Chronostratigraphy of Larsen blue ice, East Antarctica, and a tentative reconstruction of surface temperature and accumulation rate during the last deglaciation

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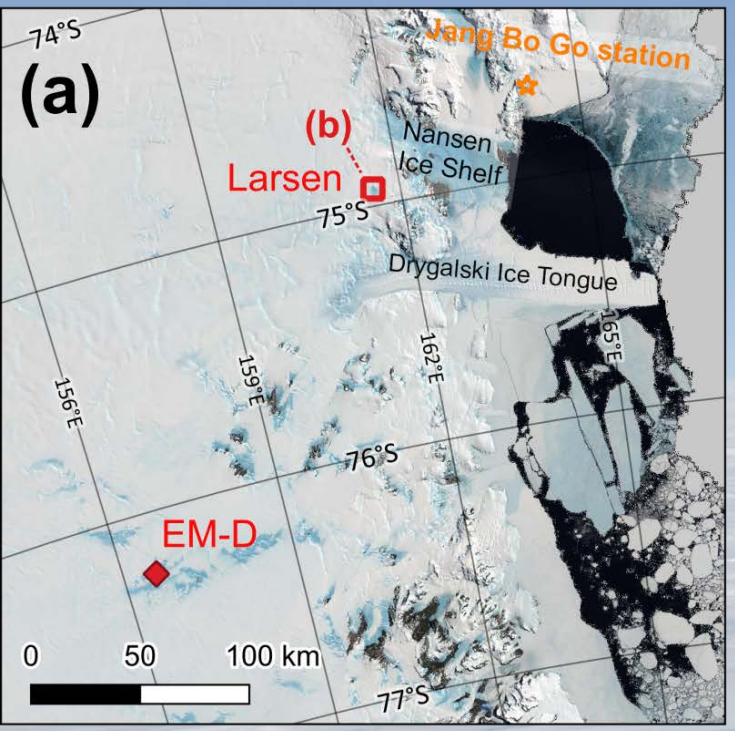
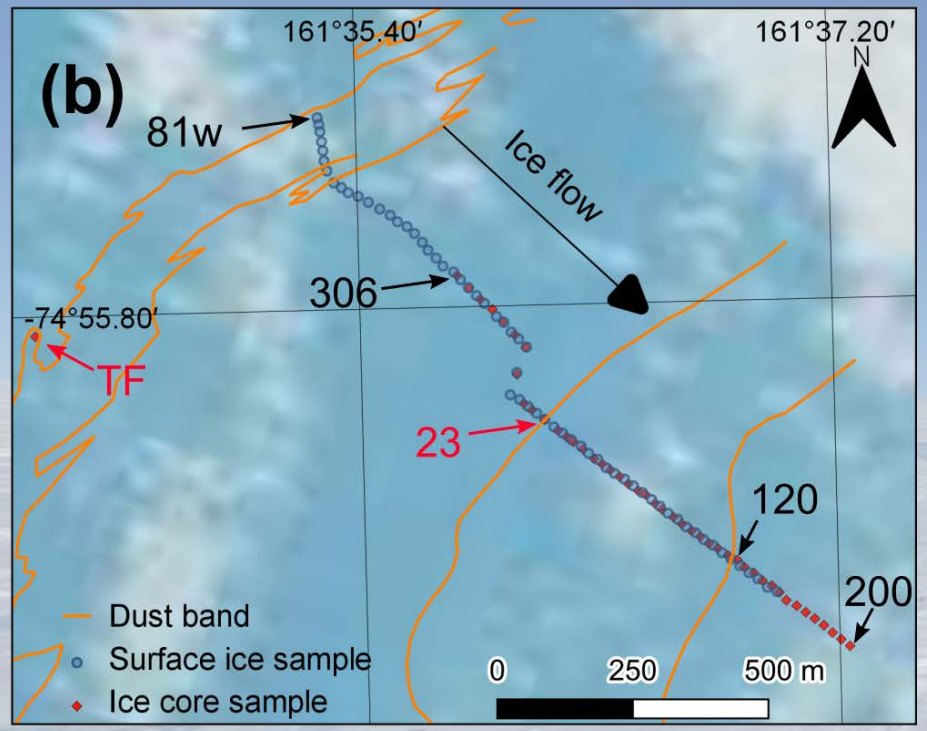
Study area: Larsen blue ice area (BIA)

