

Restricted glaciations on the Tibetan Plateau and palaeoclimatic implications

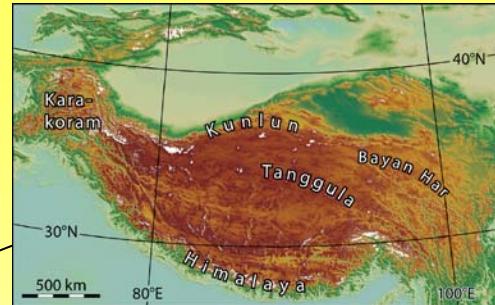


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5. Lund University, Sweden
6. University of Tennessee Knoxville, USA
7. Peking University, China

Outline

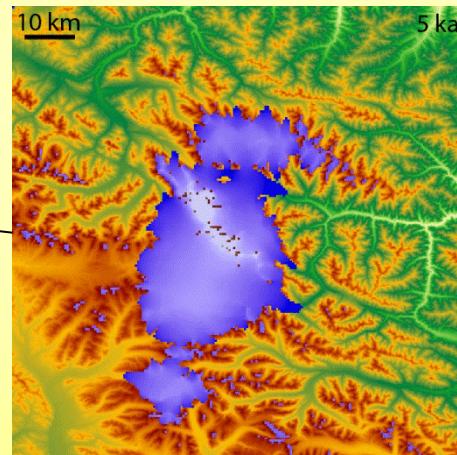
- Background



- Limited glaciation

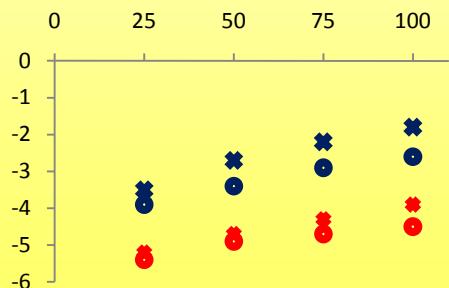


- Method



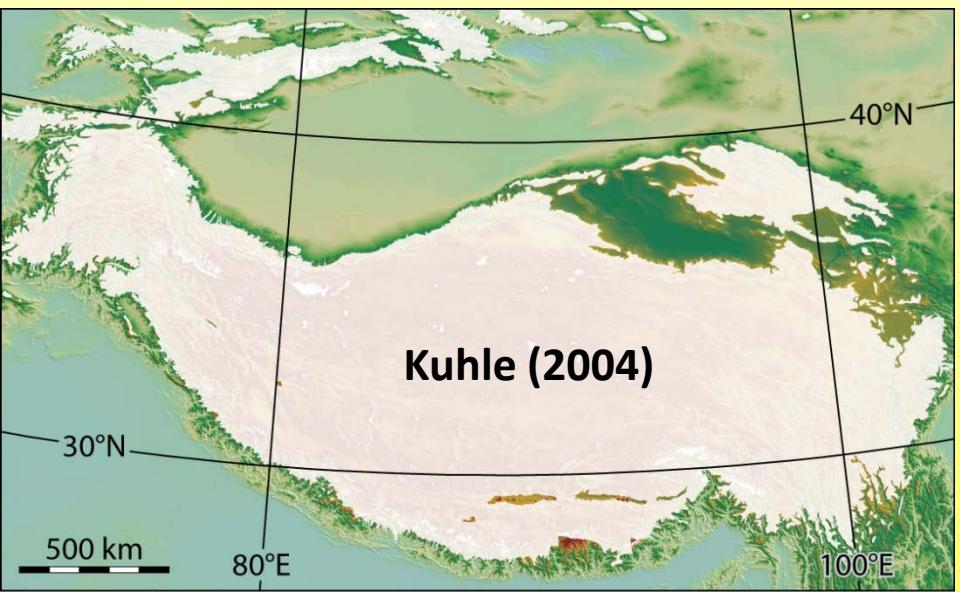
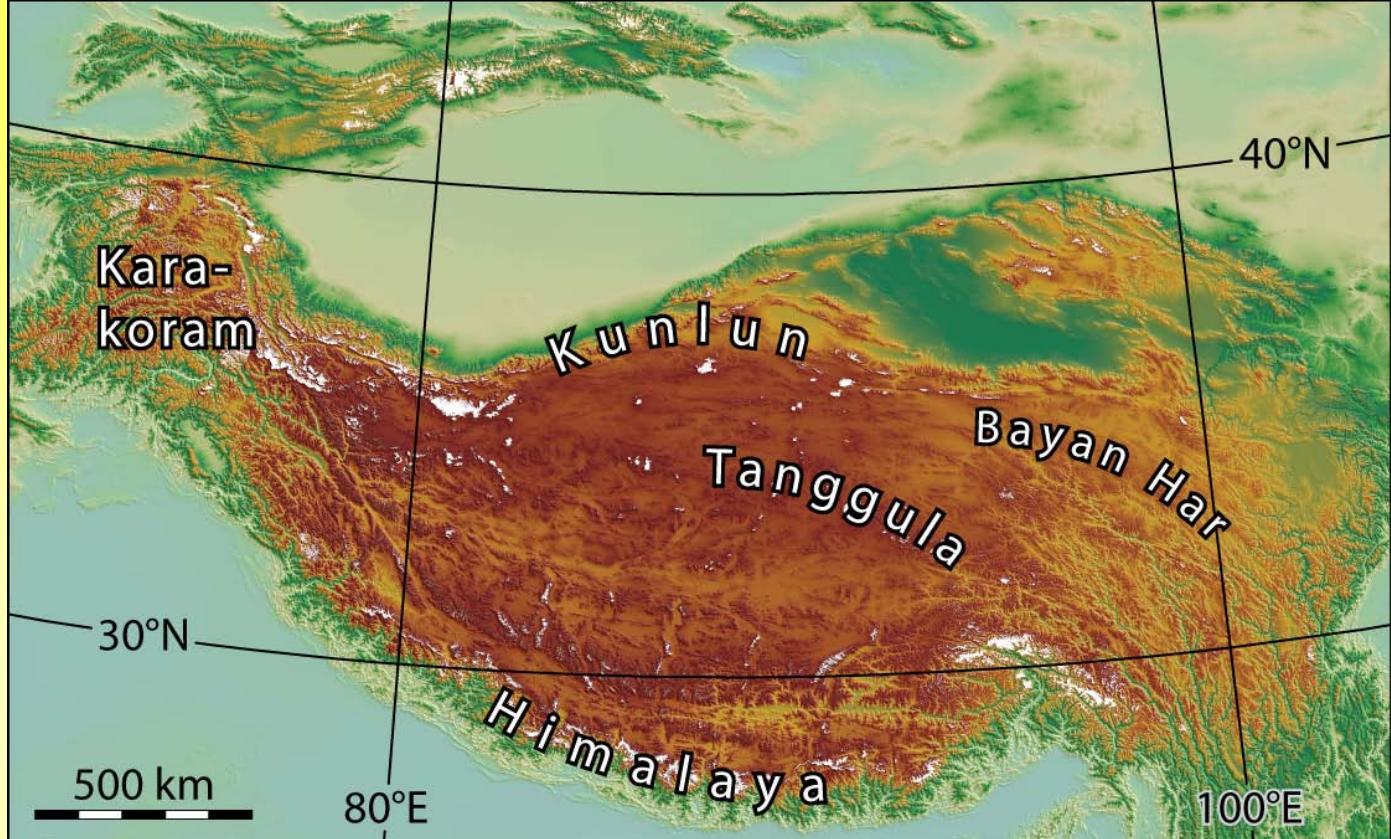
- Modeling data

