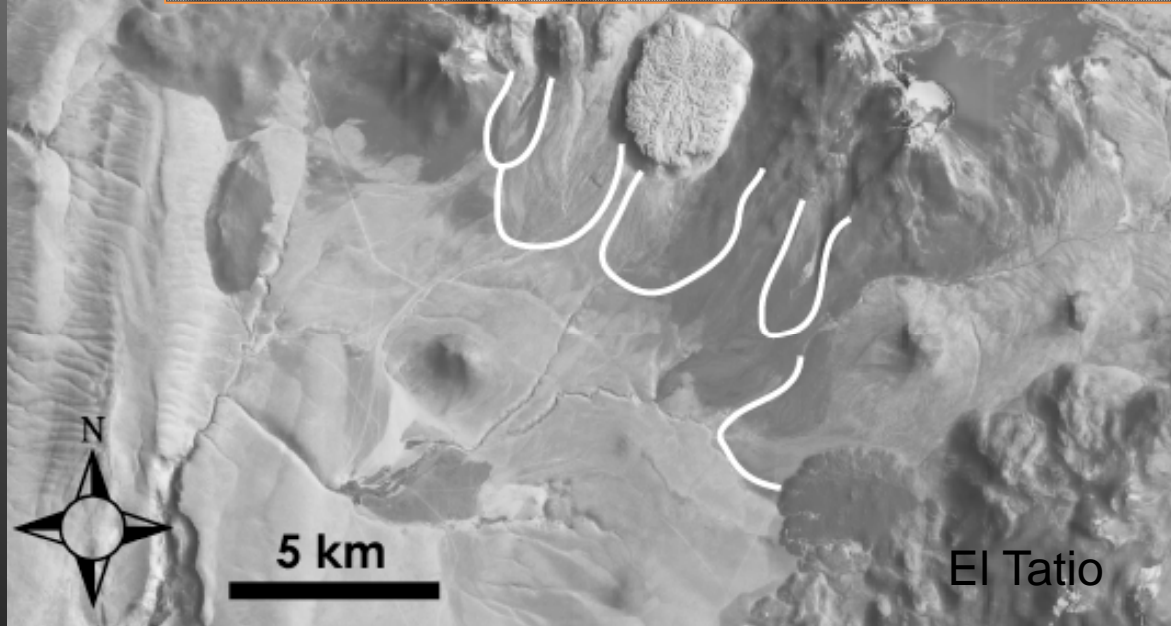








Modeling of this glacier by Kull and Grosjean (2000) suggests that ~ 1 m/yr **additional precipitation** is needed to create these glaciers - a ~ 5x increase.