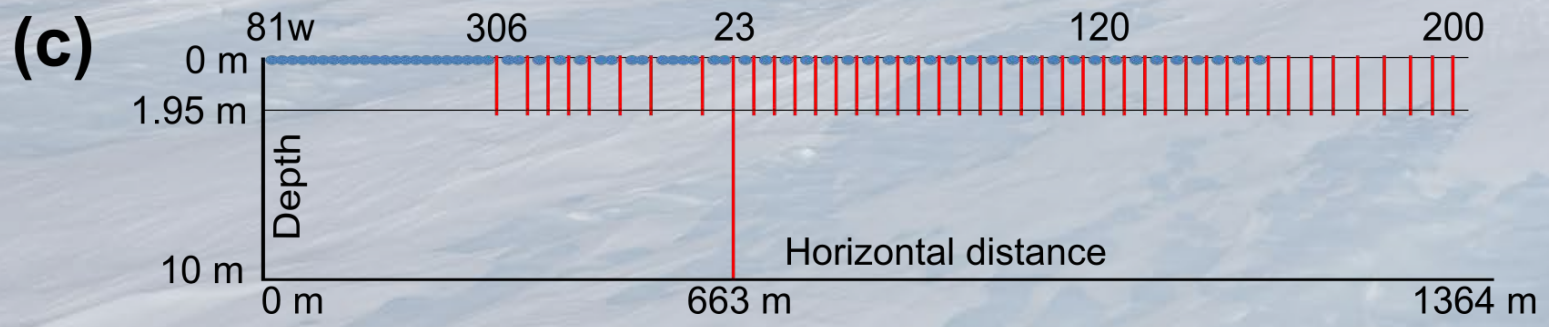
❖Main focus

- To constrain the chronostratigraphy of Larsen BIA.
  - ➢ Facilitate future paleoclimate research in this region.

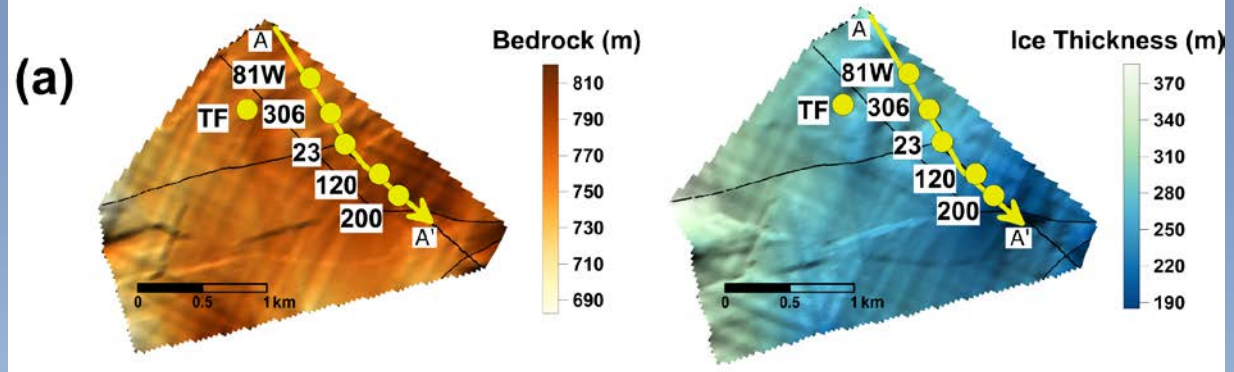
Collection of ice cores and surface ice samples

