



# Cirques upon the Kamchatka Peninsula: palaeoglacial and palaeoclimatic inferences

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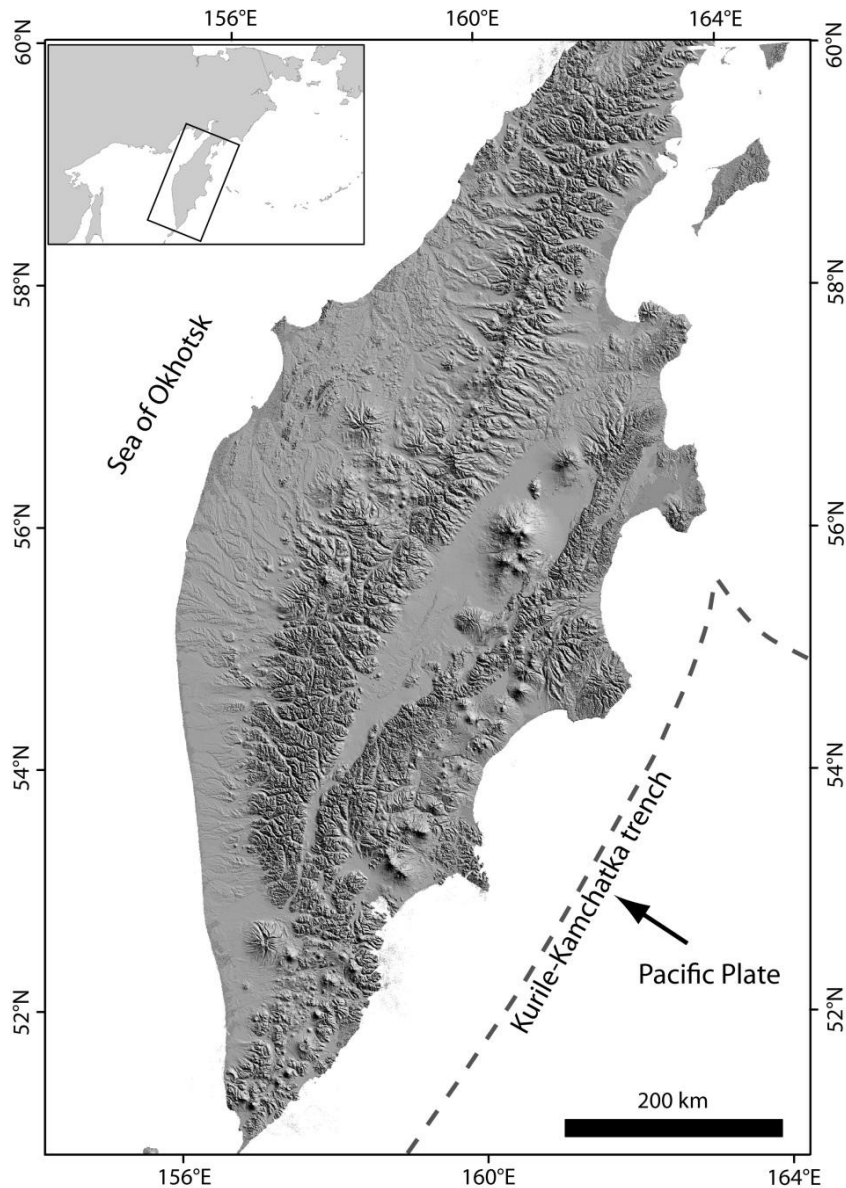
# Objectives

- Map the distribution of glacial cirques upon the Kamchatka Peninsula (NE Russia)
- Analyse cirque morphometry
- Better understand former glaciation
- Better understand regional palaeoclimate

# Outline

- Study area
- Approach
- Glacial history
- Information from the cirque record
- Link to palaeoclimate

