Research articles summarized in this solicited oral presentation at EGU24

- **Davtian, N.**, Bard, E., Darfeuil, S., Ménot, G., and Rostek, F.: The novel hydroxylated tetraether index RI-OH′ as a sea surface temperature proxy for the 160-45 ka BP period off the Iberian Margin, Paleoceanography and Paleoclimatology, 36, e2020PA004077, https://doi.org/10.1029/2020PA004077, 2021.

- **Davtian, N.** and Bard, E.: A new view on abrupt climate changes and the bipolar seesaw based on paleotemperatures from Iberian Margin sediments, Proceedings of the National Academy of Sciences, 120, e2209558120, https://doi.org/10.1073/pnas.2209558120, 2023.

Please cite the summarized research articles rather than the EGU24 abstract and presentation!

The value of Iberian Margin paleotemperature records with a novel organic proxy to revisit the bipolar seesaw model

Nina Davtian and Edouard Bard

EGU General Assembly 2024 | 16 April 2024

cerege
Centre de recherche et d'enseignement des géosciences de l'environnement

COLLÈGE DE FRANCE
1530

Background and motivation

- **Uncertain long-term AMOC changes from modern observations**
- **Uncertain role of AMOC changes in the present "warming hole"**
- **Recent geological past with large AMOC and temperature changes**

Observed fingerprint of a weakening Atlantic Ocean overturning circulation

L. Caesar[1,2*], S. Rahmstorf[1,2*], A. Robinson[1,3,4,5], G. Feulner[1] & V. Saba[6]

Caesar et al. (2018) *Nature*

Atlantic circulation change still uncertain

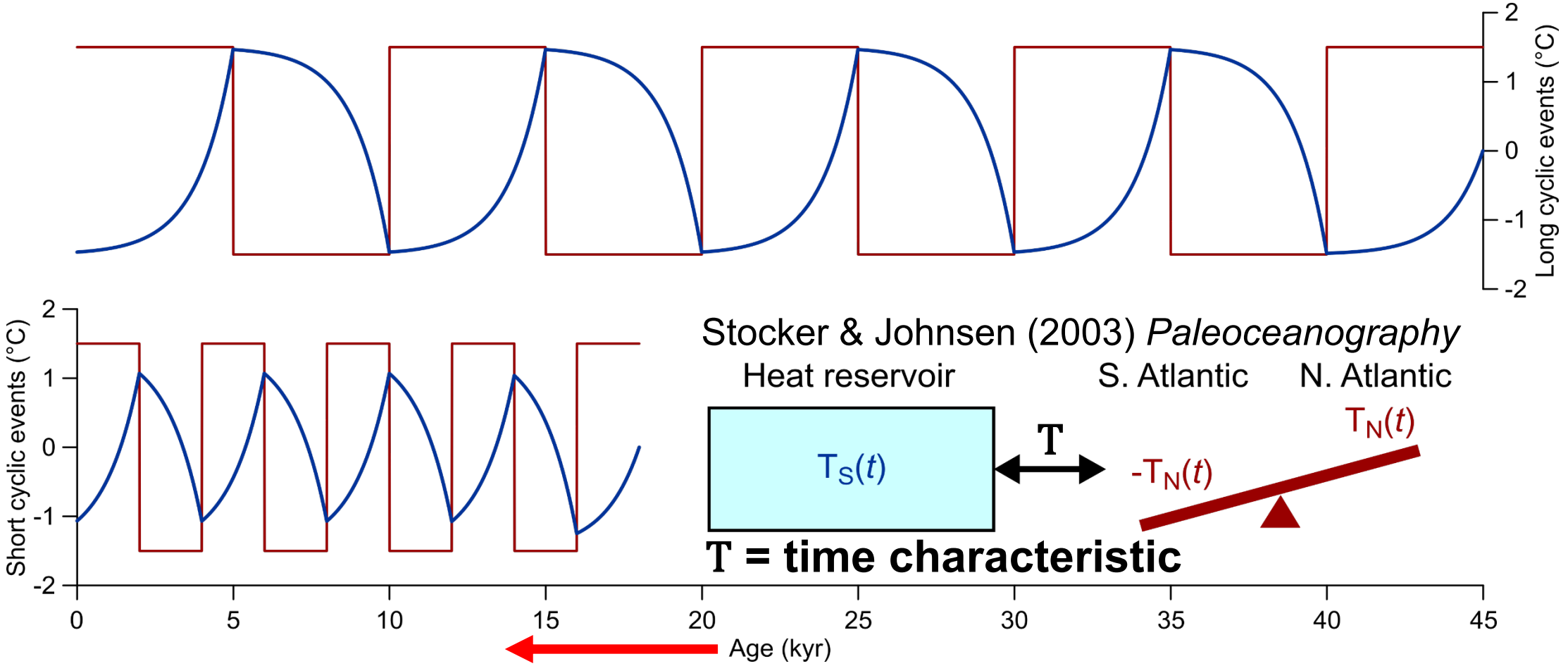
K. Halimeda Kilbourne[1], Alan D. Wanamaker[2], Paola Moffa-Sanchez[3], David J. Reynolds[4], Daniel E. Amrhein[5], Paul G. Butler[4], Geoffrey Gebbie[6], Marlos Goes[7,8], Malte F. Jansen[9], Christopher M. Little[10], Madelyn Mette[11], Eduardo Moreno-Chamarro[12], Pablo Ortega[12], Bette L. Otto-Bliesner[5], Thomas Rossby[13], James Scourse[4] and Nina M. Whitney[6,14]