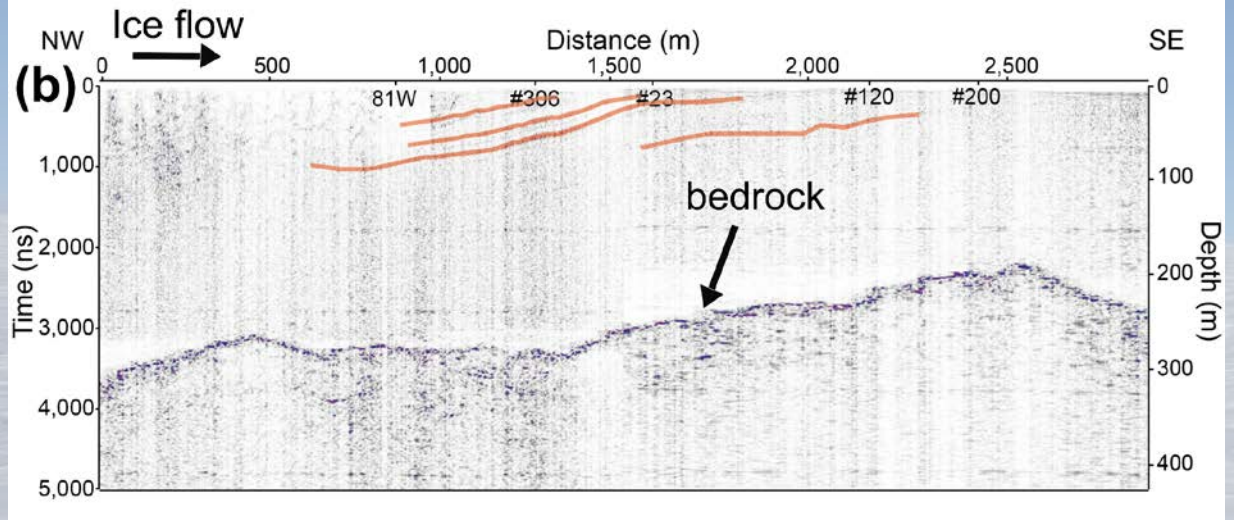


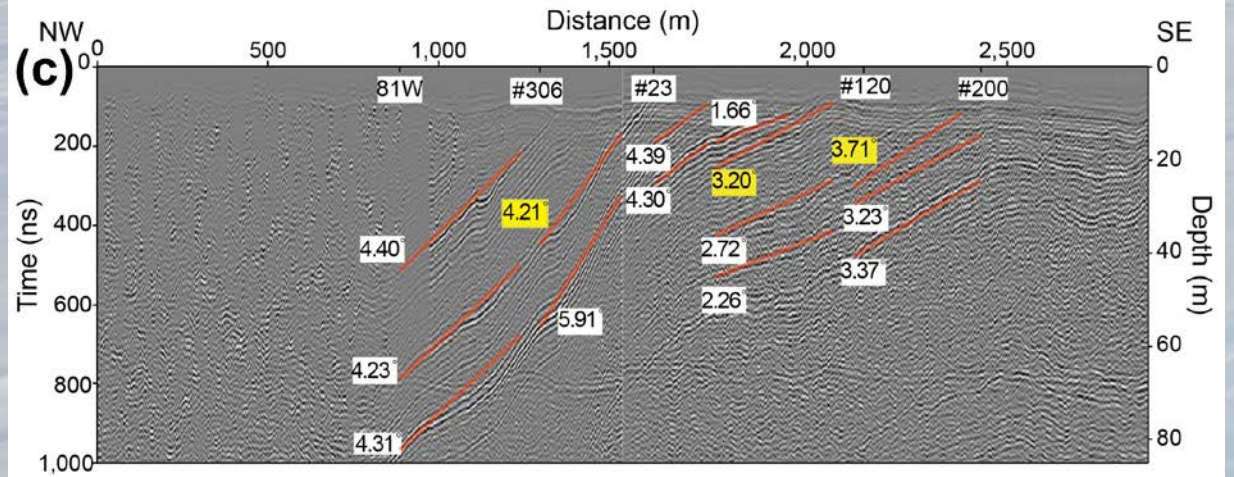




- Simple ice flow is identified at the downstream ice.
- 2-10 m length ice cores were collected.
- Surface ice samples were collected to analyze water isotopes.