# Study area



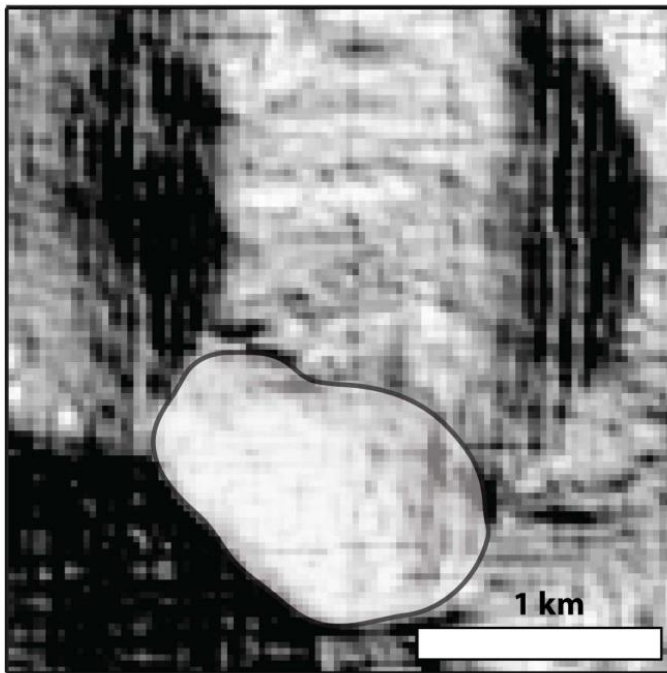
## Kamchatka Peninsula

- ~1250 km long
- Max alt: 4750 m
- Volcanically-active
- ~450 small glaciers

# Approach

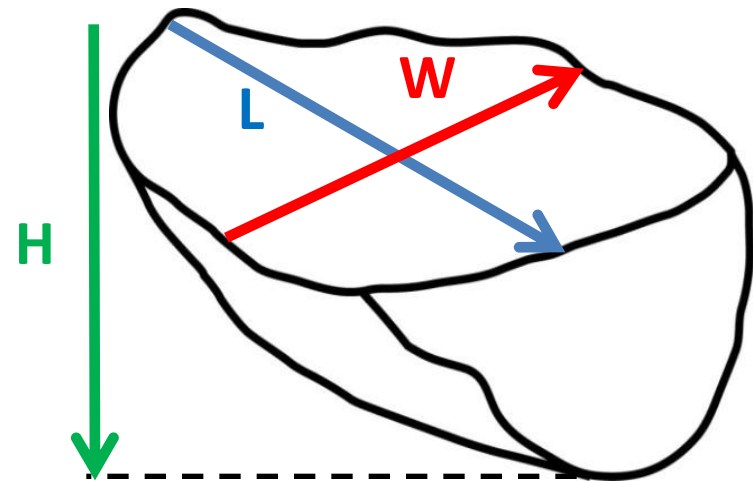
## ➤ Remote sensing

- Landsat
- ASTER GDEM



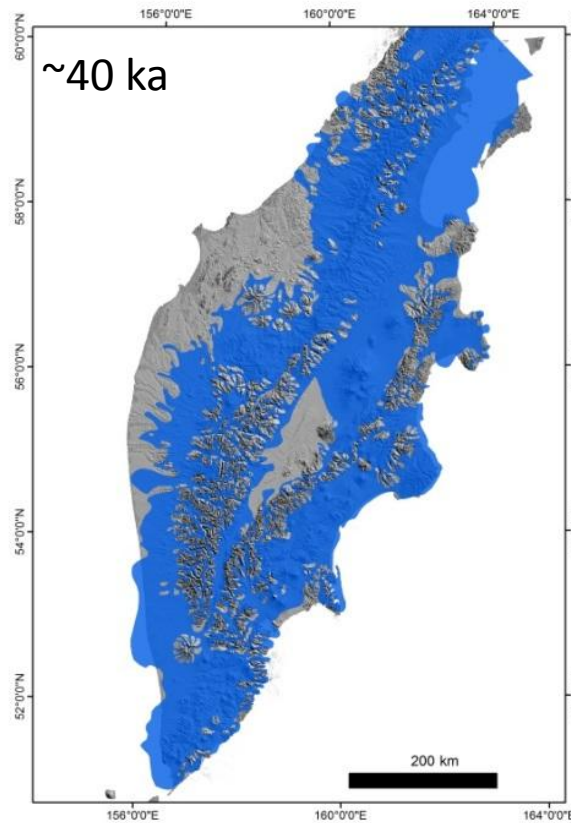