ARISING FROM L. Caesar et al. *Nature Geoscience* https://doi.org/10.1038/s41561-021-00699-z (2021)

Kilbourne et al. (2022) *Nature Geoscience*

Thermal bipolar seesaw (TBS)

A concept describing the meridional heat transport leading to asynchronous temperature changes between both hemispheres



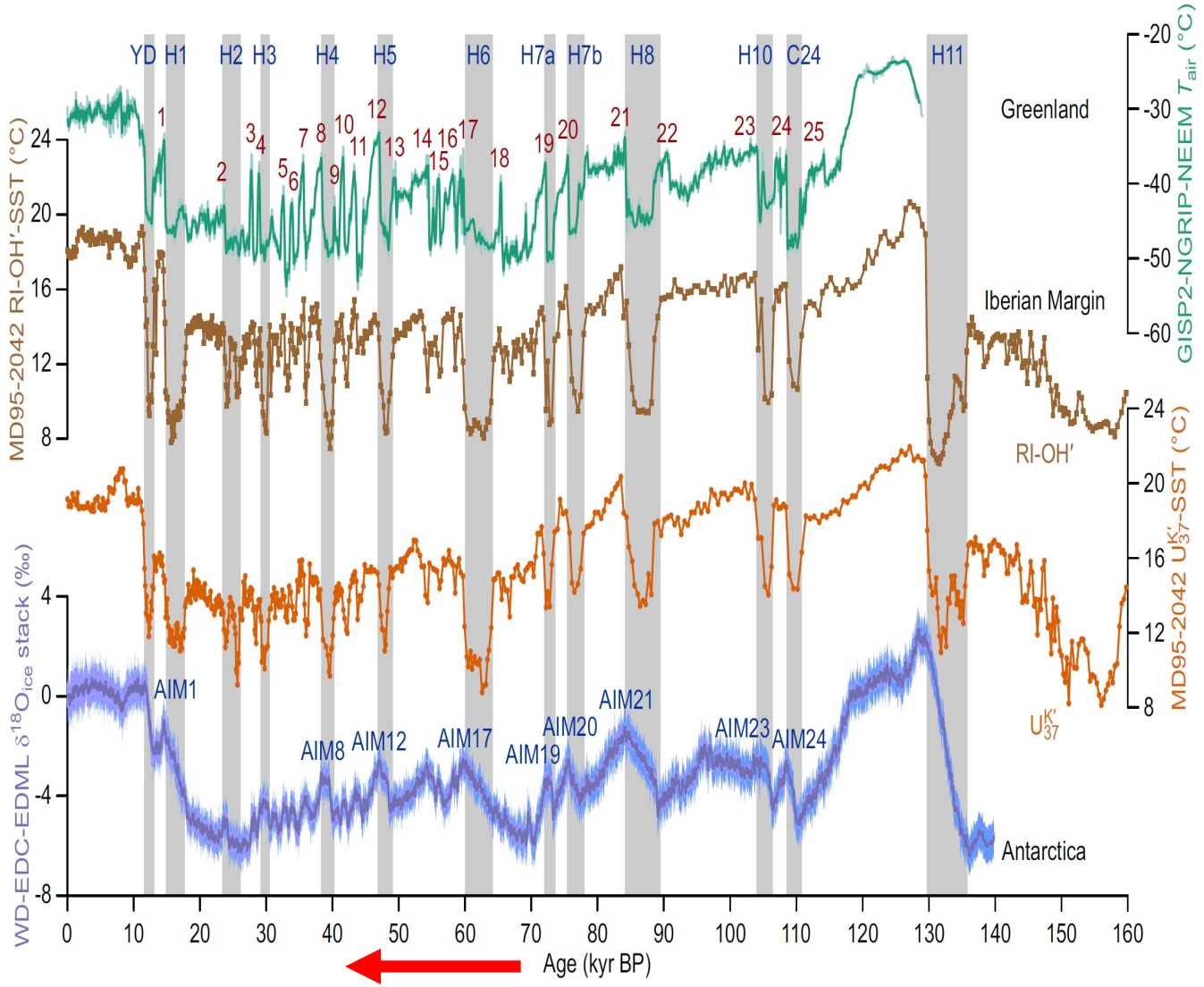
Modified after Davtian & Bard (2023) *PNAS*