- Conclusions

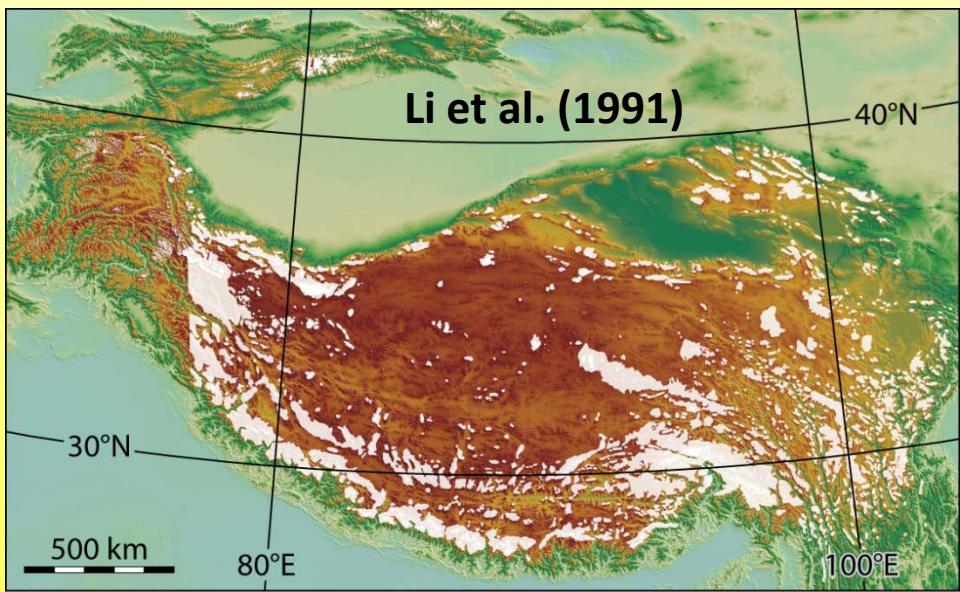


Background

Tibetan Plateau
glaciation



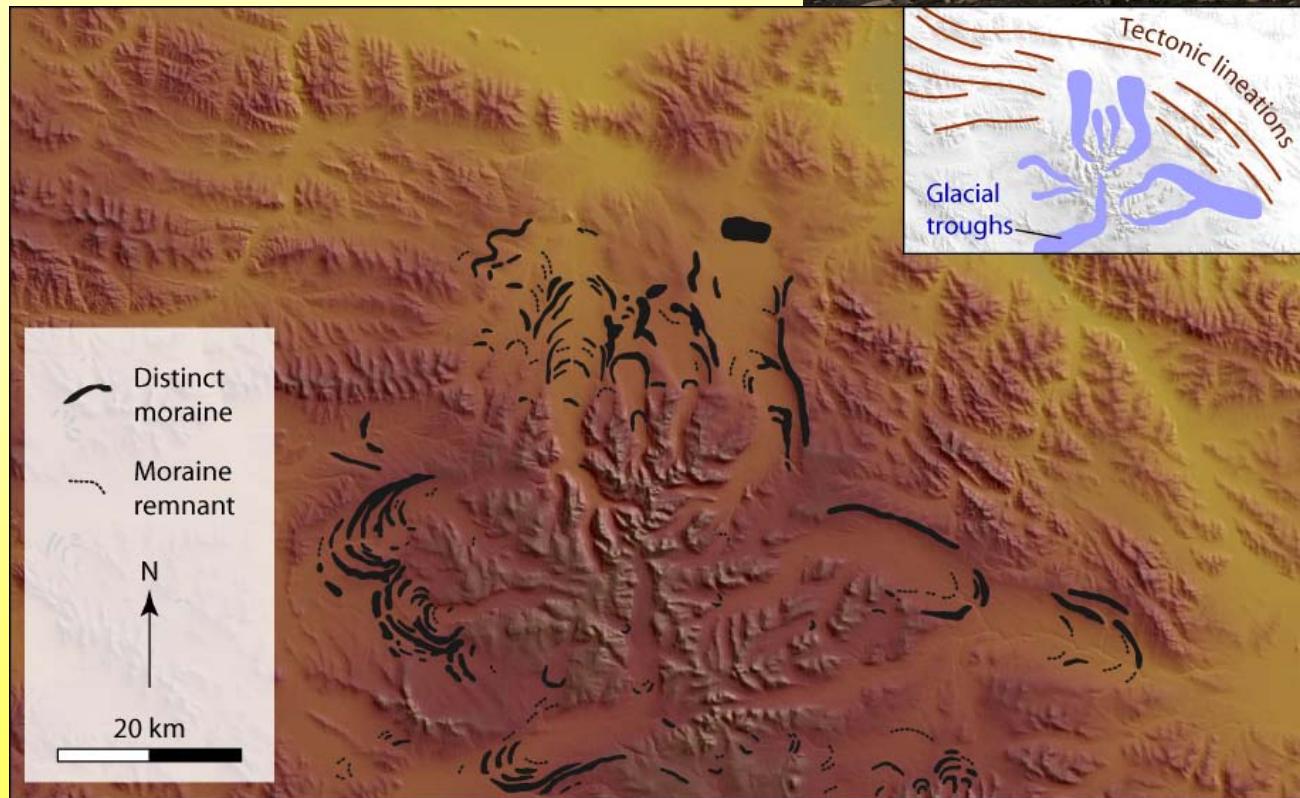
Kuhle (2004)



Li et al. (1991)