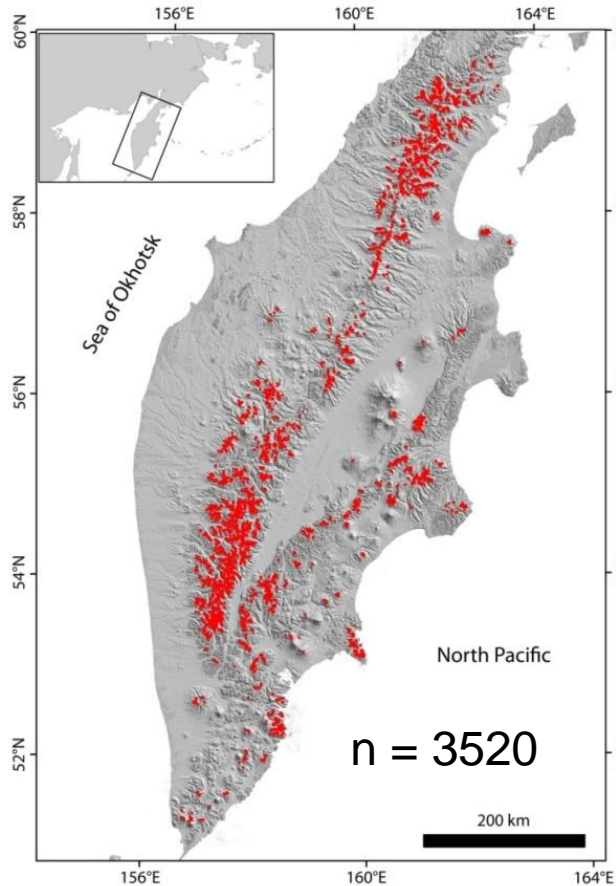
## ➤ Measures

- **Length (L)**
- **Width (W)**
- **Alt range (H)**
- Azimuth
- Altitude

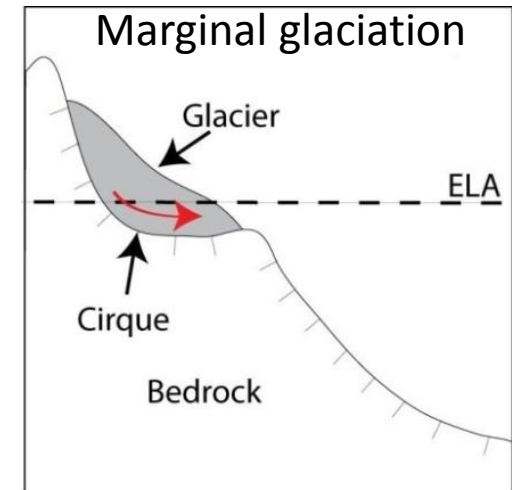
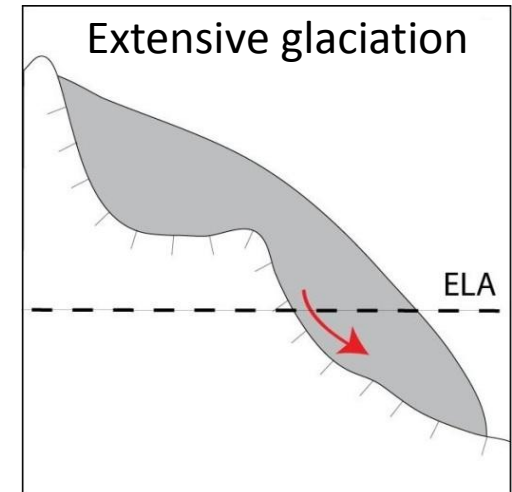


# Glacial history

## ➤ Periods of extensive glaciation



Braitseva et al. (1968)