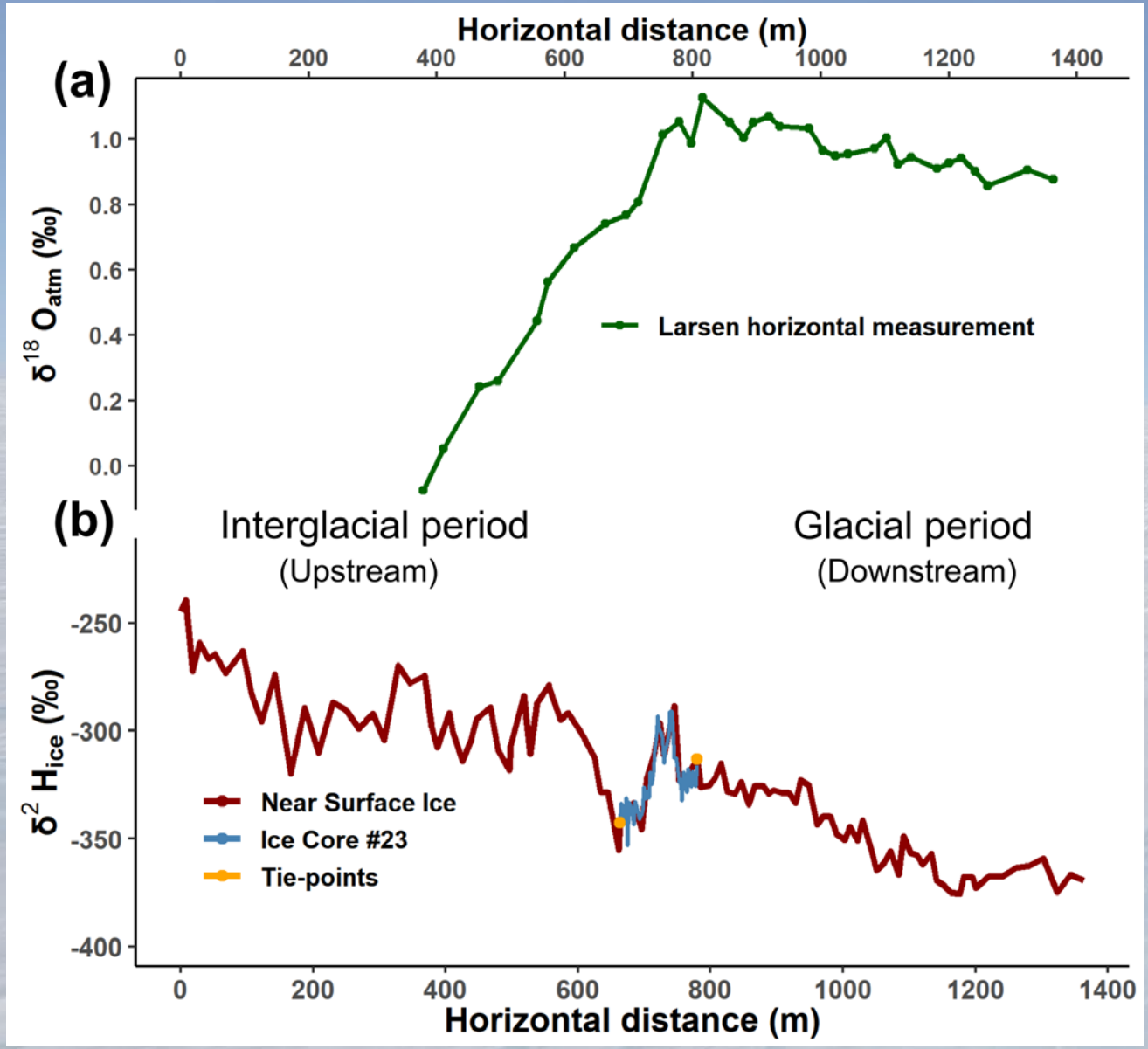




Ice stratigraphy is expected to be undisturbed

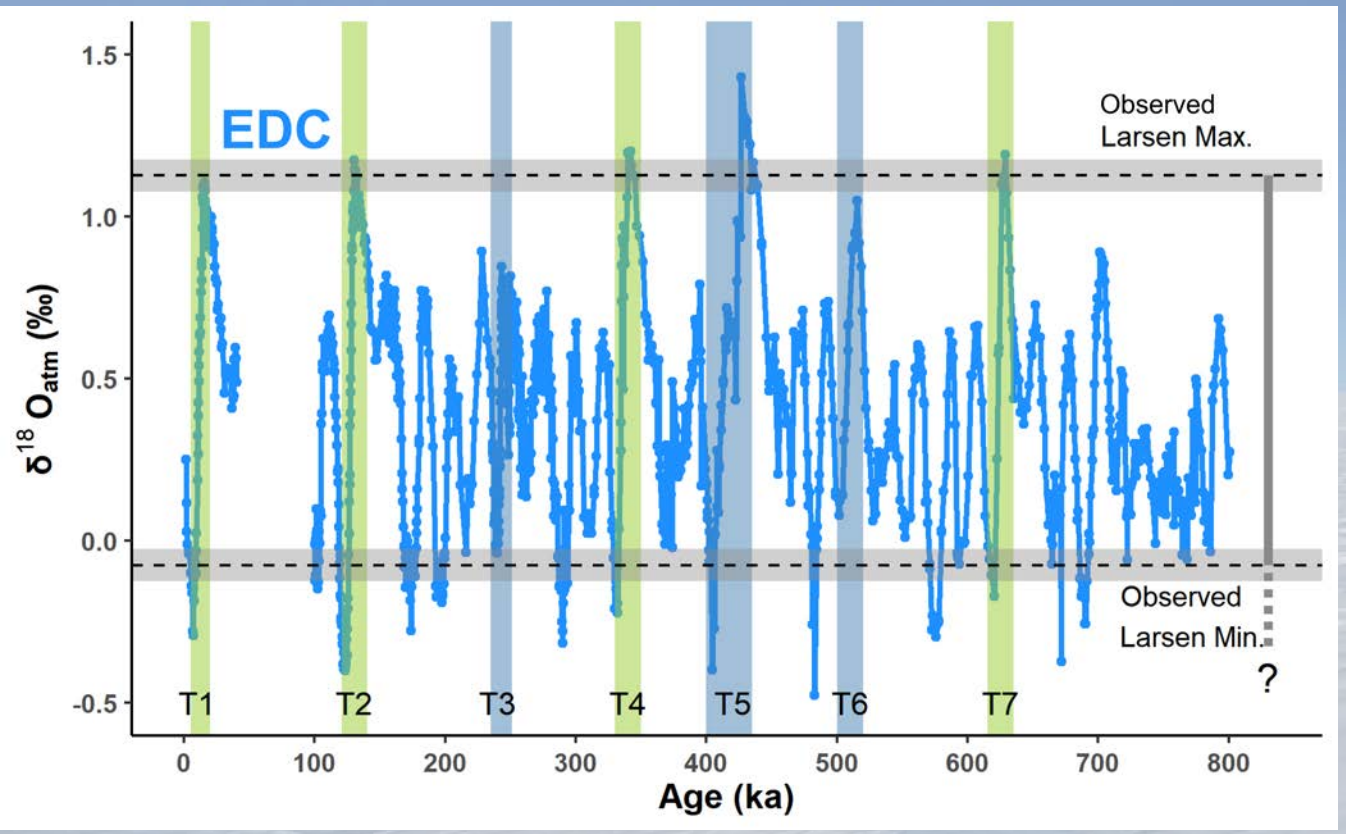
- ❖ Upstream → Downstream
  - Bedrock elevation increase
  - Ice thickness decrease
  - Dip of the ice layer decrease
- ❖ No such fold/fault structure are identified that can make inversion in the ice chronology.