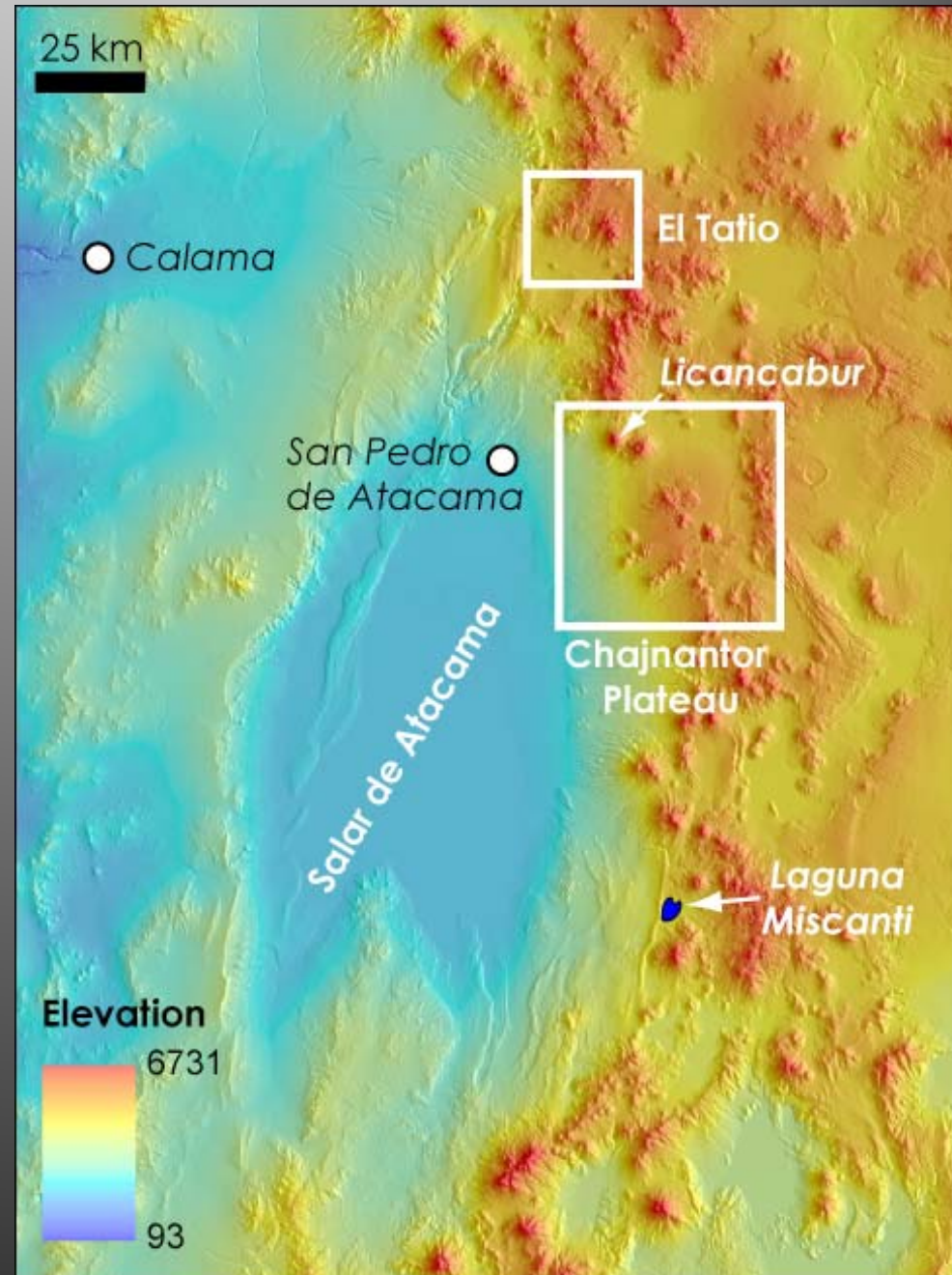
Regional paleoprecipitation records

Salar de Atacama salt
core

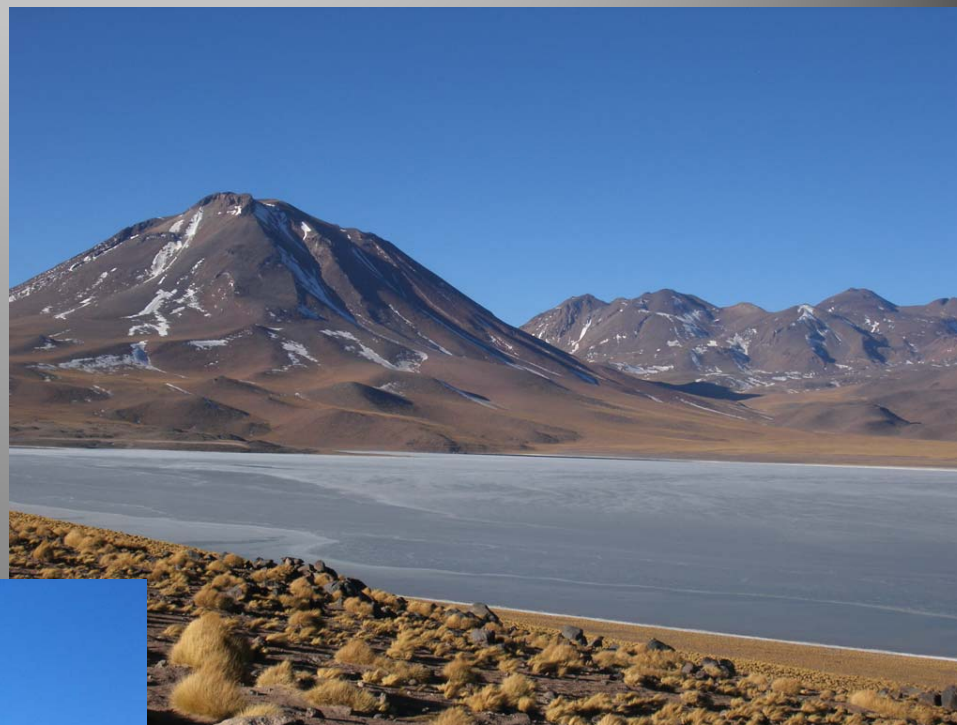
Salar de Uyuni salt core
(Bolivia)