## Cirque morphometry indicates:

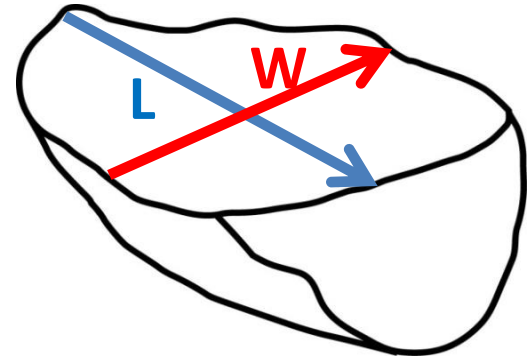
➤ Former glaciation better characterised as **marginal**

Evidence to suggest marginal  
glaciation

Cirque shape, development and  
azimuth

# 1. Shape

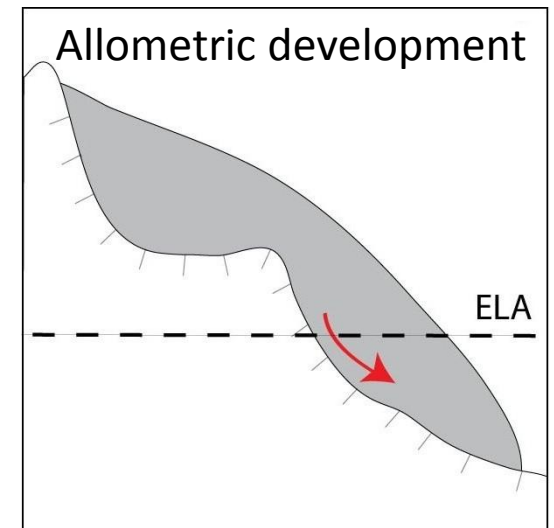
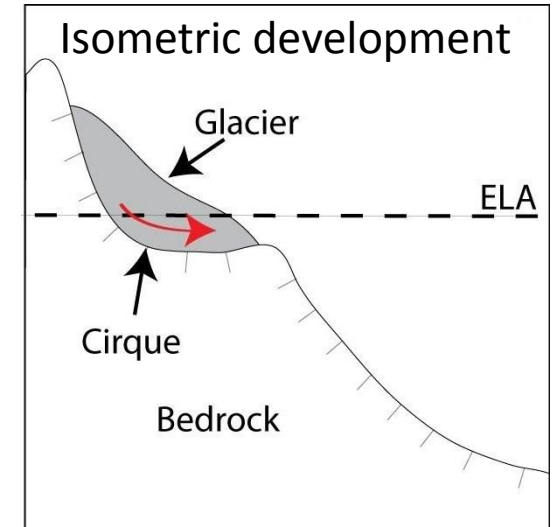
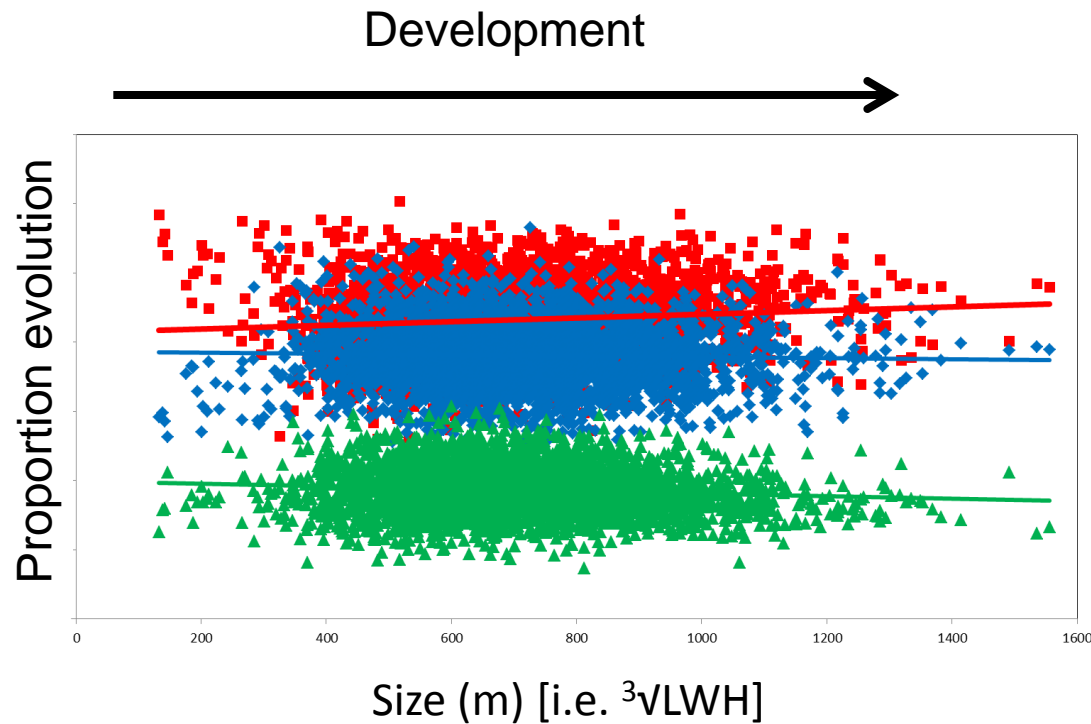
- L/W classification  
(Damiani and Pannuzi, 1987)