Main objectives

1. Generate high-resolution SST records from the Iberian Margin (e.g., RI-OH′, TEX_{86}, and $U^{K'}_{37}$)

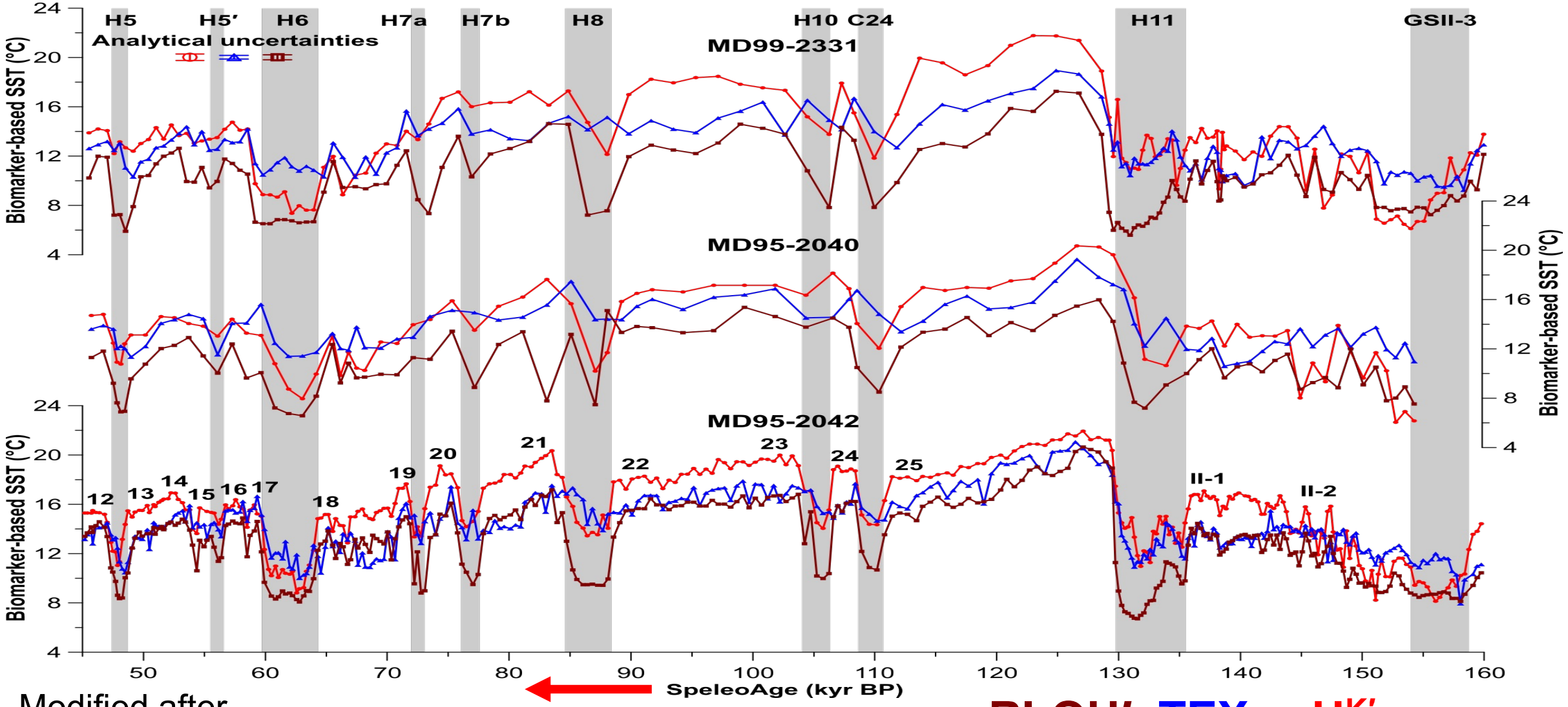
2. Revisit the classical TBS diagram and TBS model