Restricted glaciation

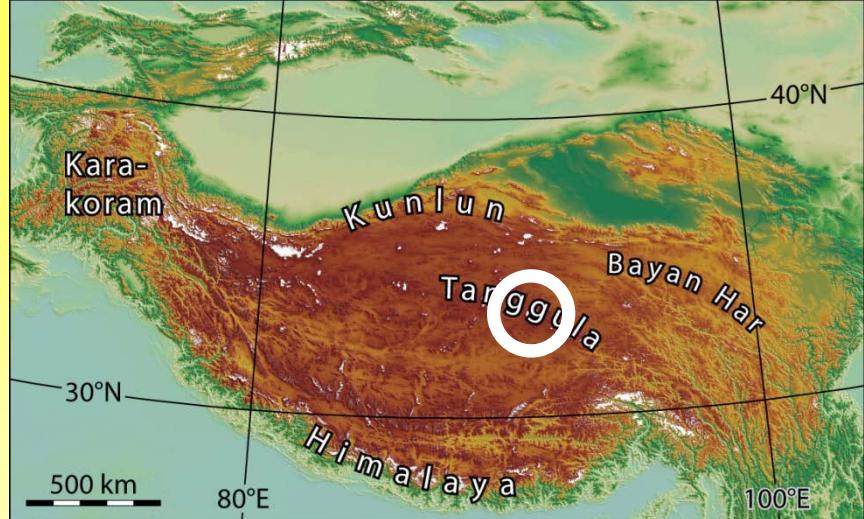
Glacial landforms and sediments are limited to the highest parts of the plateau



Stroeven et al. (2009)

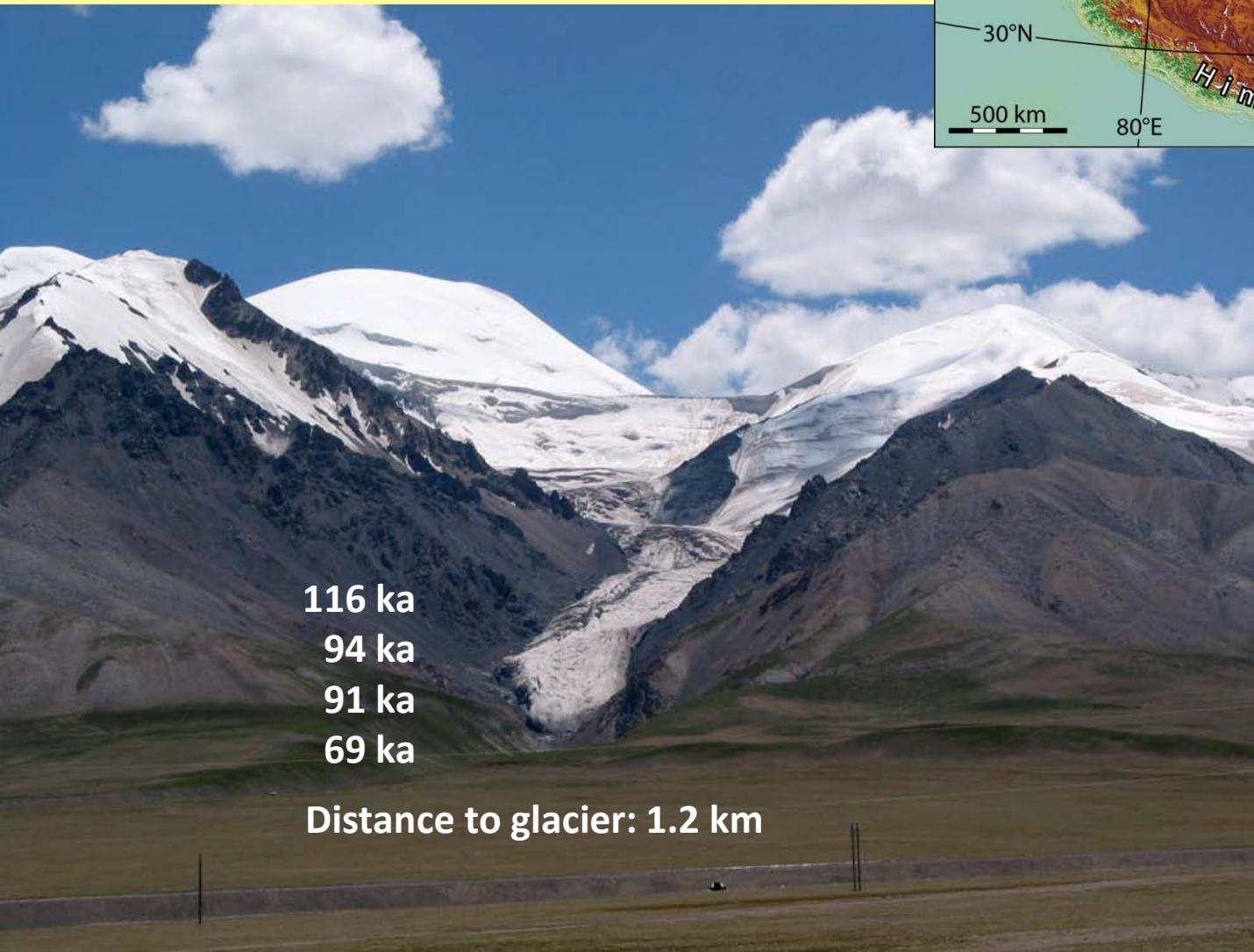
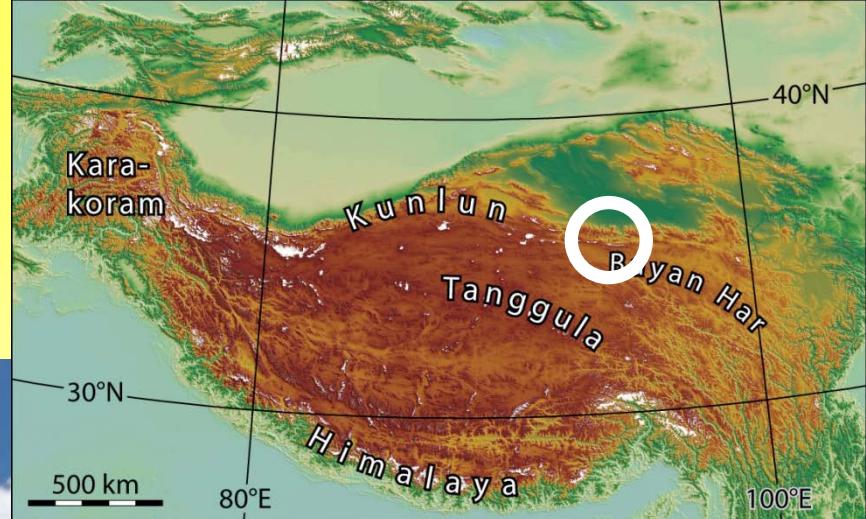
Tanggula ice-field

Exposure age data from Schäfer et al. (2002),
Owen et al. (2005), Colgan et al. (2006)



Kunlun pass ice-field

Exposure age data from Owen et al. (2006)



Glaciers on the Tibetan Plateau have been restricted to alpine style mountain glaciation