L/W	Erosion dominated by...	Kamchatka
>1.0	Valley Glaciers	28%
0.5 – 1.0	Cirque-type glaciers (marginal)	72%
<0.5	Post-glacial processes	<1%

## 2. Development

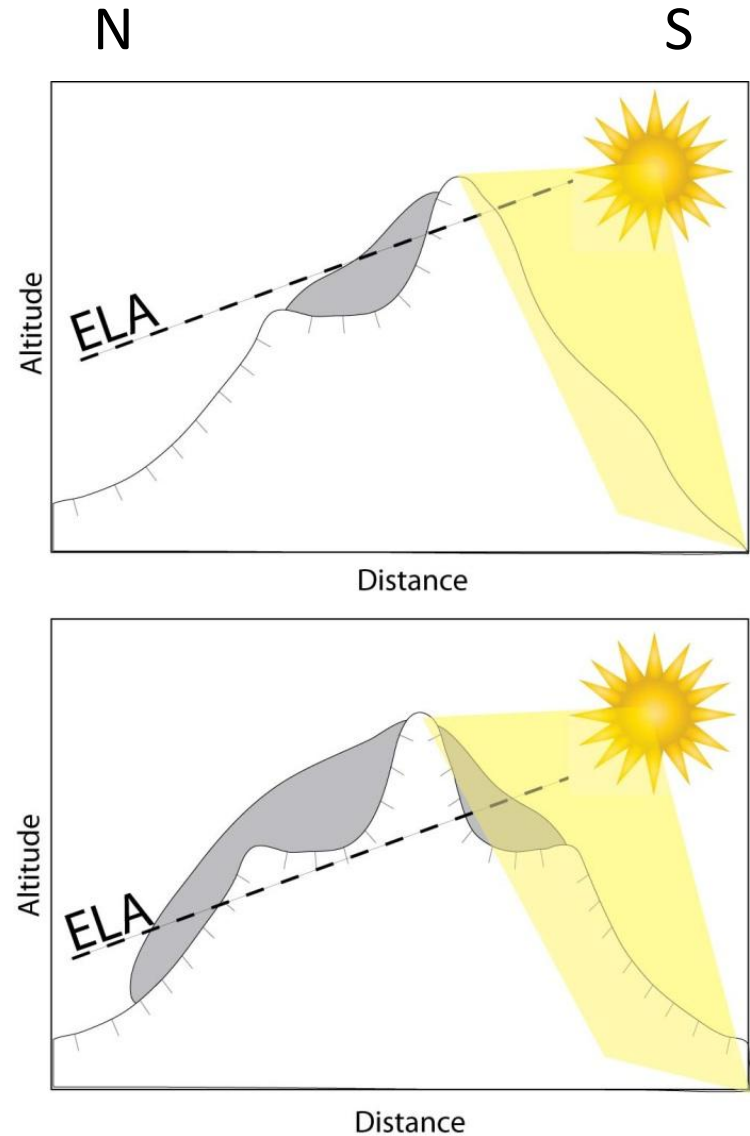
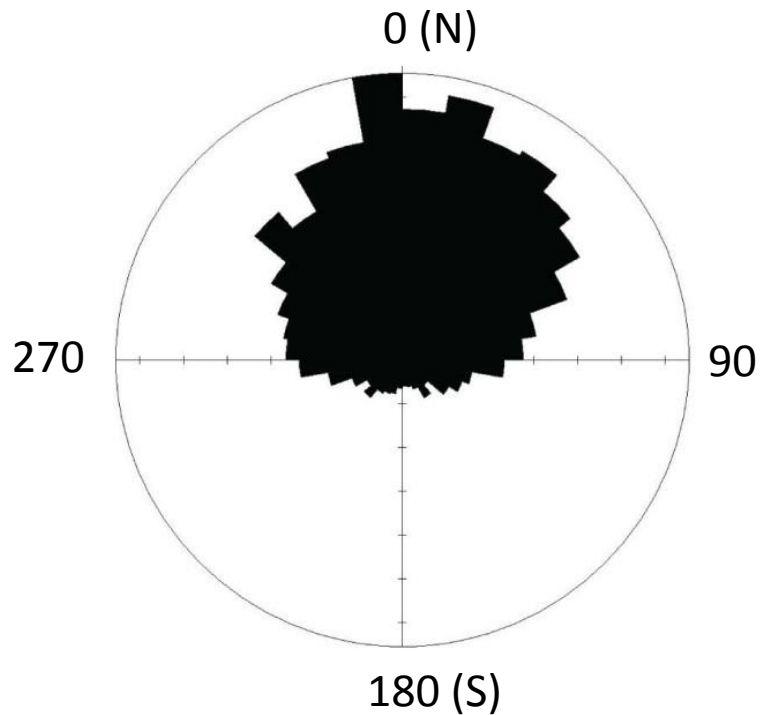
### ➤ Evidence for isometric development