Laguna Miscanti sediment
core

Paleowetland deposits in
Atacama

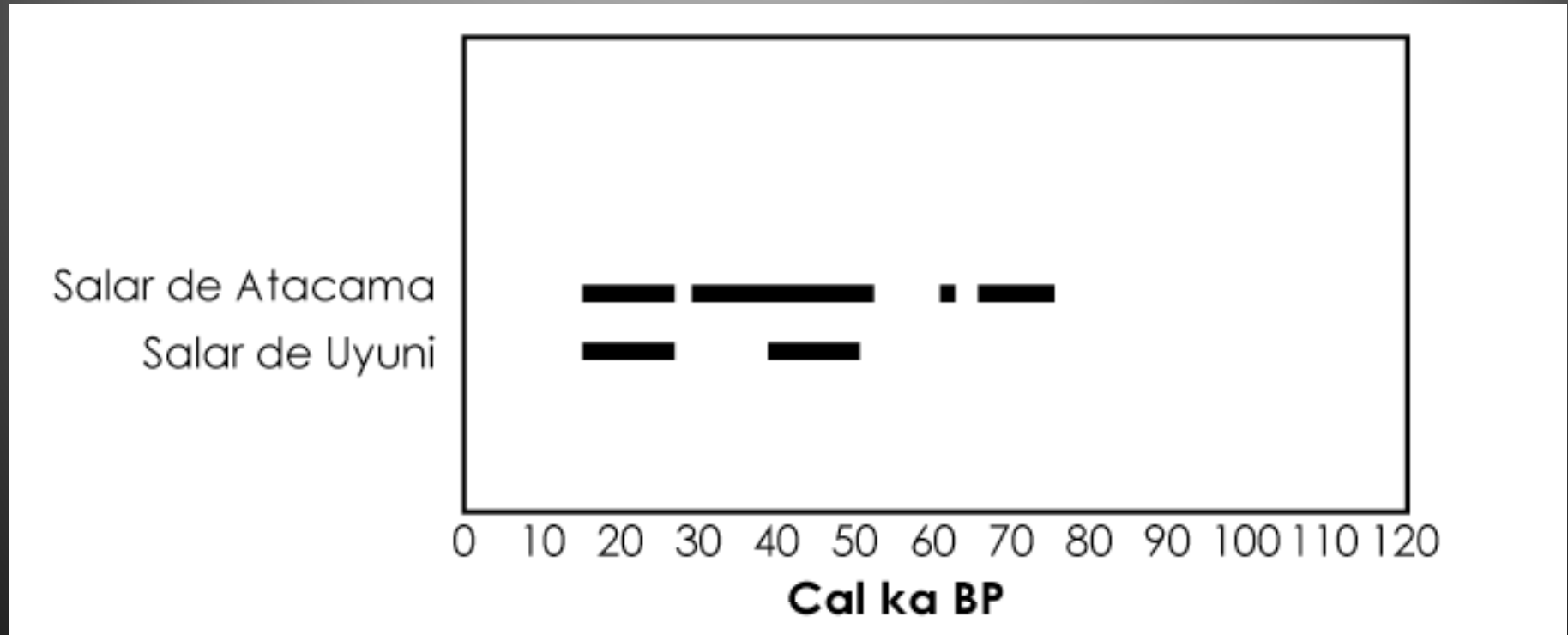


Salar de Atacama

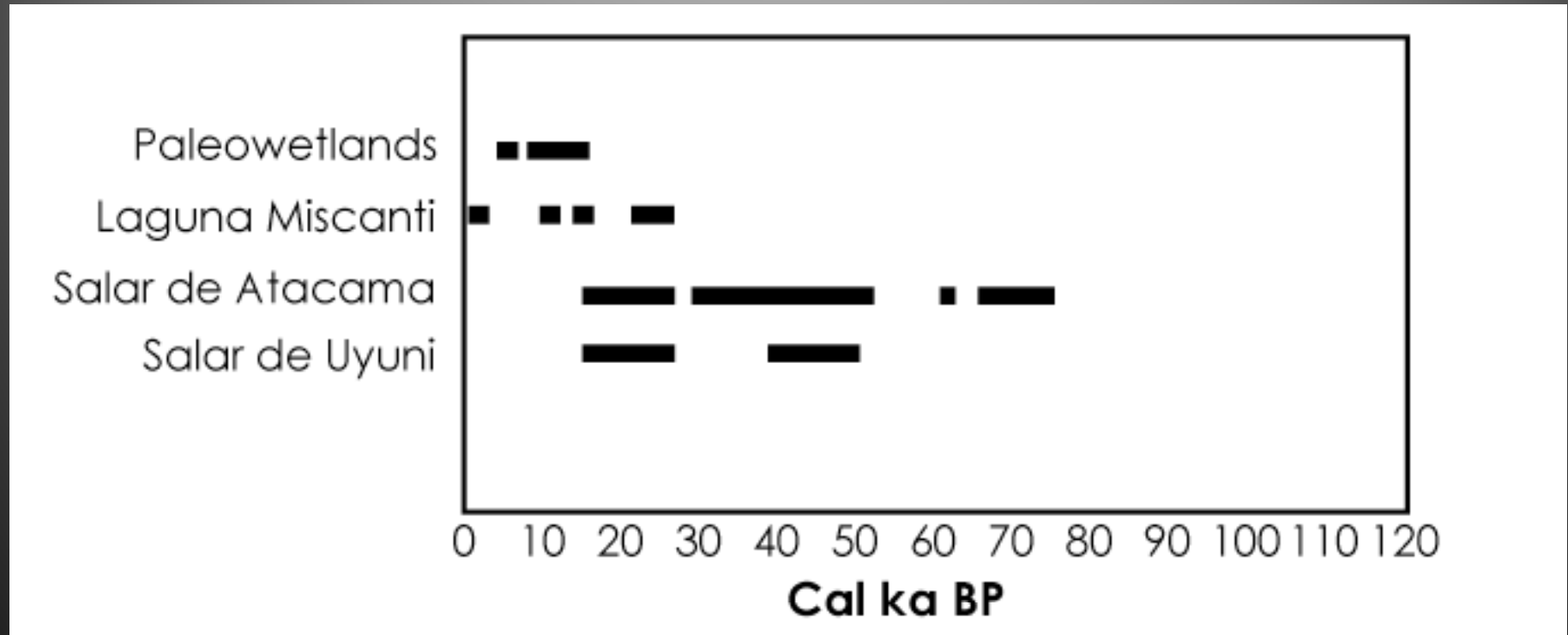


Laguna Miscanti

Times of increased precipitation