Larsen BIA shows one of the Glacial Termination

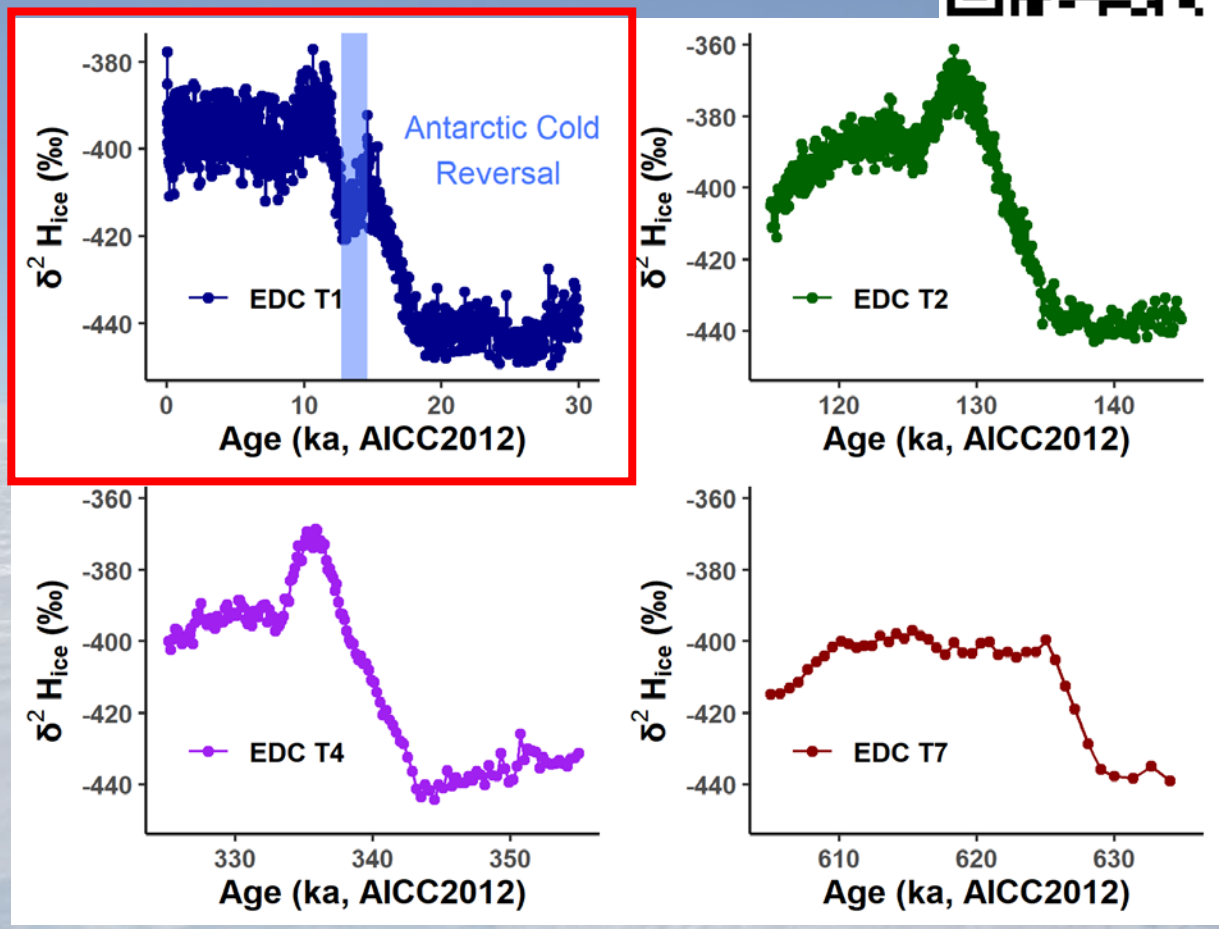


- $\delta^{18}O_{atm}$ shows that Larsen BIA covers one of the glacial termination.
- The increase in $\delta^{2}H_{ice}$ and decrease in $\delta^{18}O_{atm}$ value from the downstream to upstream ice shows that the atmospheric conditions changed to warmer climate.

The studied Larsen BIA covers the Last Glacial Termination (LGT)



Landais et al. (2013),
Extier et al. (2018)



Bazin et al. (2013)