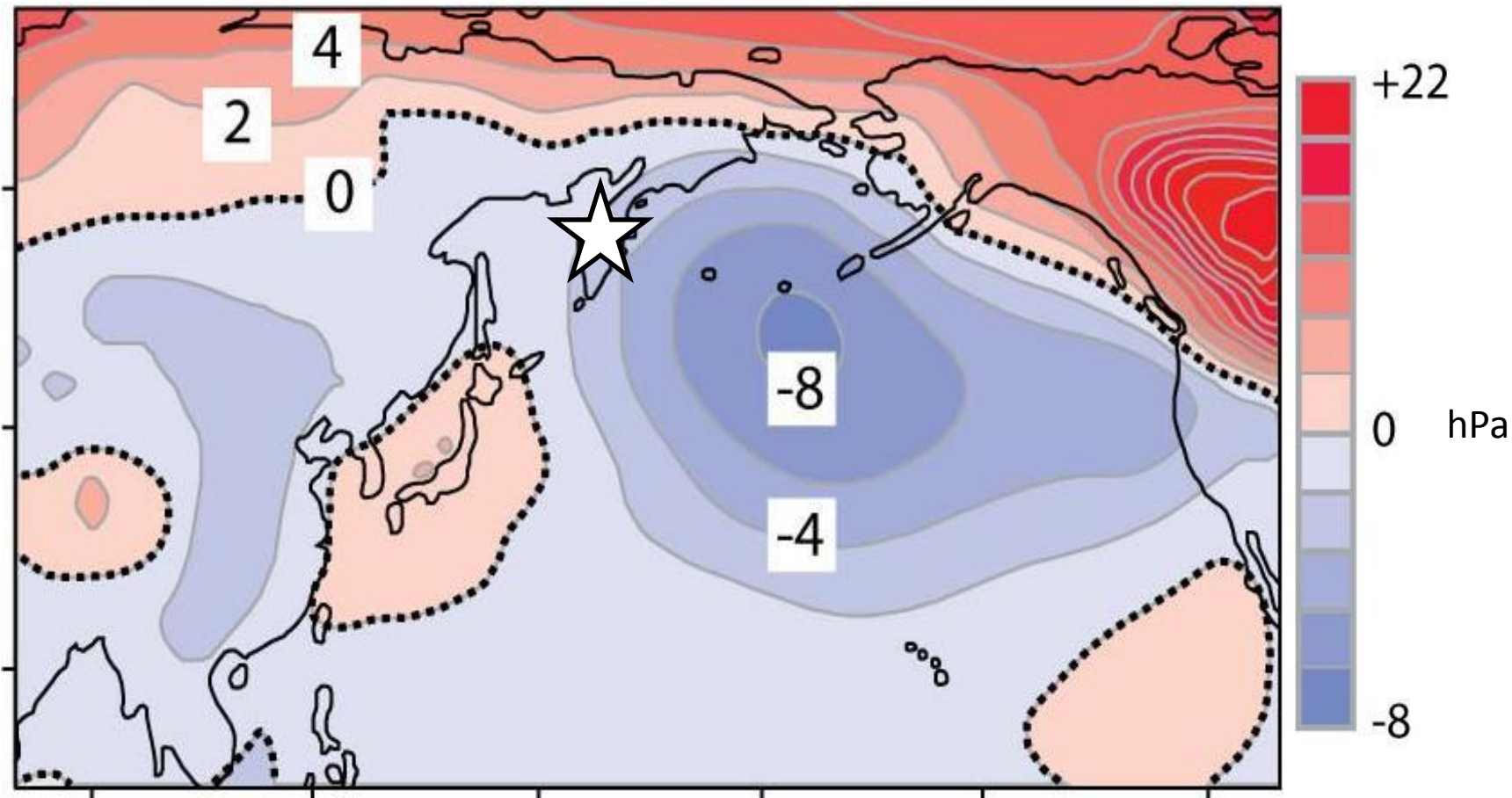
### 3. Azimuth

- strongly biased towards N-directions



# Marginal glaciation and palaeoclimate ...aridity

# Palaeoclimatic inferences

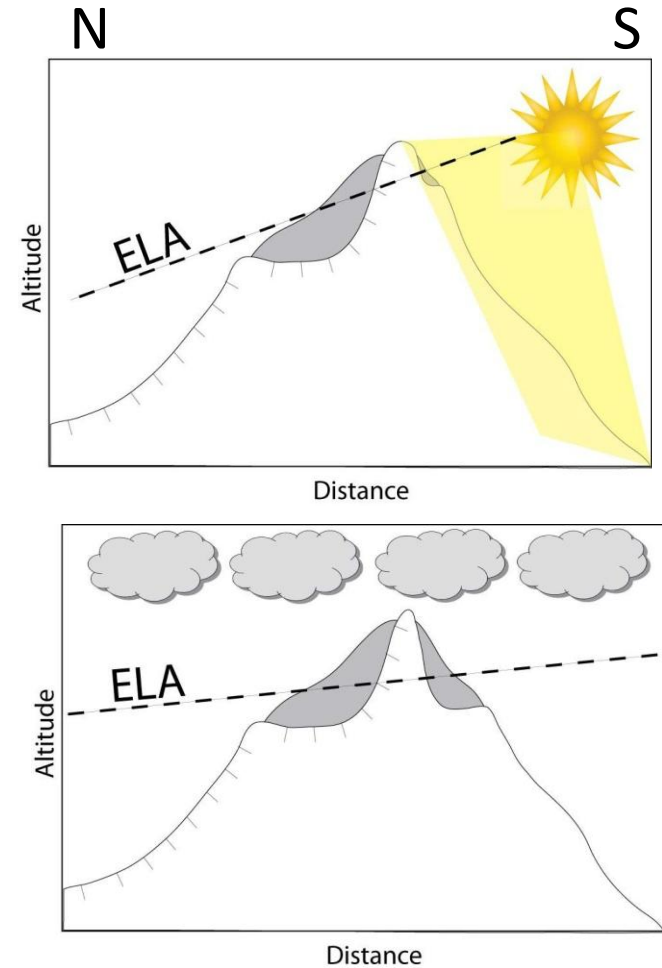
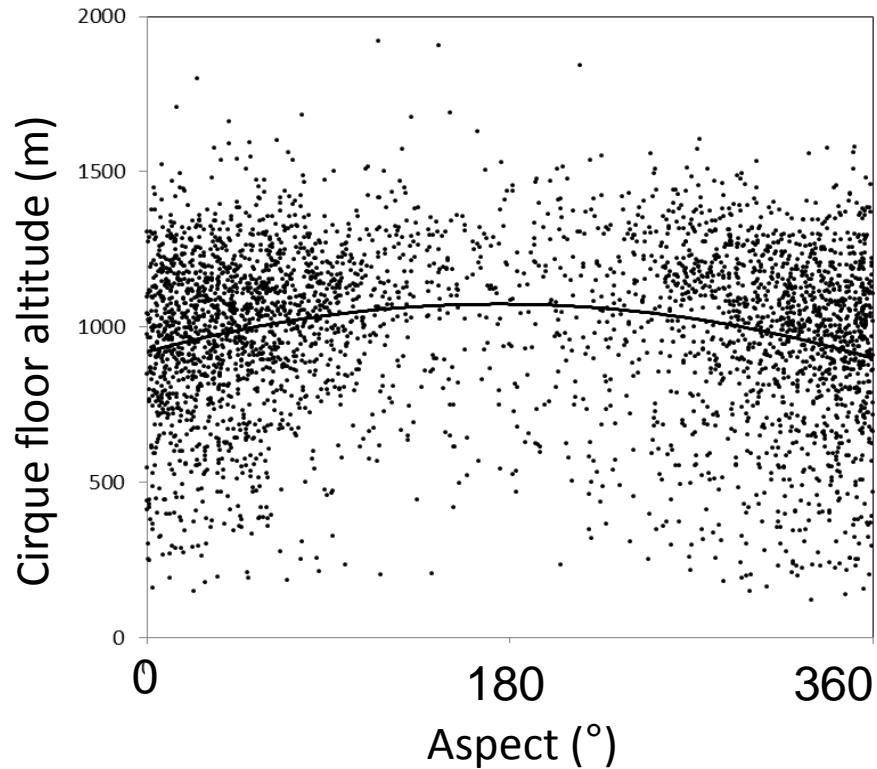


Pressure anomaly (LGM – present day)

[from Yanase and Abe-Ouchi, 2007]

# Evidence of aridity

- comparatively **cloud-free conditions**



# Conclusions

- Cirques reflect former glaciation across much of the peninsula
- Periods of extensive glaciation
- Cirque characteristics suggest marginal glaciation with high ELAs (relative to topography)