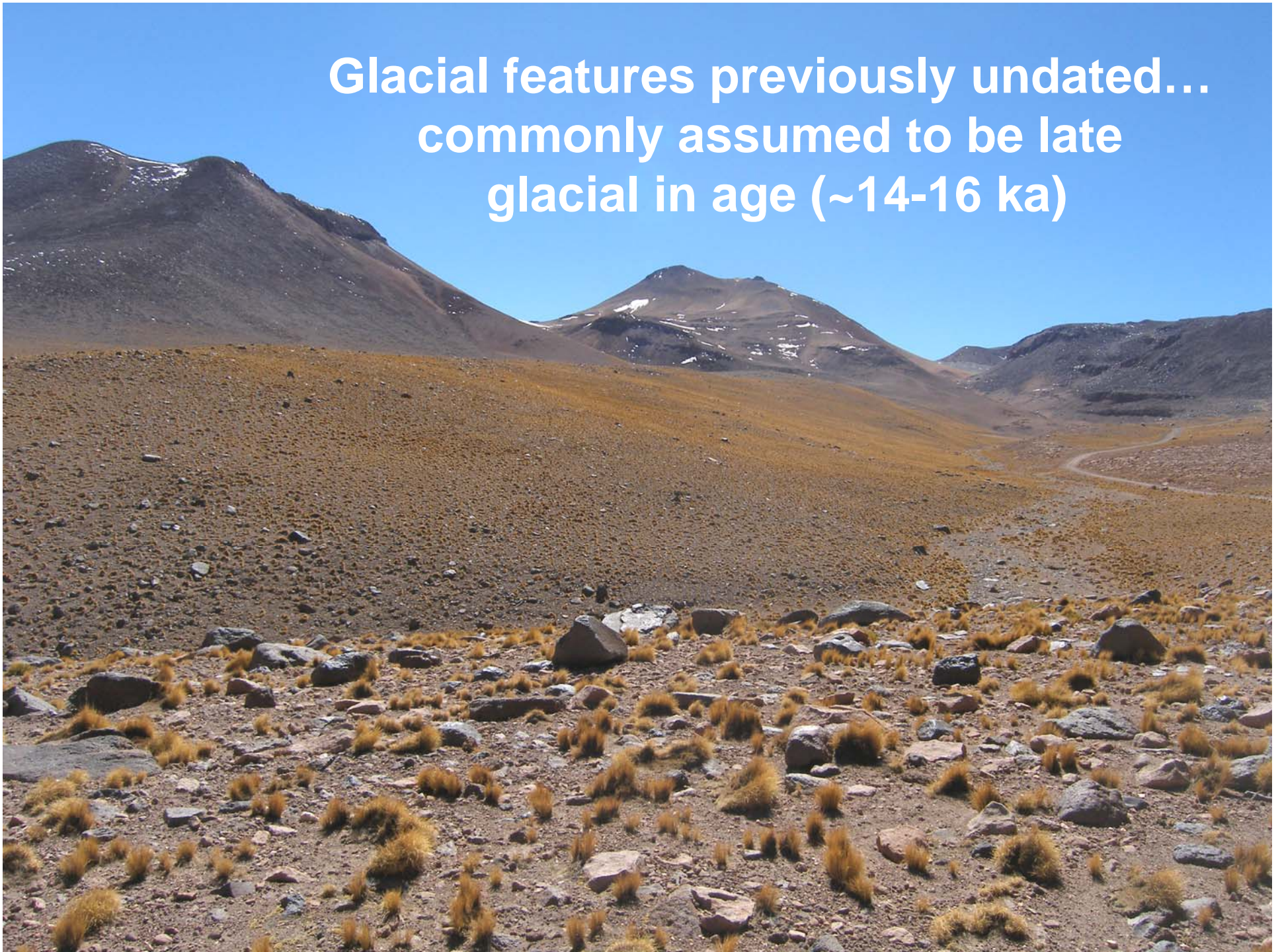


Times of increased precipitation



So, when were the glaciers last present?

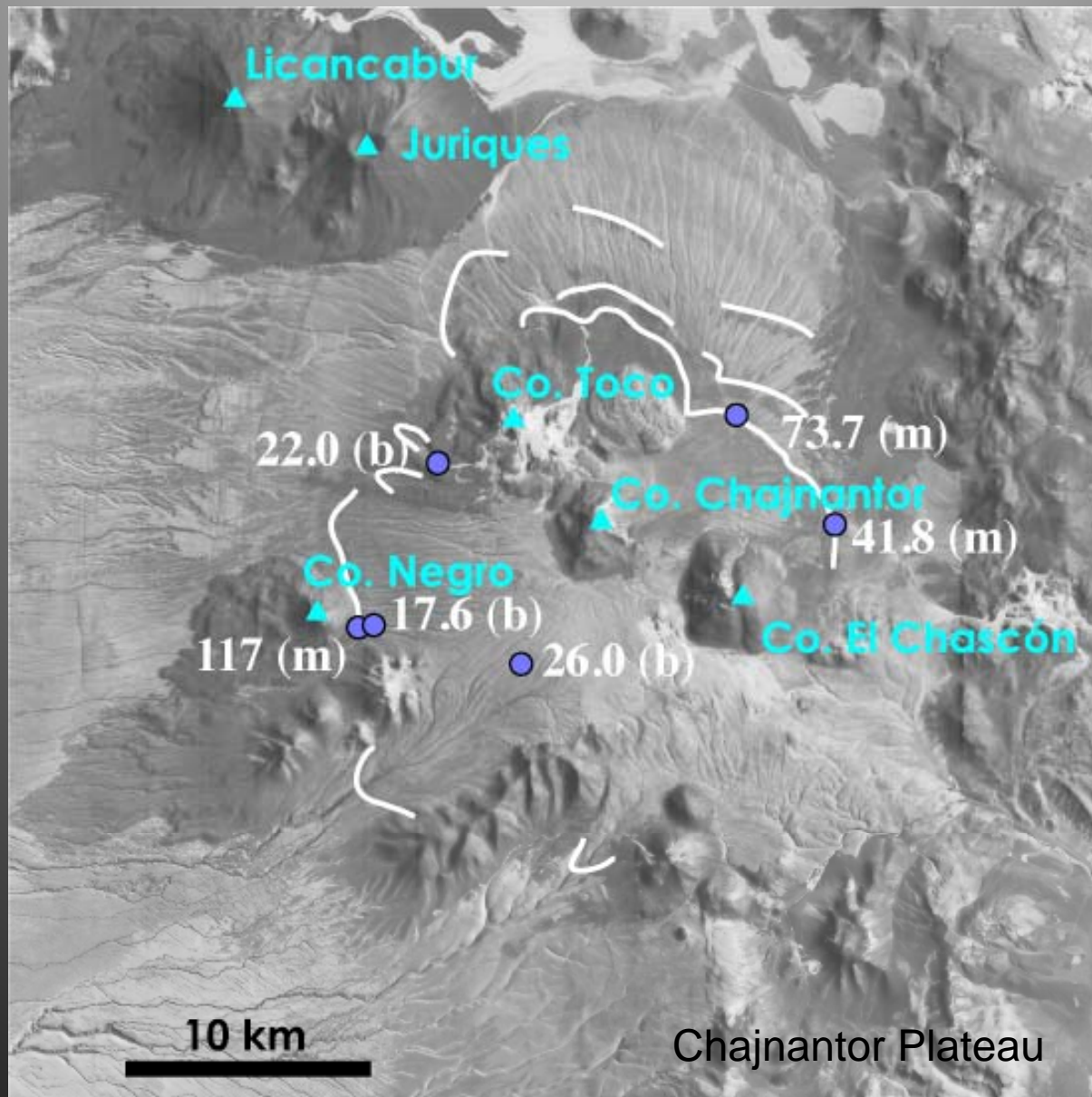
**Glacial features previously undated...
commonly assumed to be late
glacial in age (~14-16 ka)**