3. Extend the TBS model with two new TBS diagrams and a new climatic index



Davtian & Bard (2023) *PNAS*

Faithful RI-OH′-based paleothermometry

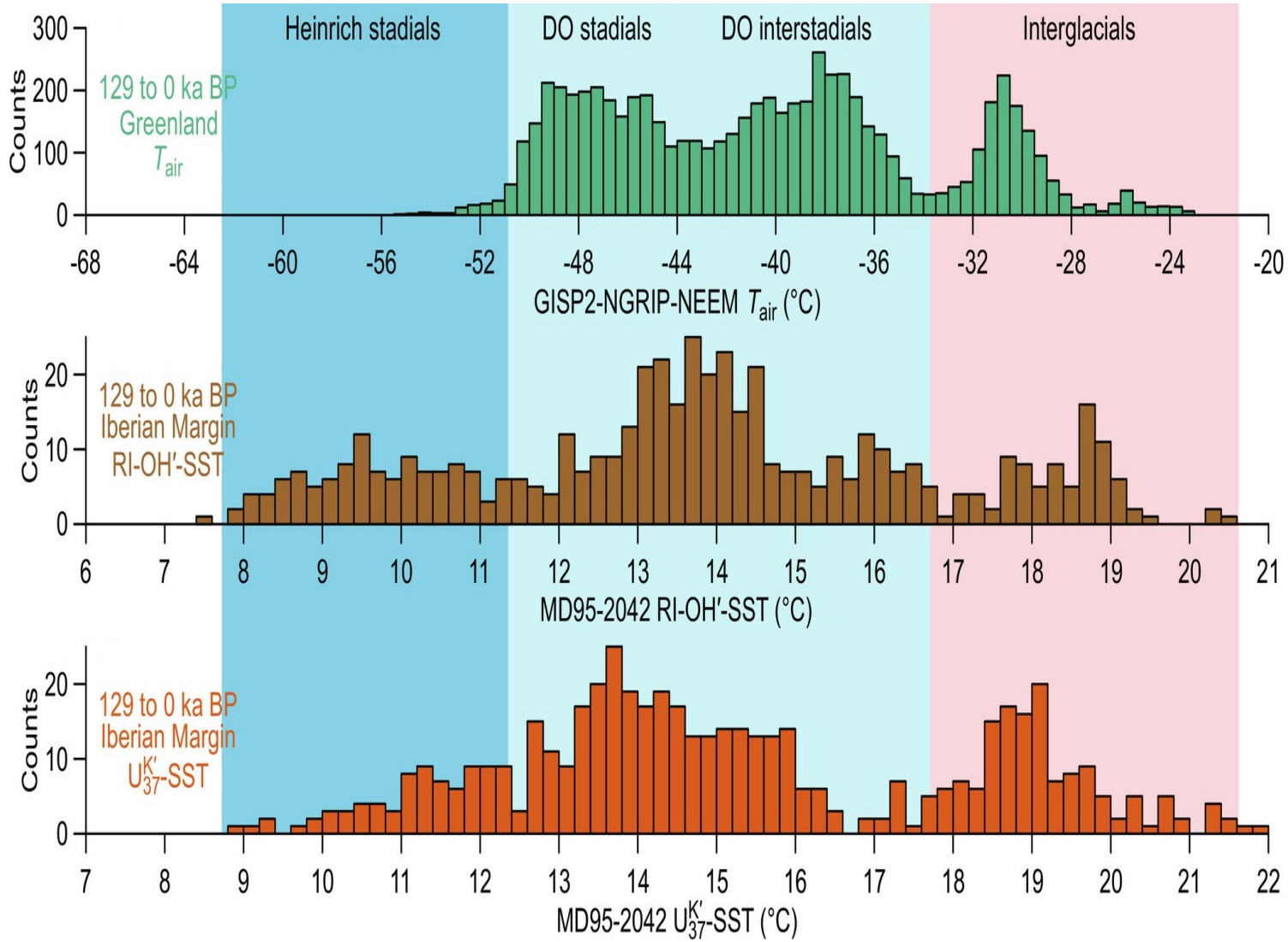


Modified after
Davtian et al. (2021) *Paleoceanography and Paleoclimatology*

RI-OH′ **TEX_{86}** **$U^{K'}_{37}$**

Contrasting H-DO SST coolings

- **Iberian Margin SST records faithfully capture contrasting H-DO SST cooling amplitudes**
- **Greenland T_{air} record appears "truncated"**
- **Need to revisit and extend the TBS model**