Candidate period

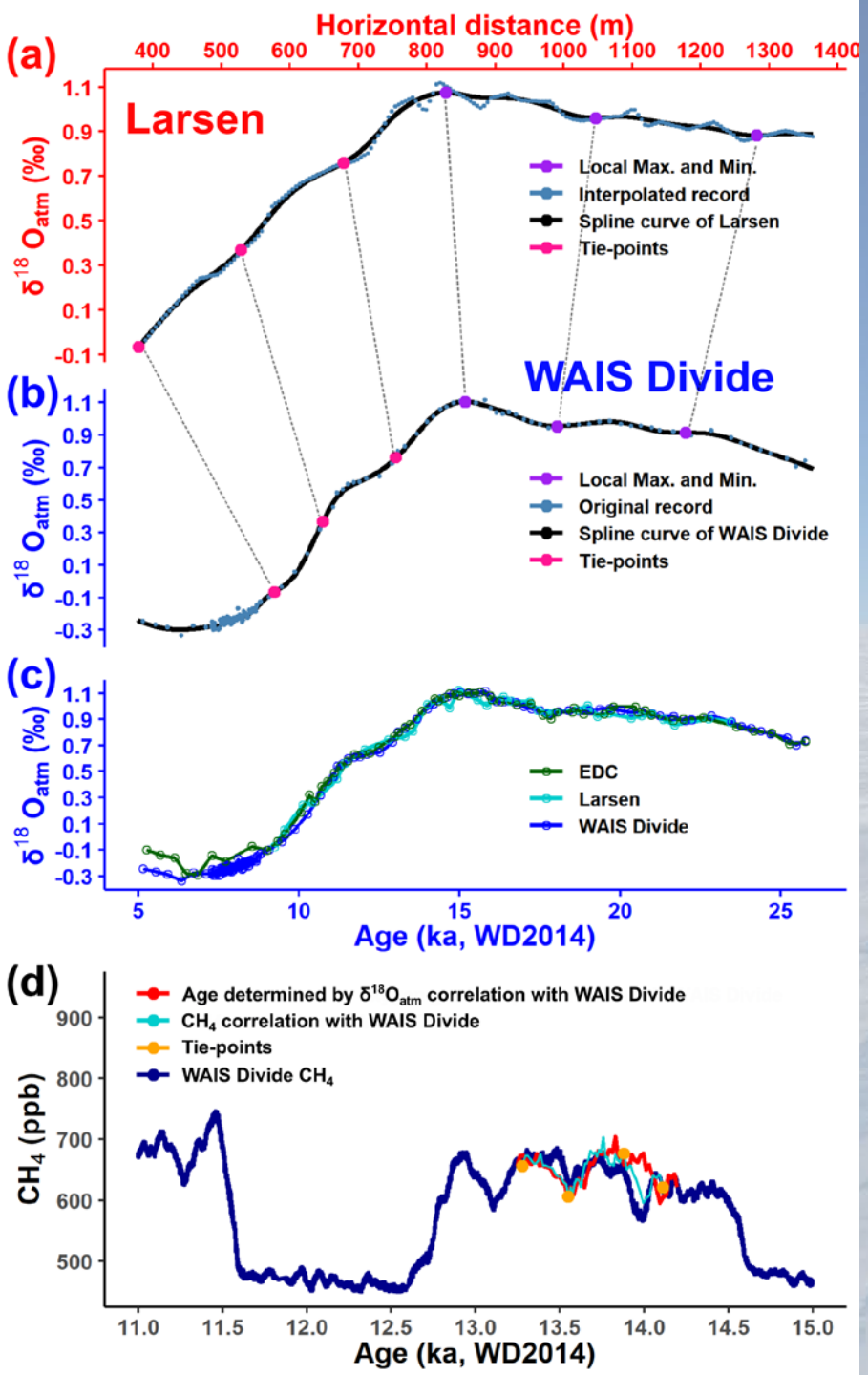
Rejected for the candidate period

^{81}Kr dating support the age constraint

Sample	Mass (kg)	Depth (cm)	^{85}Kr (dpm cc^{-1})	^{81}Kr (pMKr)	^{81}Kr age (ka)	Systematic error (ka)
TF	5.4	798–1192.5	< 1.2	93.5 ± 4.7	26^{+15}_{-17}	± 1
#23	5.3	711–1040	< 0.7	92.4 ± 4.1	29^{+14}_{-15}	± 1

- ^{81}Kr is a radioactive isotope with a half-life of 229 ± 11 ka.
- ^{81}Kr age of ice core #23 shows a range of 14–43 ka.
- We conclude that the Larsen BIA corresponds to the last glacial termination.