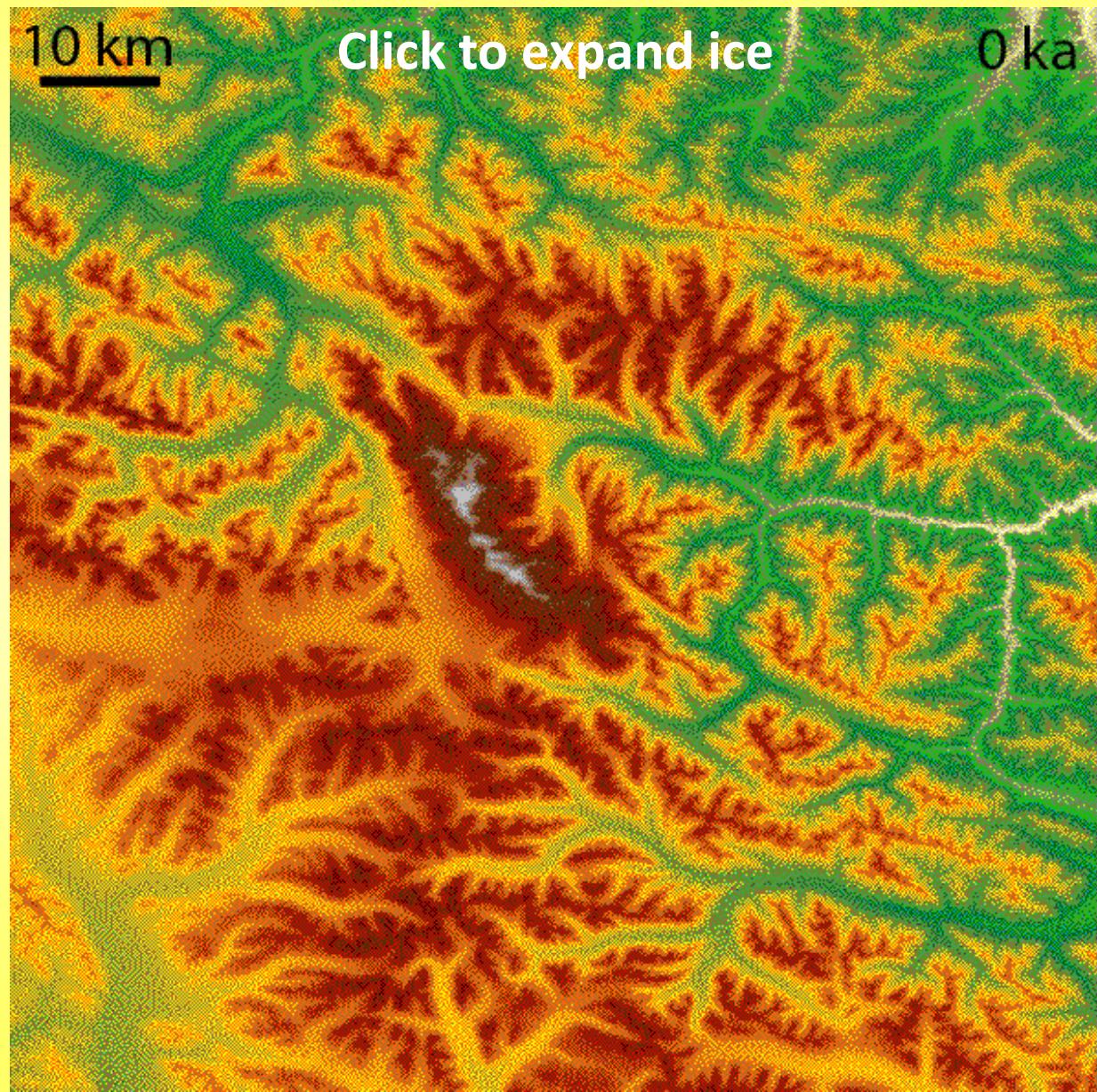
What does the glacial geological record tell us about past climate on the Tibetan Plateau?



Methodology – glacier modeling

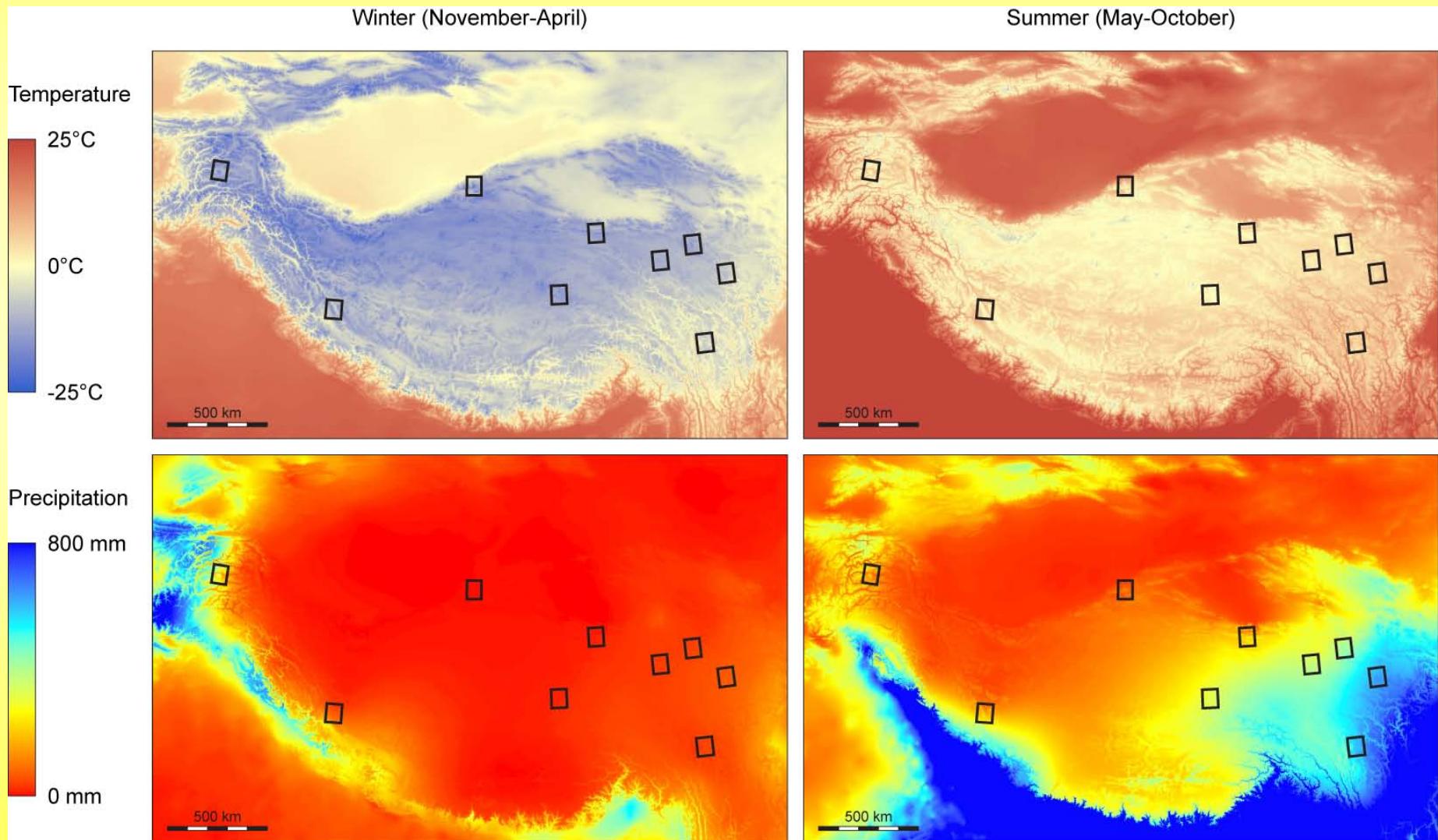
High resolution
(<500 m) 3D
glacier model