Davtian & Bard (2023) *PNAS*

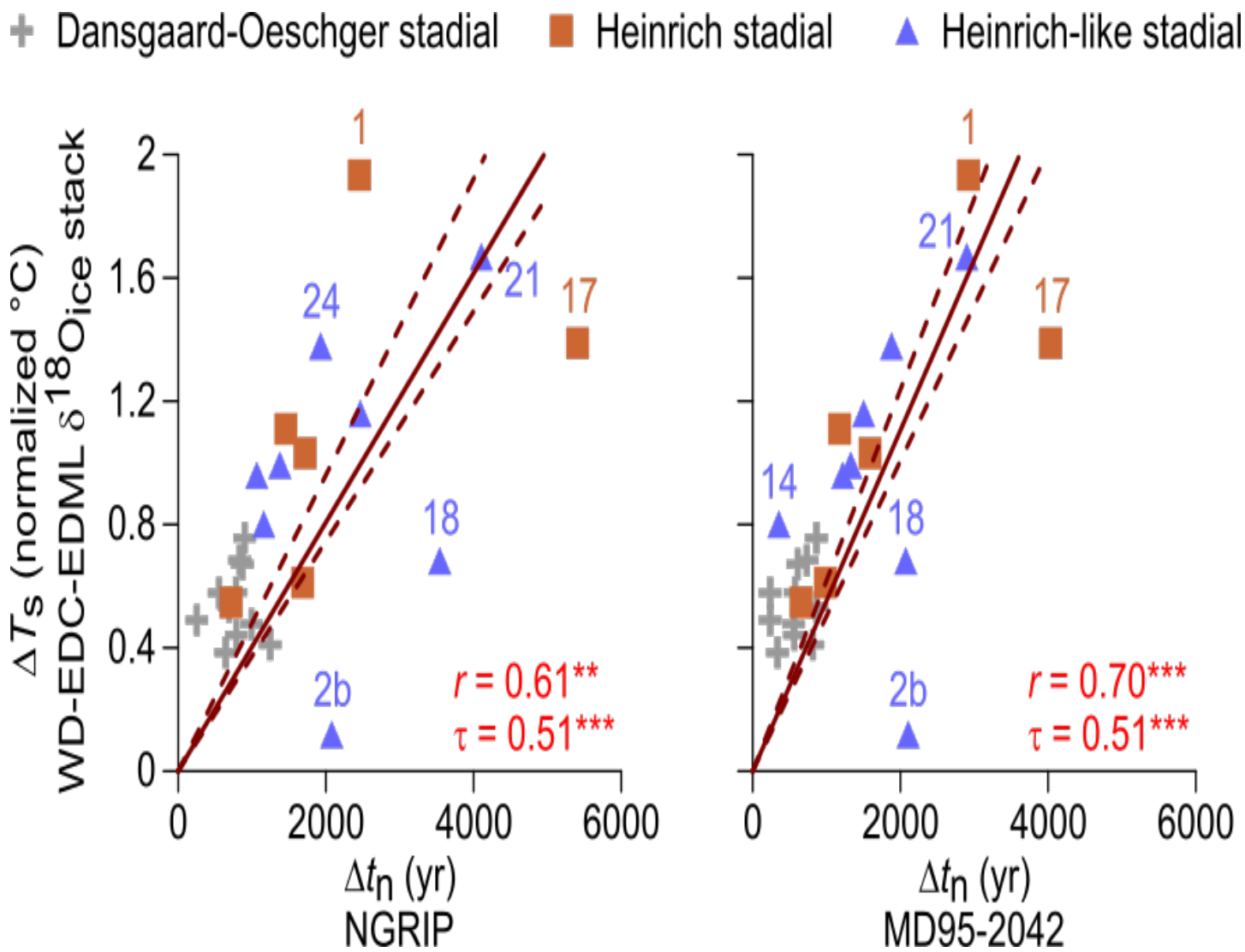
Classical TBS diagrams

- **Strong relationships with the following physical basis:**

$$\Delta T_s \approx \left(\frac{\Delta T_n}{2T}\right) \cdot \Delta t_n$$