- Data suggest aridity and comparatively cloudless skies during former periods of glaciation
- Likely driven by the Laurentide Ice Sheet

# References

Barr, ID., Spagnolo, M., 2013. Palaeoglacial and palaeoclimatic conditions in the NW Pacific, as revealed by a morphometric analysis of cirques upon the Kamchatka Peninsula. *Geomorphology*. doi:10.1016/j.geomorph.2013.03.011

Braitseva OA, Melekestsev IV, Evteeva IS, et al. 1968. Stratigraphy of Quaternary Deposits and Glaciations of Kamchatka. Nauka Press: Moscow (in Russian).

Damiani, AV., Pannuzi, L., 1987. La glaciazione pleistocenica nell'Appennino Laziale-Abruzzese. III nota: opportunità di precisazioni terminologiche, metodologiche ed introduzione di parametric morfometrici. *Bollettino della Società Geologica Italiana* 105 (1985–86), 75–96.

Hijmans, RJ., Cameron, SE., Parra, JL., Jones, PG., Jarvis, A., 2005. Very high resolution interpolated climate surfaces for global land areas. *International journal of climatology* 25 (15), 1965-1978.

Yanase, W., Abe-Ouchi, A., 2007. The gLGM surface climate and atmospheric circulation over East Asia and the North Pacific in the PMIP2 coupled model simulations. *Climate of the Past* 3 (3), 439-451.