Static climate
perturbation



Input:

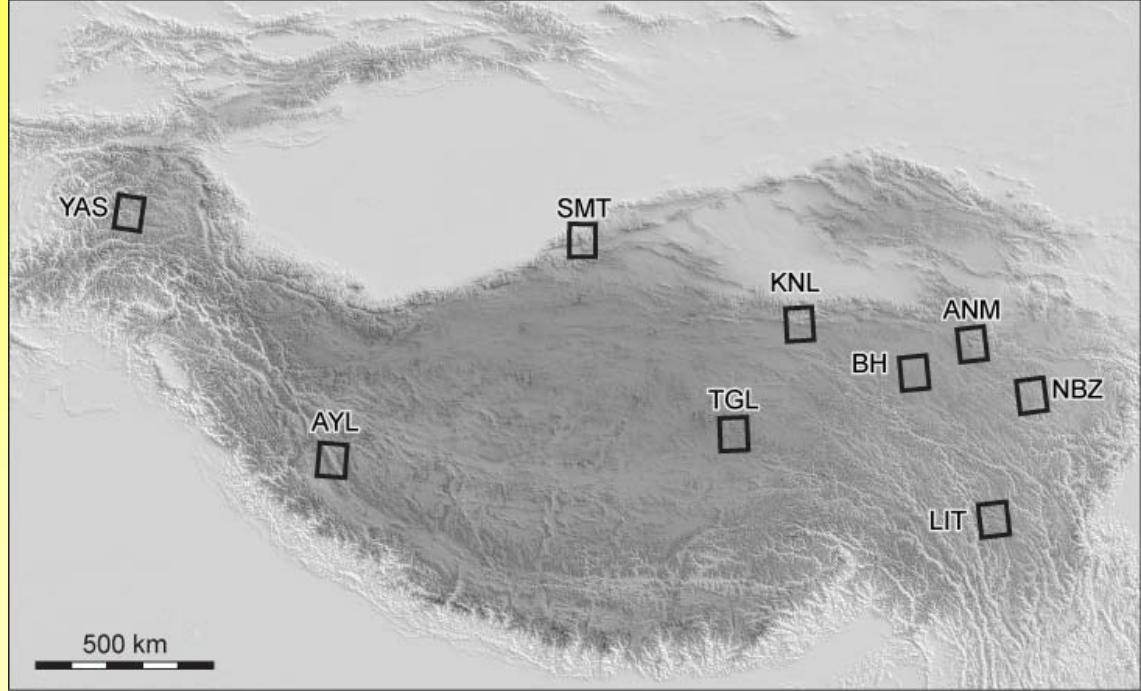
High resolution monthly interpolated present-day climate (Hijmans et al., 2005) used for mass balance calculations



Initial model runs for 9 domains

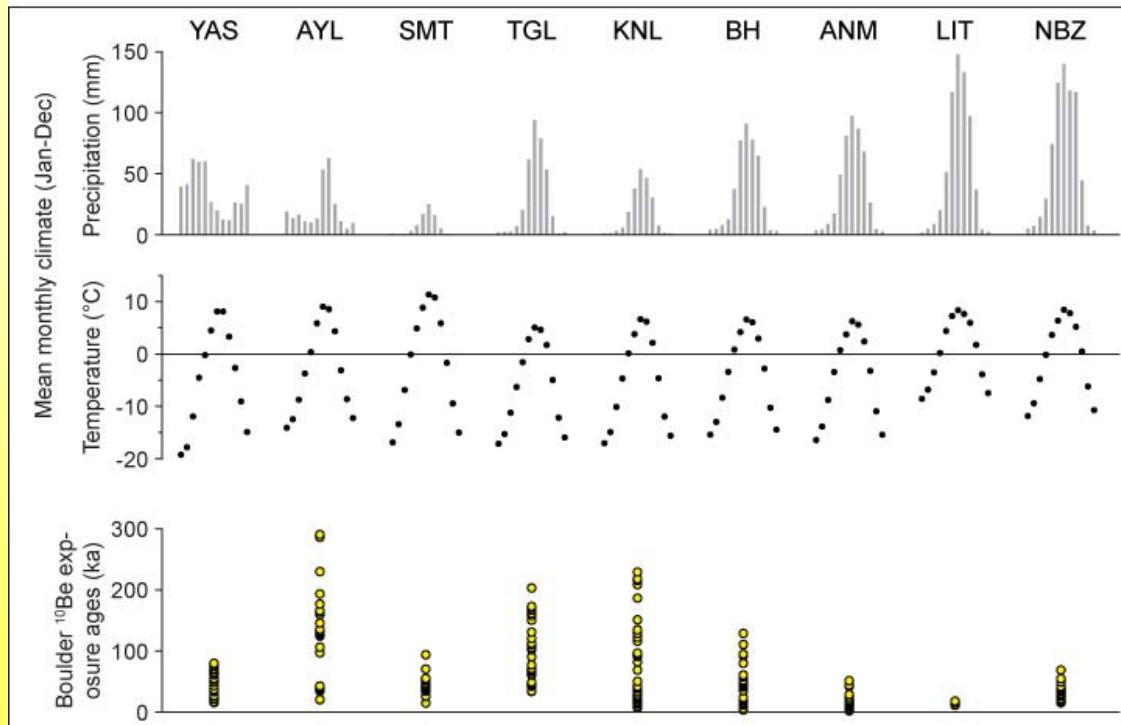
All domains have glacial boulder ^{10}Be exposure ages