- **A few consistent DO-AIM deviations from linear regression lines**

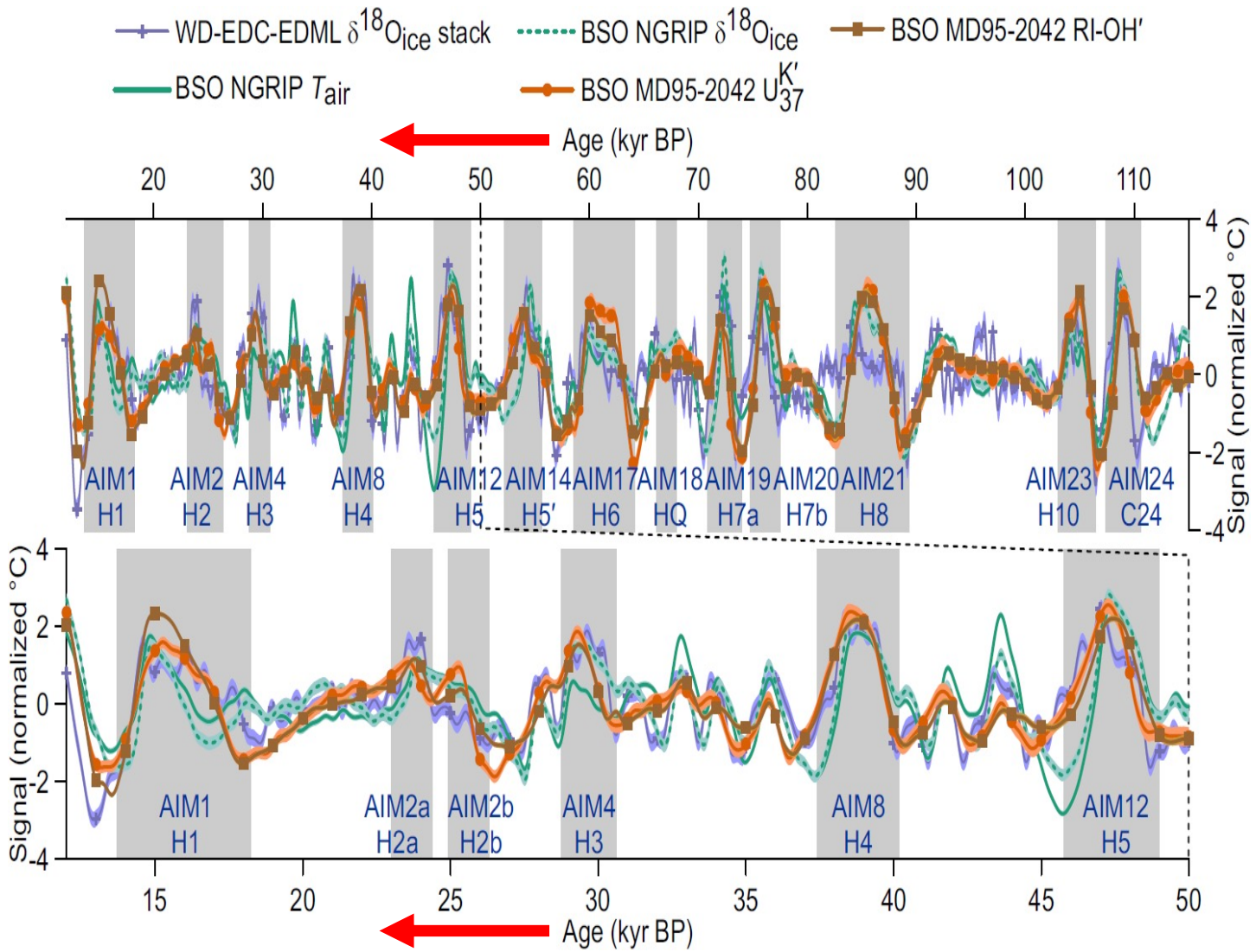
- **Iberian Margin SST records yield the best regression fits**



