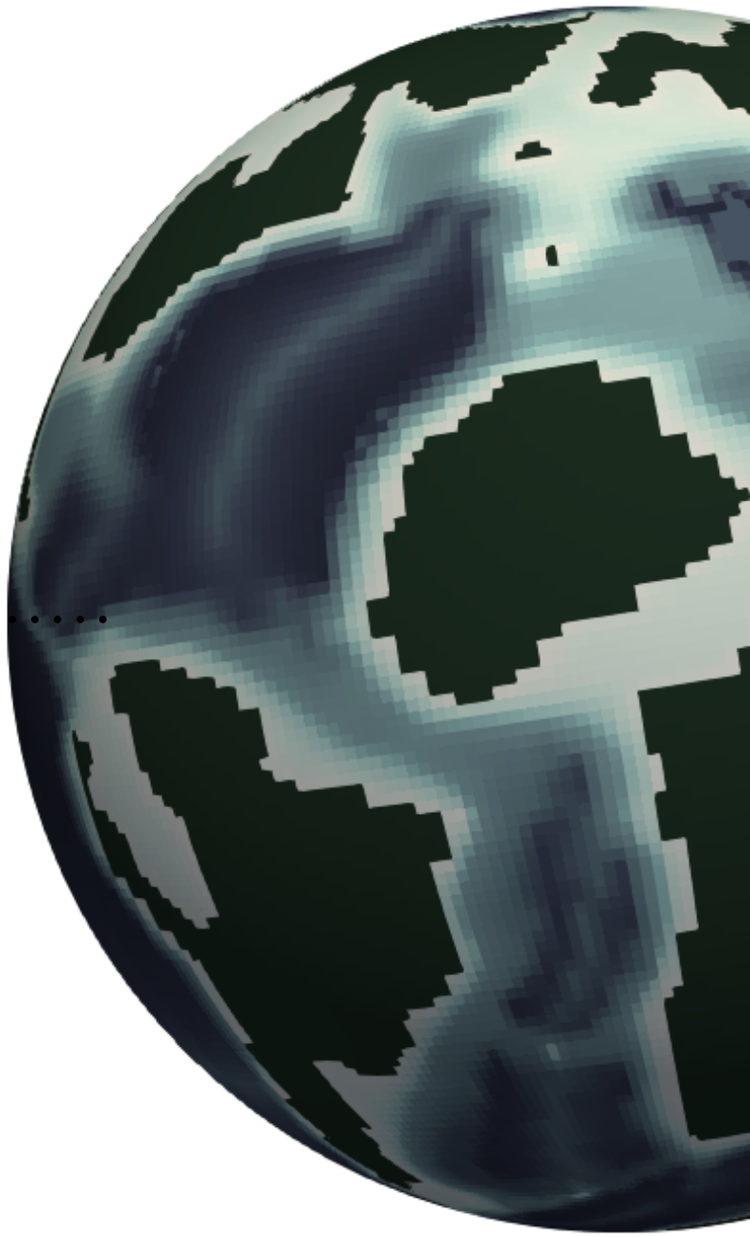
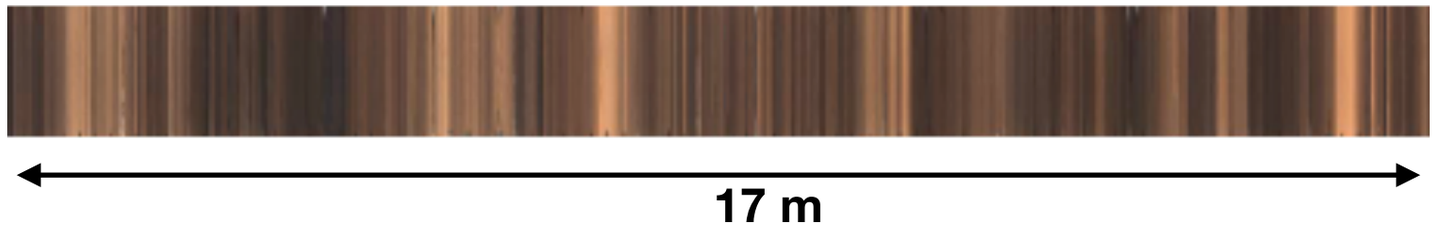
Orbital-scale deoxygenation trends driven by ventilation in Cretaceous ocean