Correlating $\delta^{18}O_{atm}$ value to the WAIS Divide record



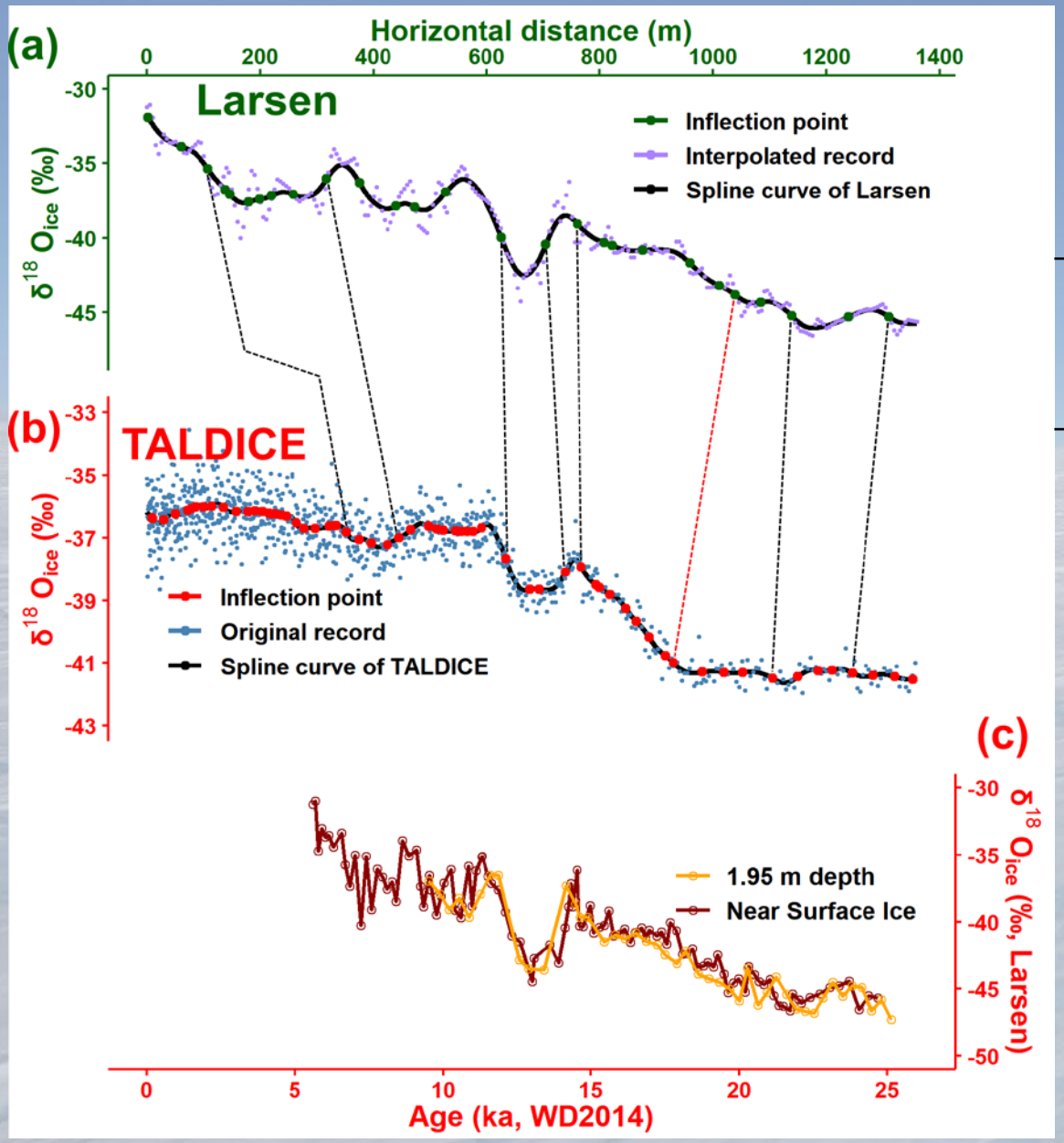
Gas age of Larsen BIA

WD2014 scale

9.2–23.4 ka BP

Buizert et al. (2021),
Rhodes et al. (2017)