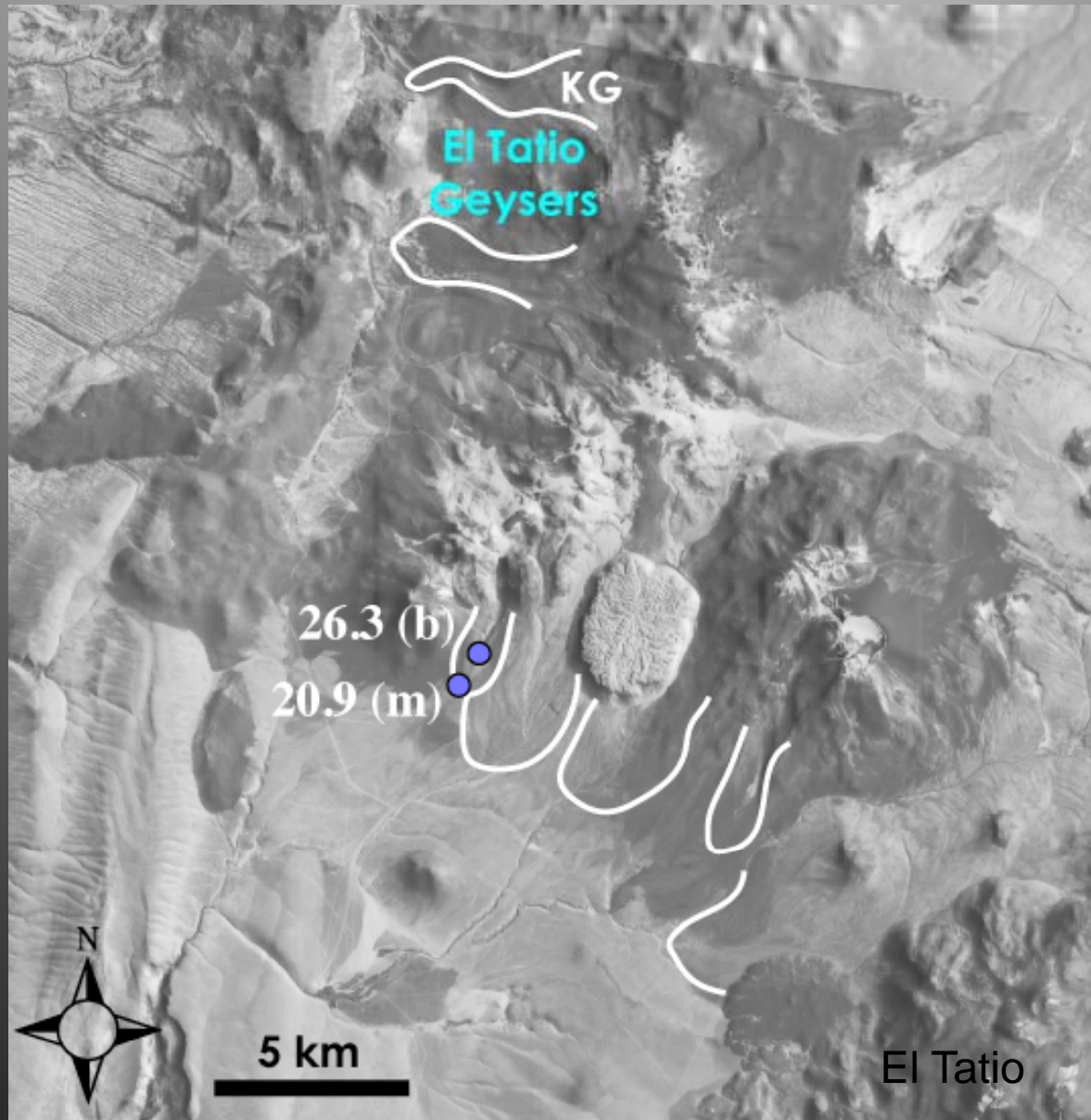


Cosmogenic exposure ages: ^{10}Be in quartz

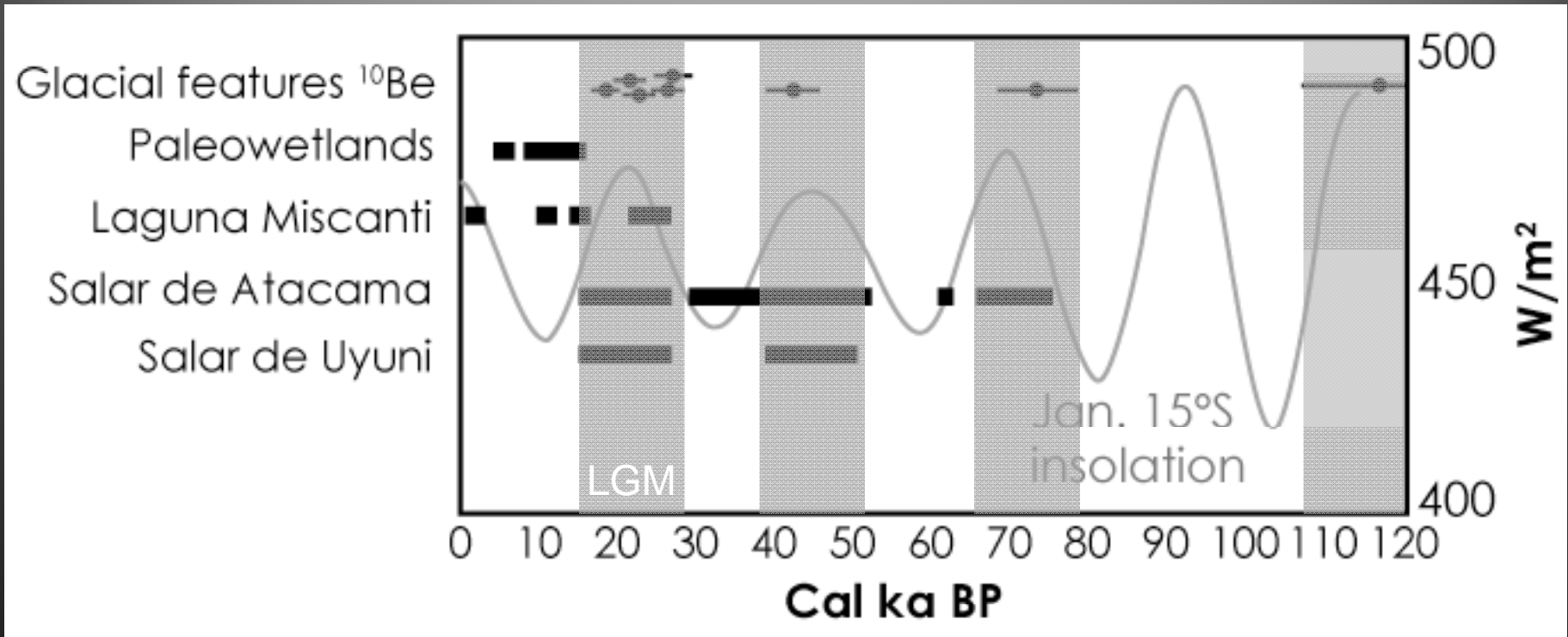


(results from 8 pilot samples)