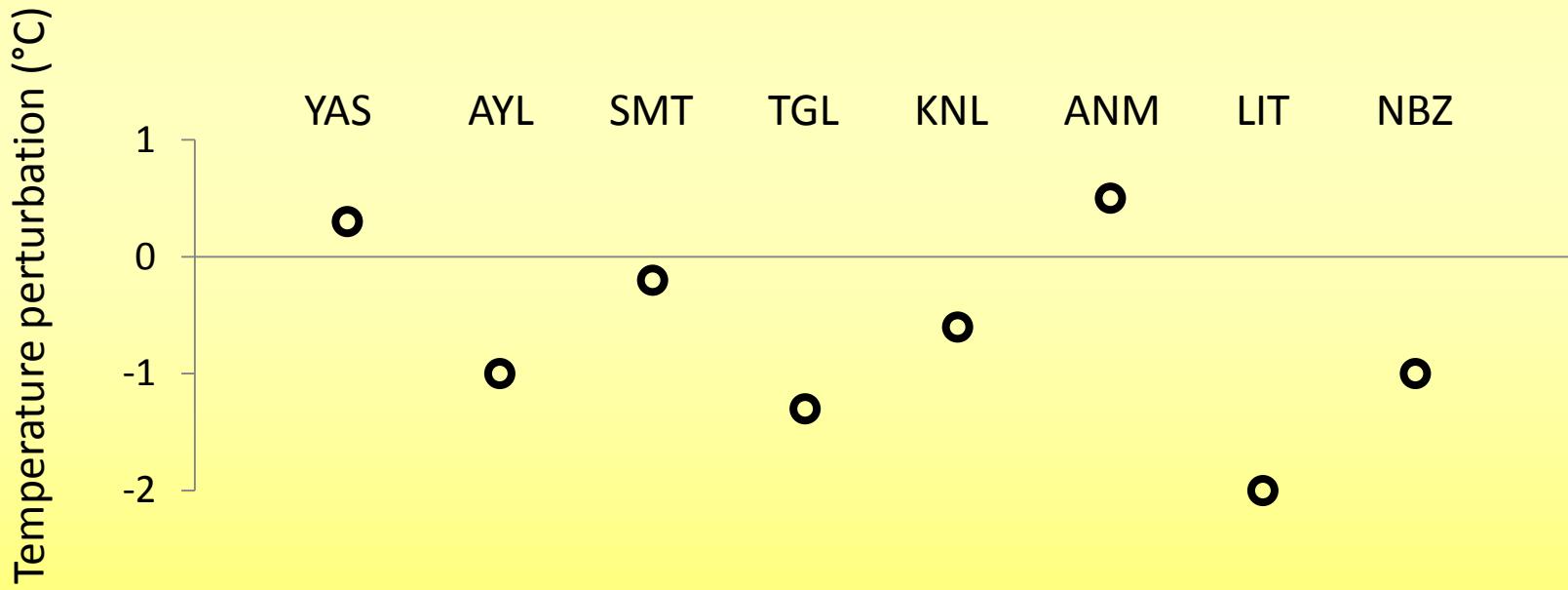
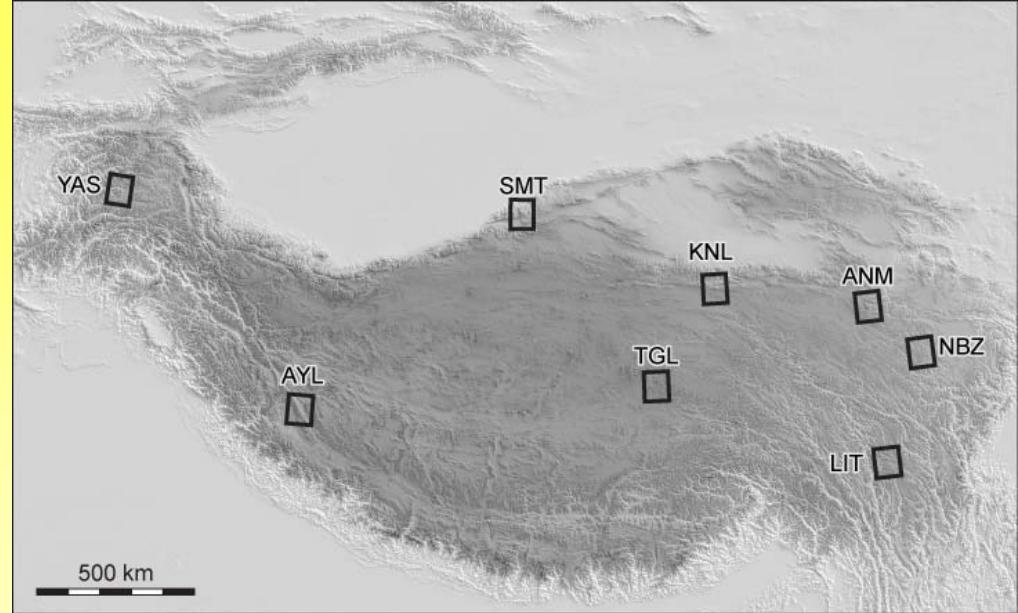
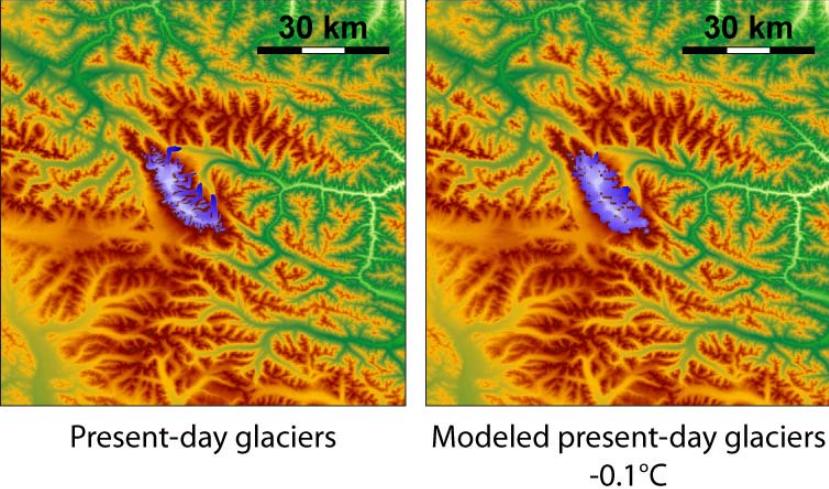
→ Chronological constraints