Correlating $\delta^{18}O_{ice}$ value to the TALDICE record



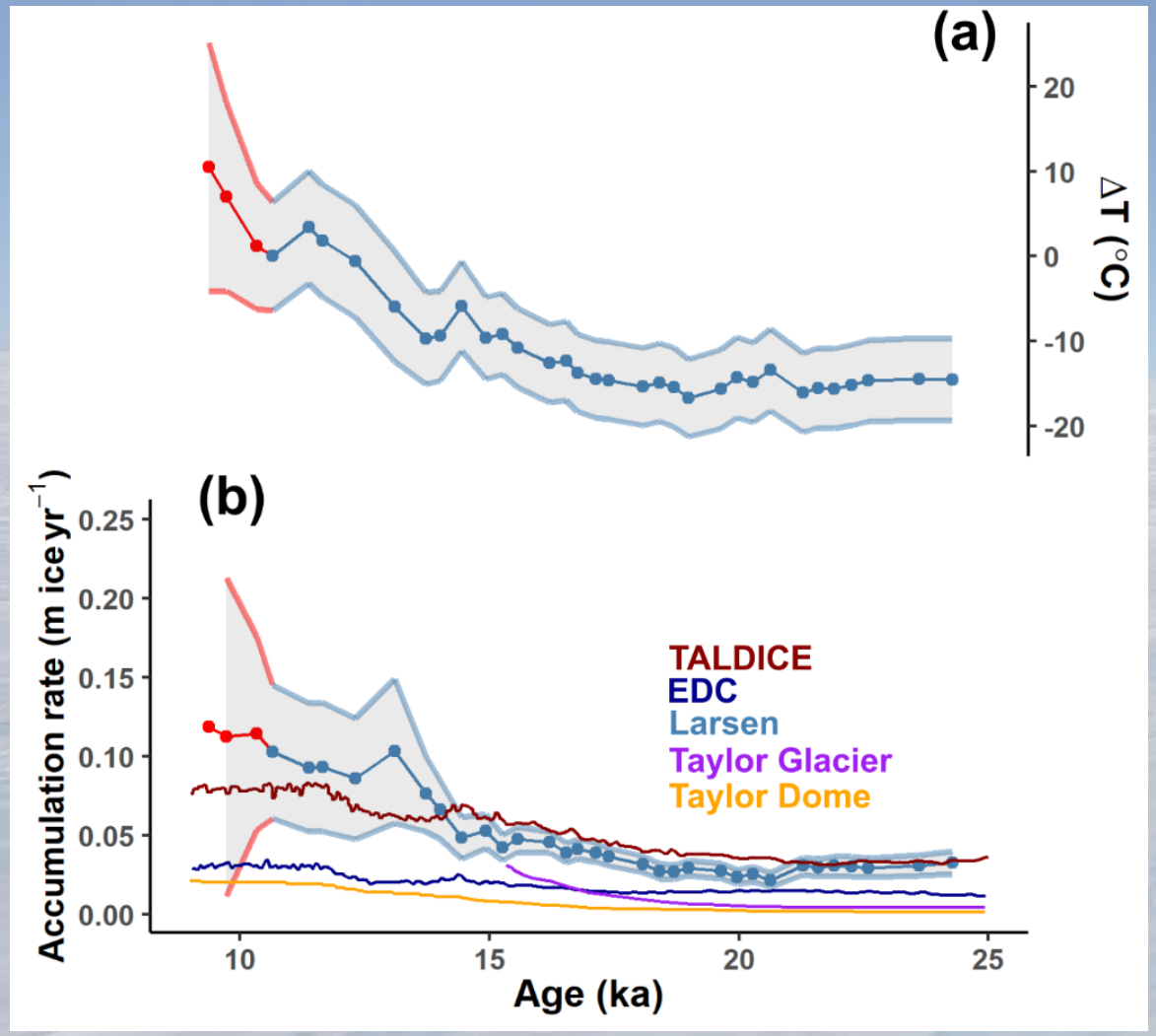
Ice age of Larsen BIA

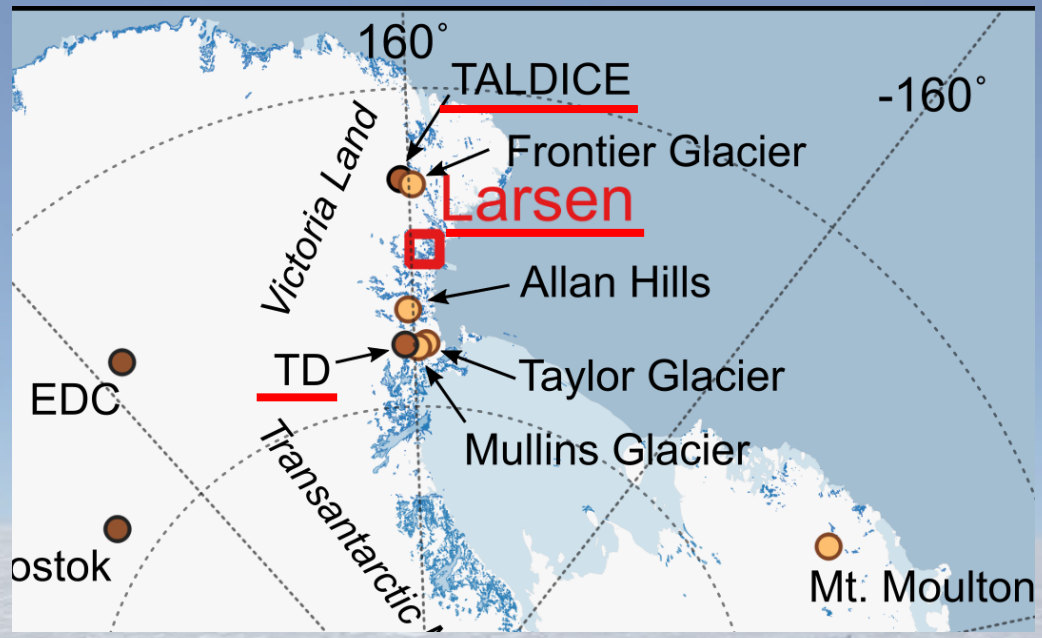
WD2014 scale

5.6–24.7 ka BP

Stenni et al. (2011),
Bazin et al. (2013)

Reconstruction of surface temperature and accumulation rate





- Surface temperature increased 15 ± 5 ℃, which is greater than those for any other ice core sites.
  - ➢ Enhanced cooling may be due to the extended ice sheet of Ross ice shelf.

- Accumulation rates at Taylor Dome, Larsen, and TALDICE increased by a factor of ~15.4, ~3.1, and ~2.4, respectively.
  - ➢ The storm track migrates to the Southern Victoria Land from the Northern Victoria Land and so precipitation more increases at the Southern part.

Conclusion

- Based on the shapes of dust bands, GPR profiles, and analytical data ($\delta^{18}O_{atm}$, $\delta^{2}H_{ice}$, and CH_4) we conclude that ice age at the Larsen BIA (the downstream ice) monotonically increase along the ice flow direction.

- The gas ages of the studied Larsen ice cover 9.2–23.4 ka BP and ice ages cover 5.6–24.7 ka BP. This is additionally supported by ^{81}Kr ages from local ice cores (#23 and TF).

- We suggest a tentative climate reconstruction of surface temperature (15 ± 5 ℃ increase) and accumulation rate (increased by a factor of 1.7–4.6) at the deposition site of Larsen ice during the last deglaciation.

Thank you!