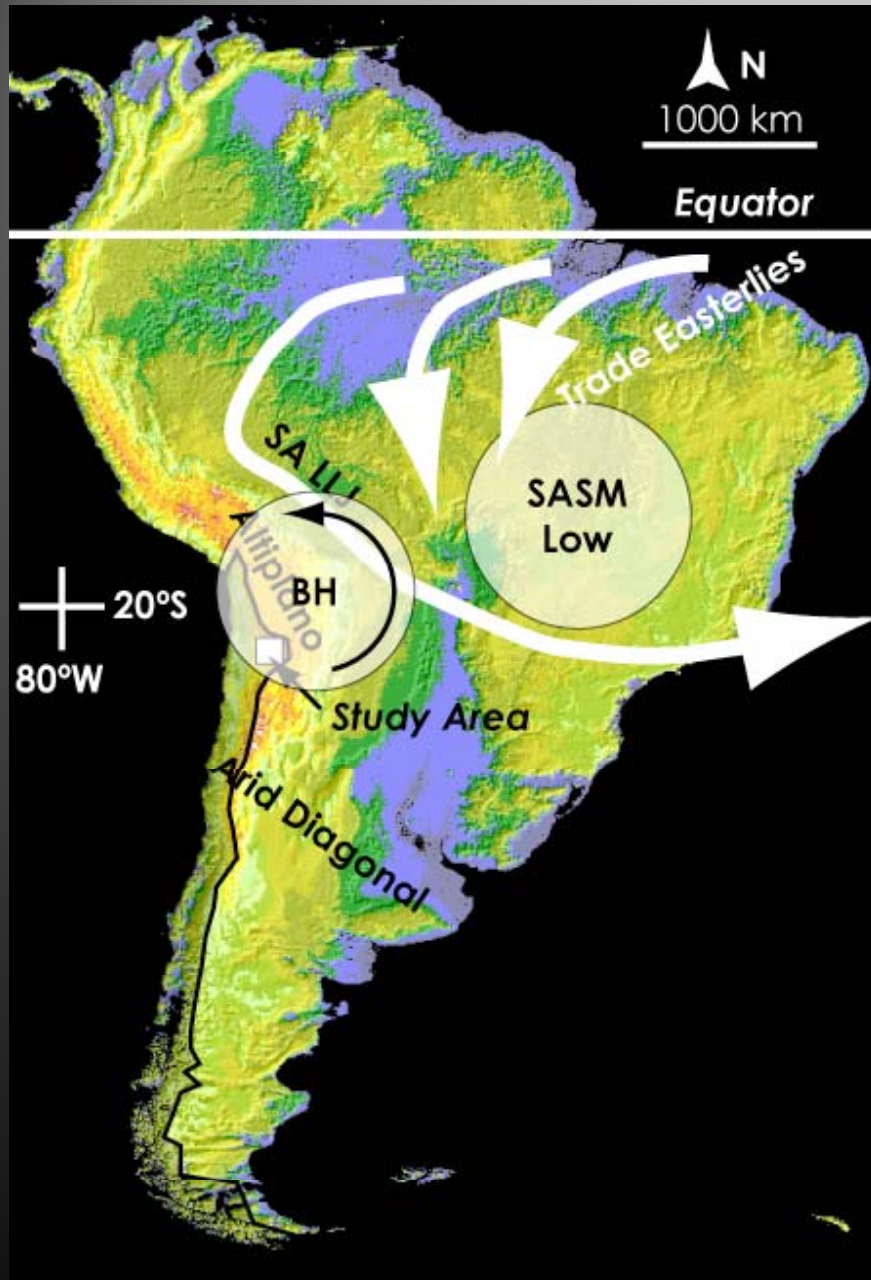


Times of increased precipitation



Increased precipitation during late glacial insufficient to re-glaciate the area

Glaciations and highstands of salar lakes appear to occur during SH insolation maxima



One hypothesis...

During times of high insolation, the monsoon system is shifted to the south (as demonstrated by speleothem records in Brazil)

This shifts the climatological Bolivian High to the south, resulting in more frequent upper-level easterly winds over the Altiplano...

... resulting in enough additional precipitation to glaciare the Chajnantor area.



Next steps ... **(proposed to NSF)**

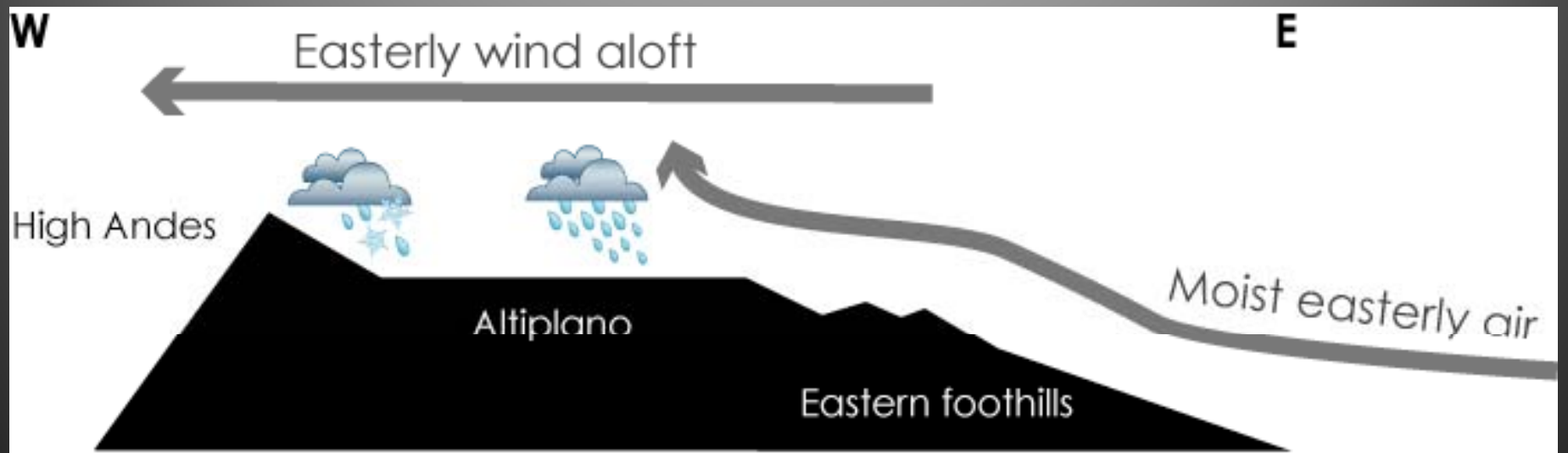
Further glacier modeling to constrain necessary precipitation