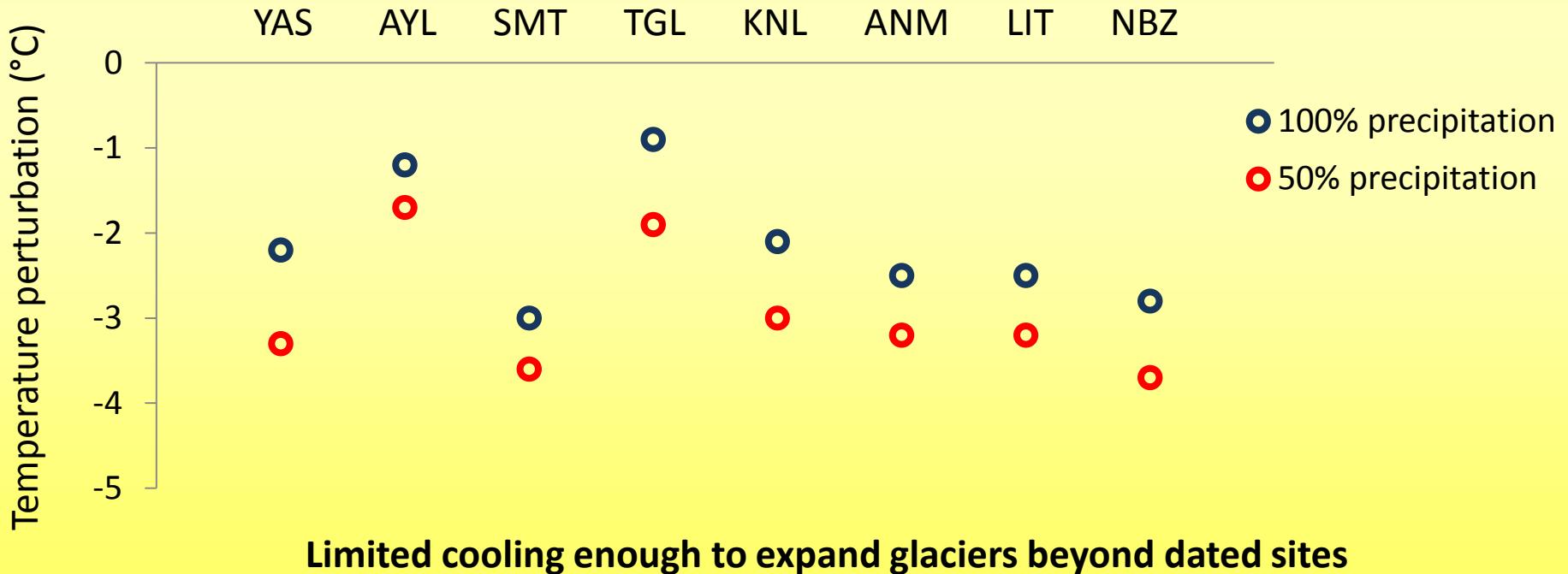
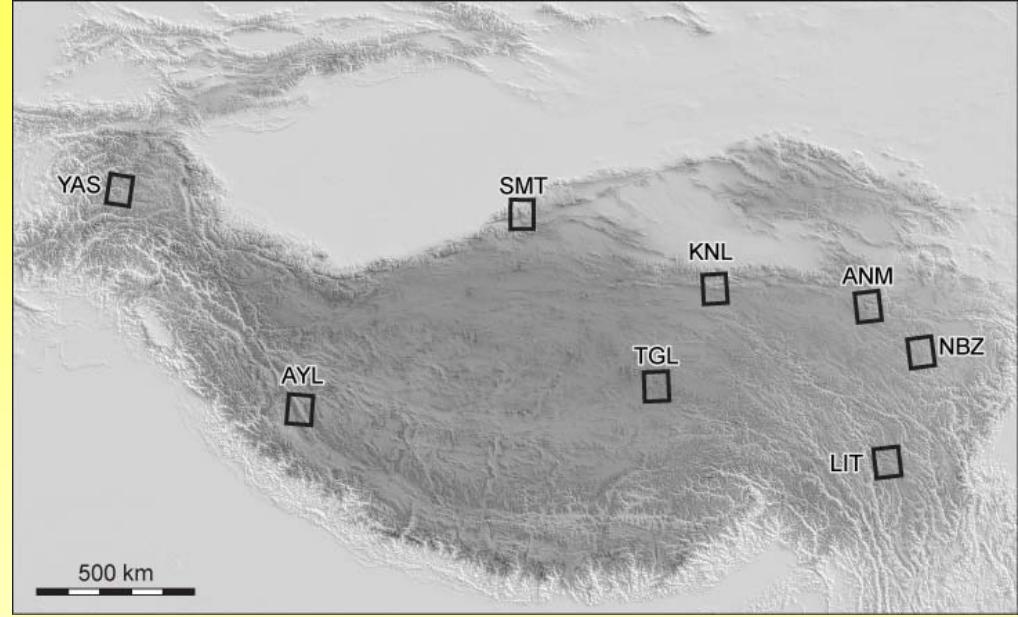
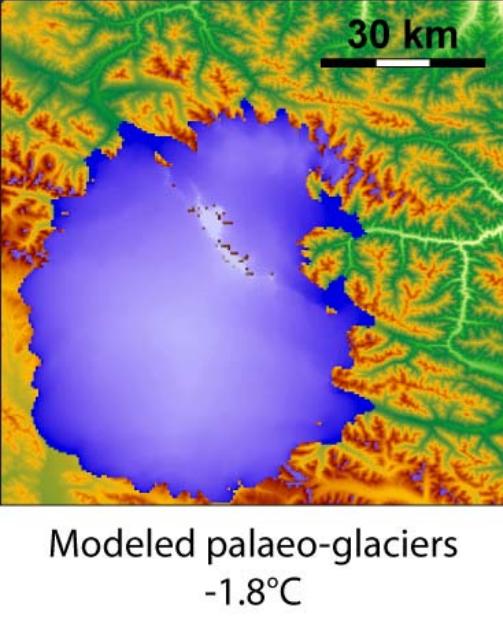
All but one domain have present-day glaciers

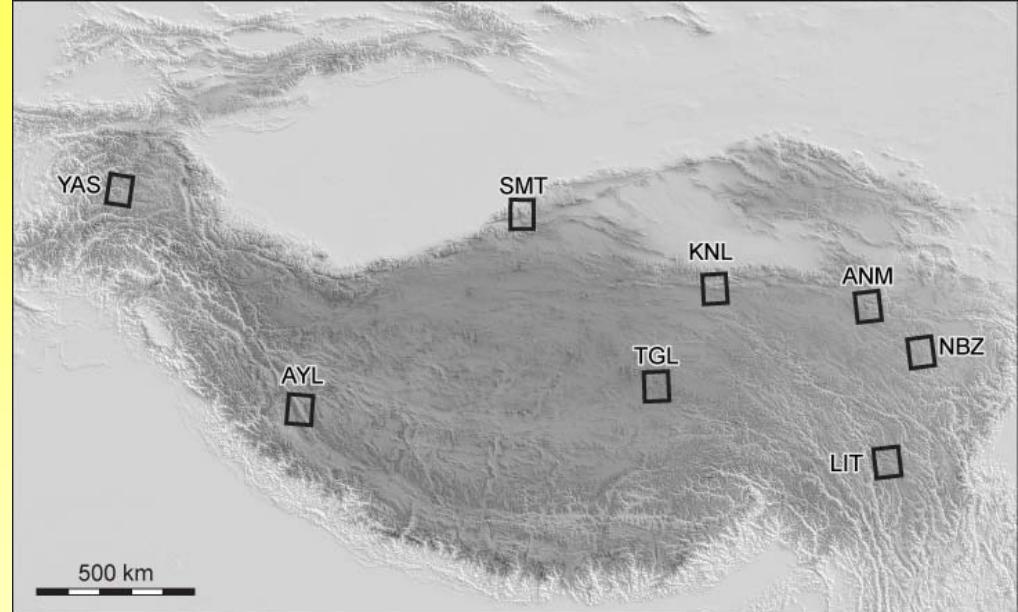
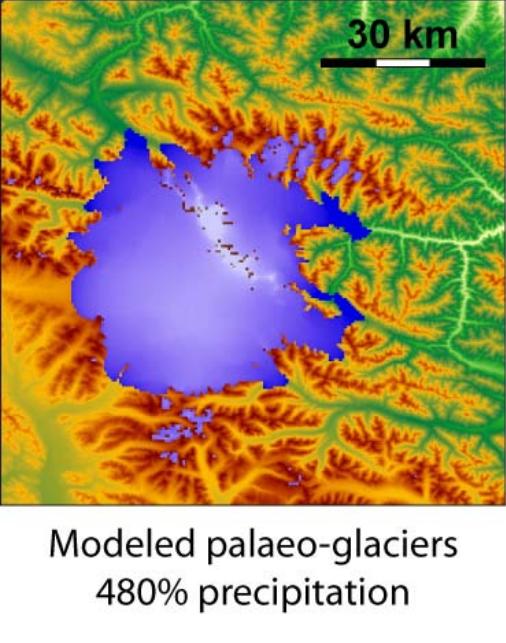
→ Modeling approach testable