Davtian & Bard (2023) *PNAS*

Classical TBS model

- **Application of the TBS model by Stocker & Johnsen (2003)**
- **Good agreements with a real Antarctic T_{air} record**
- **Iberian Margin SST records as TBS model inputs yield the best data-model agreements**



Davtian & Bard (2023) *PNAS*

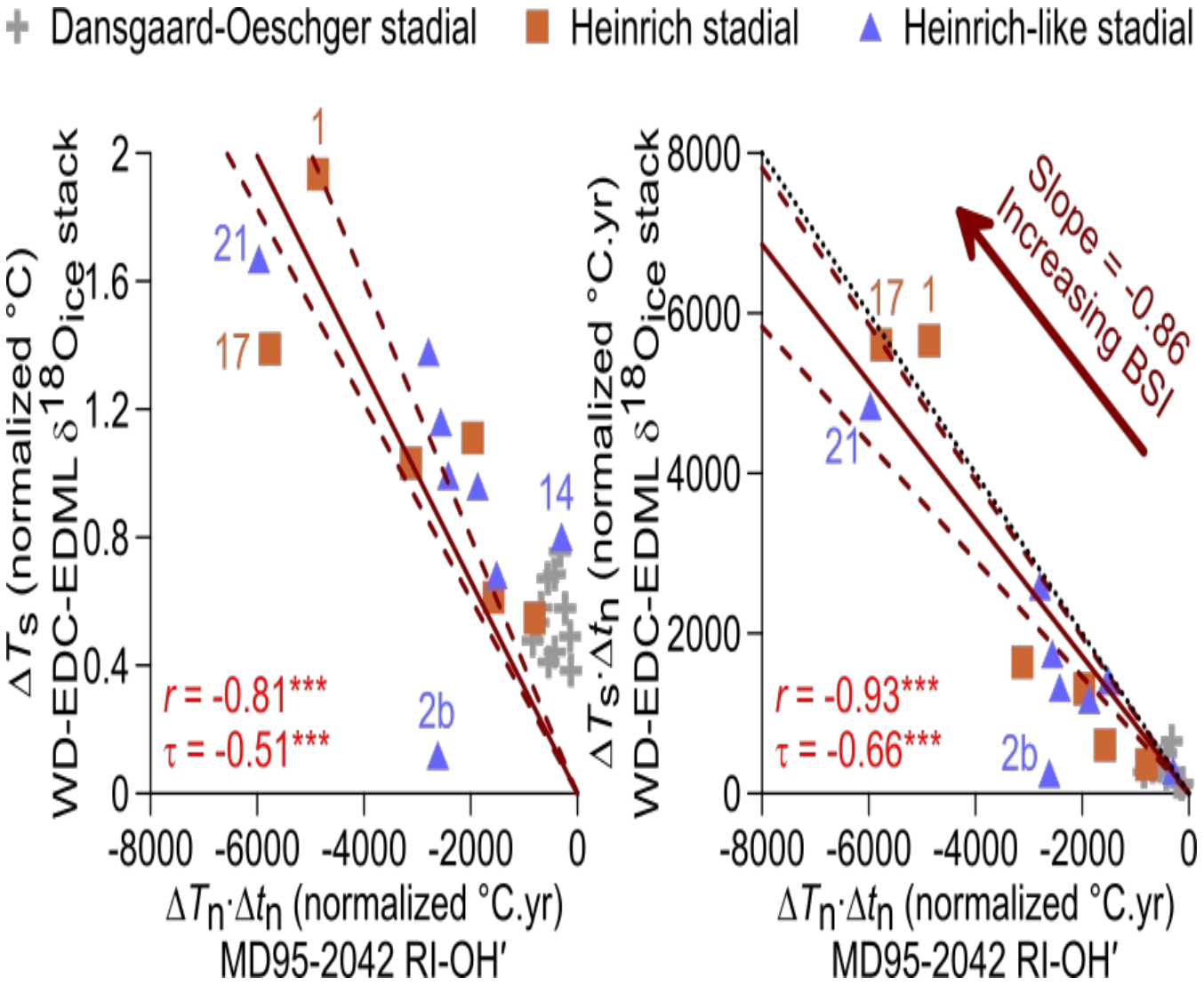
Extended TBS diagrams

- **1st extended TBS diagram: Same physical basis as for the classical TBS diagram**