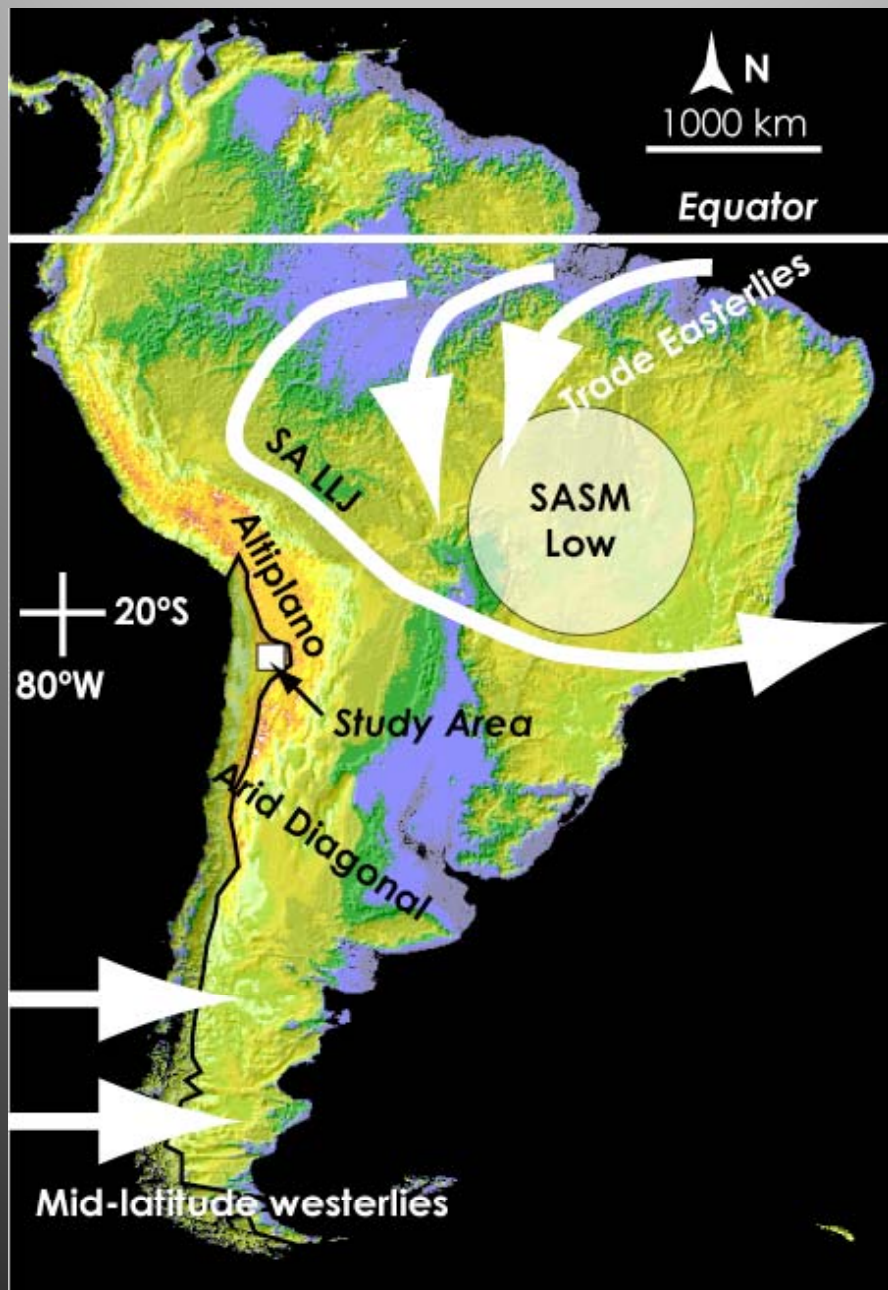
Climate modeling to evaluate mechanisms for generating this precipitation