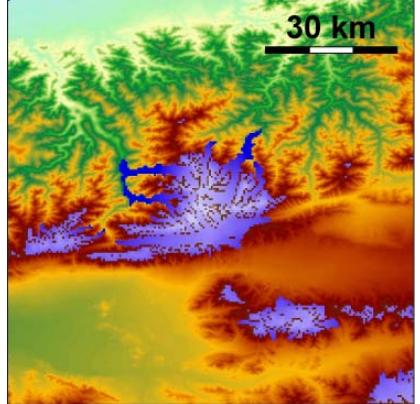
Best fit to present-day glaciers with small temperature perturbations
→ credibility to input climate and glacier model



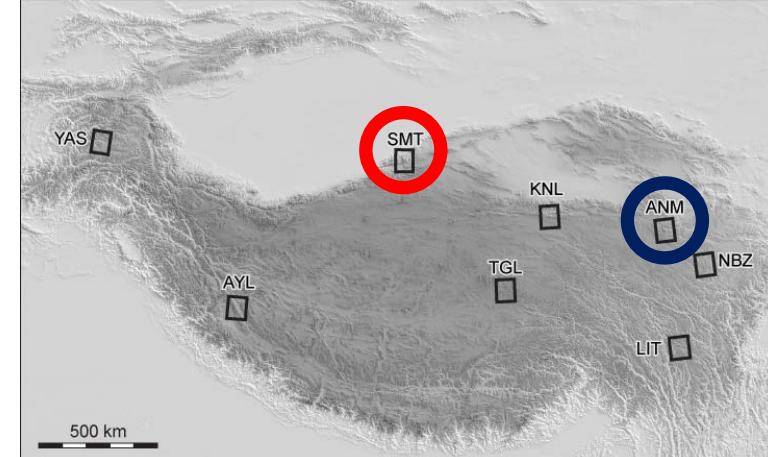
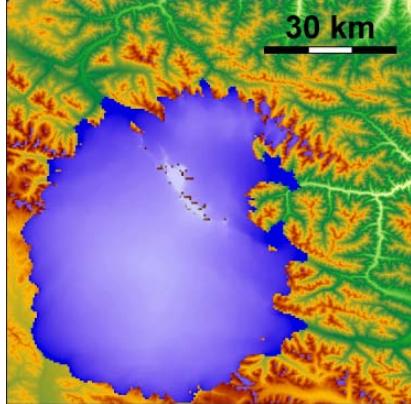


Significant precipitation increase required to expand glaciers beyond dated sites

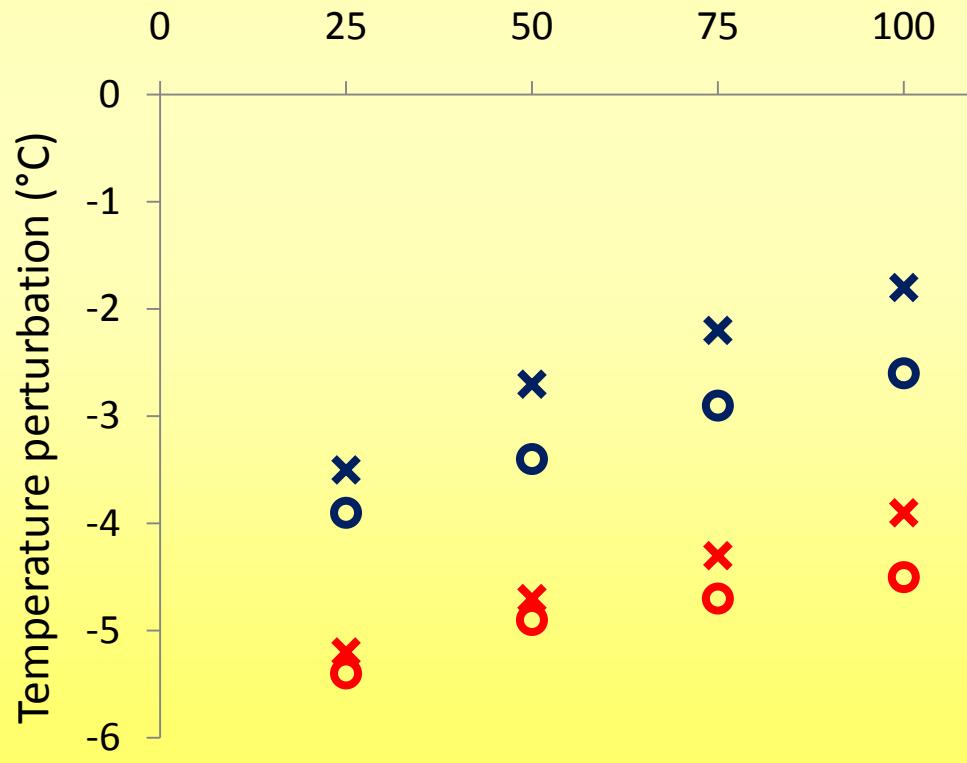
Sulamu Tagh



Anyemaqen



Precipitation (%)



● ANM basal sliding

✖ ANM frozen bed

○ SMT basal sliding

✖ SMT frozen bed

Average temperature perturbation difference between 100% and 25% precipitation:

-1.3°C (!)

Conclusions

Glacier modeling of the limited Tibetan Plateau glaciation indicates...

...limited cooling of the Tibetan Plateau (2-5°C) during glaciations

or

...past extreme dryness to offset the cooling



Thank you!