$$\Delta T_s \approx \left(\frac{\Delta T_n}{2T}\right) \cdot \Delta t_n$$

$$= \left(\frac{1}{2T}\right) \cdot \Delta T_n \cdot \Delta t_n$$

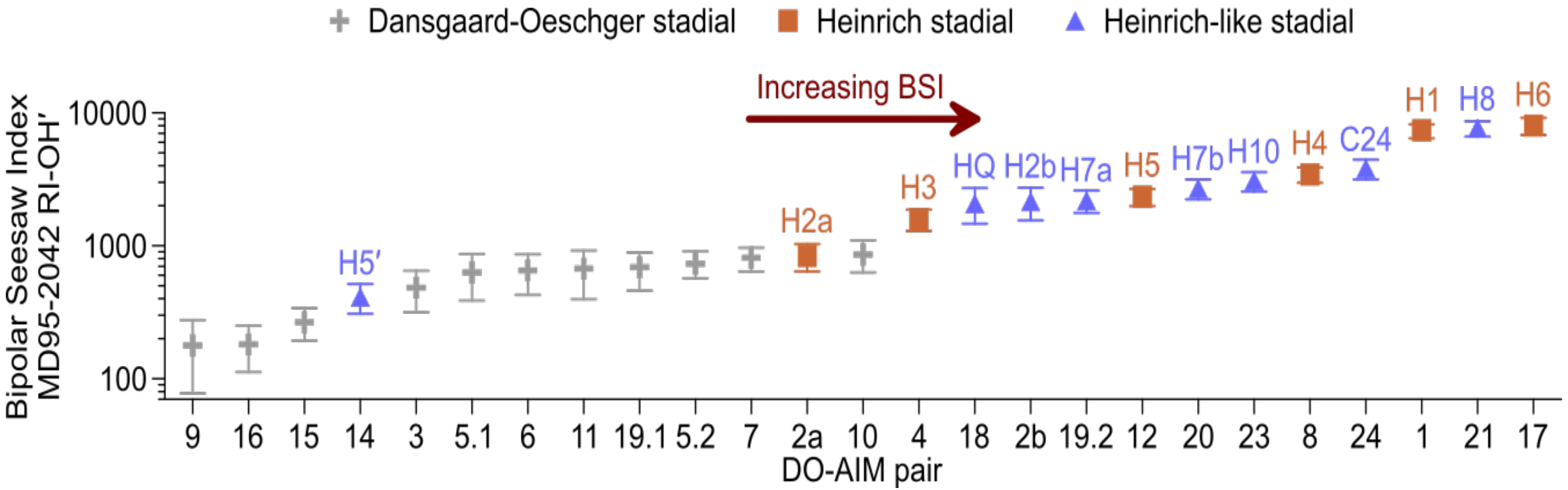
- **2nd extended TBS diagram: Two products proportional to heat loss or conservation and a Bipolar Seesaw Index (BSI)**



Davtian & Bard (2023) *PNAS*

Bipolar Seesaw Index (BSI)

- **BSI distinguishes abrupt cooling events with and without H events**
- **A continuum of BSI values -> at least three different climate states?**



Davtian & Bard (2023) *PNAS*

Key points and conclusions

1. Iberian Margin SST records based on novel (RI-OH′) and established (e.g., $U^{K'}_{37}$) proxies faithfully capture contrasting H-DO SST cooling amplitudes

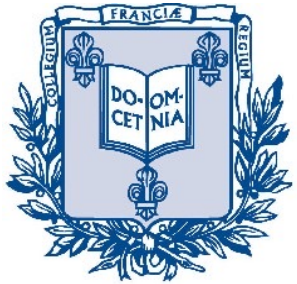
2. Iberian Margin SST records provide a stronger confirmation of the classical TBS model than does the Greenland T_{air} record

3. Contrasting H-DO cooling amplitudes from Iberian Margin SST records motivate two extensions of the TBS model and a Bipolar Seesaw Index

Thank you for your attention!

Email:
davtian@cerege.fr
nina.davtian@uab.cat

Funding:



COLLÈGE DE FRANCE
1530

Social media:
Twitter/X: @nina_davtian
Bluesky: @ninadavtian.bsky.social
Mastodon: @nina_davtian@mastodon.world
Instagram: @nina_davtian_gdgts
LinkedIn