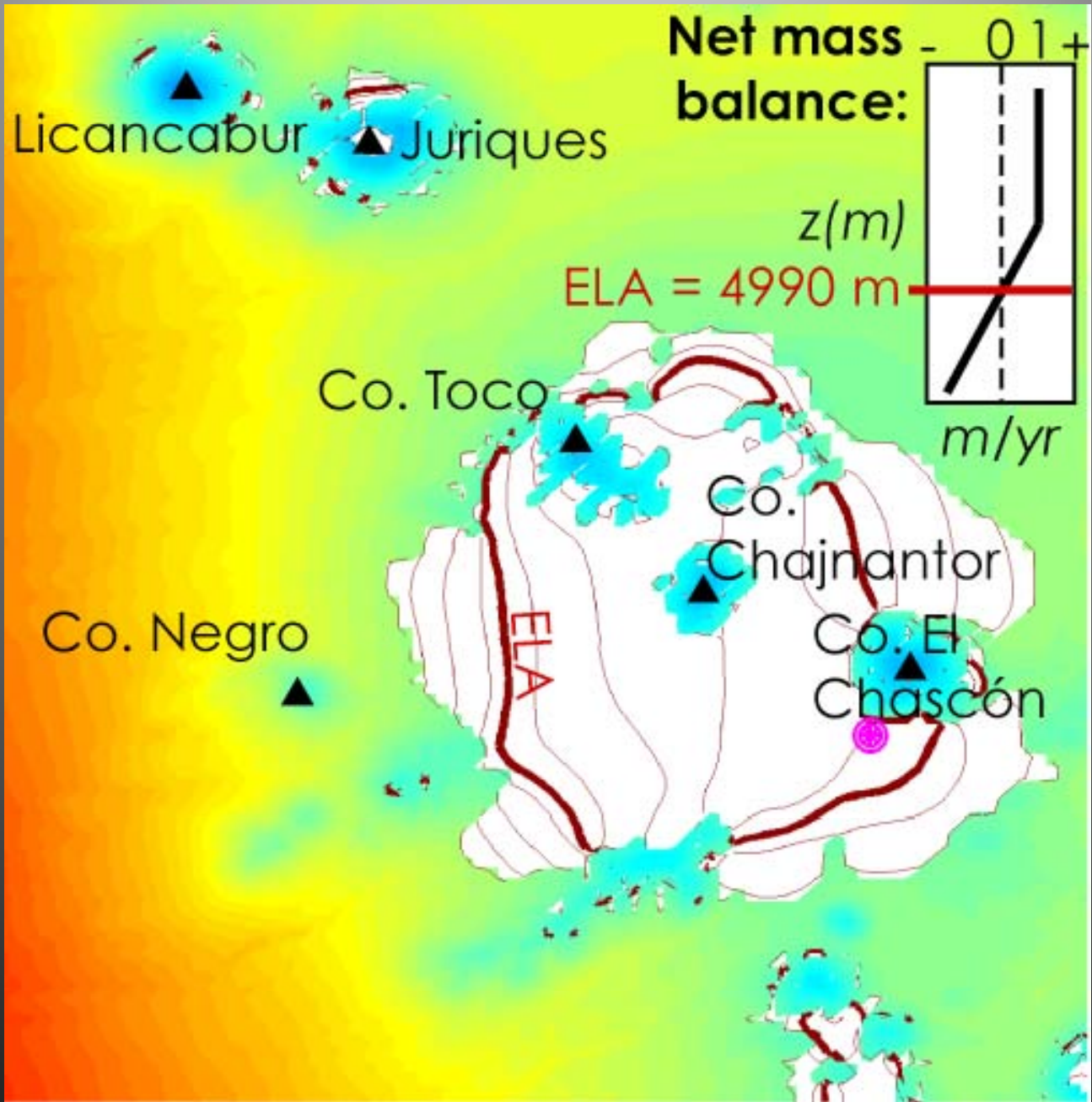
Collect and run many more cosmogenic samples to flesh out the glacial history

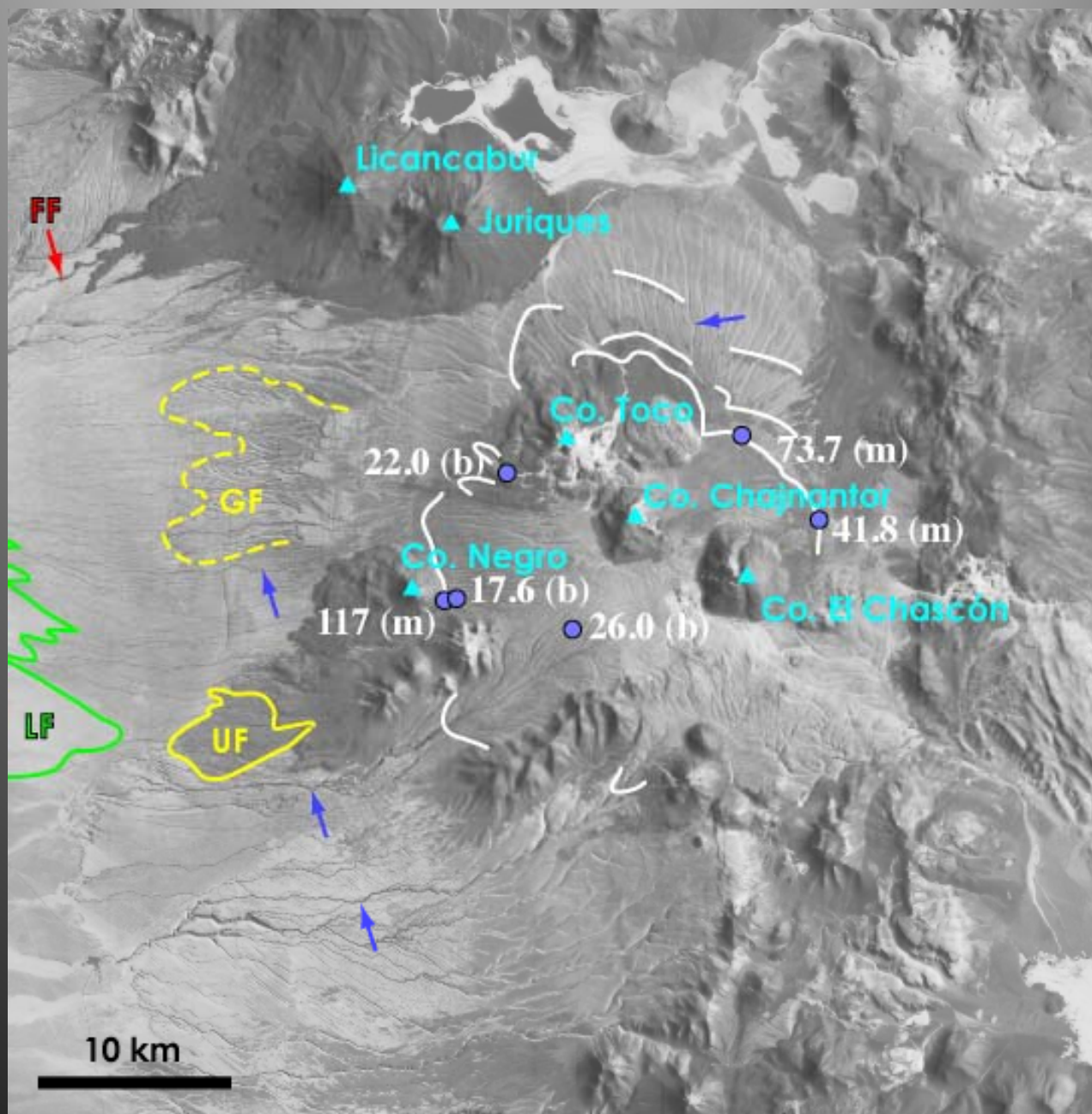
Assess geomorphic relationship between glacial features and non-glacial features – bedrock channels, alluvial fans













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