EGU 2022 - May, 24th



A-C. Sarr, M. Laugié Y. Donnadieu, J-B. Ladant, F. Raisson

Orbitally-controlled cyclicity in Organic-rich sediments



Kuhnt et al. 2017 - Tarfaya shelf, Morocco

High %TOC associated with

Indications of enhanced anoxia (redox sensitive trace metals)
Photic zone euxinia (biomarkers)
Enhanced proportion of oceanic OM

Locally

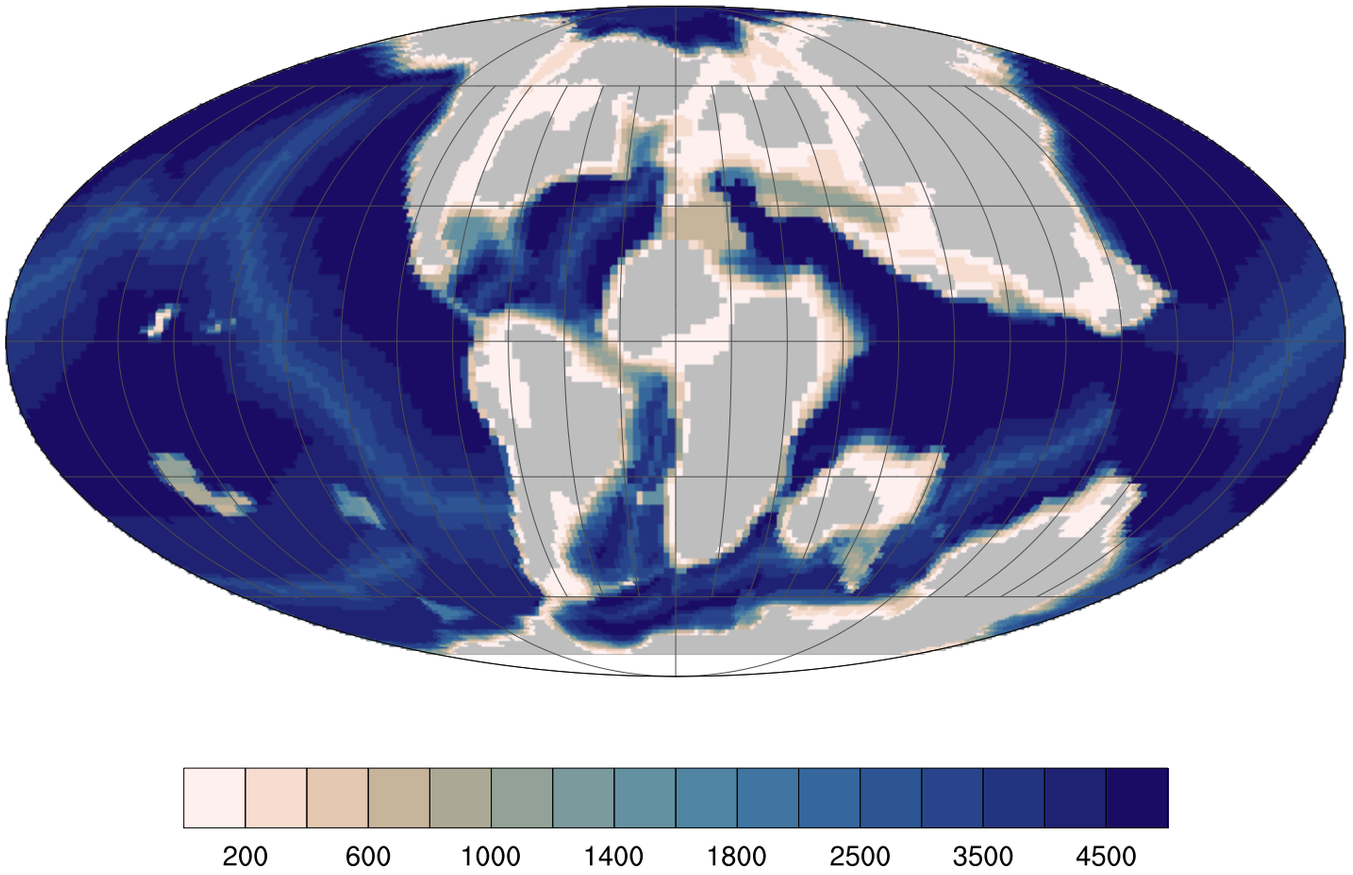
Enhance freshwater supply (faunas & organic chemistry) | **Hydrology**
Increase terrestrial input (weathering-related minerals + pollens) | **Hydrology**
Enhanced upwelling (d13C carbonate) | **Winds**
Enhanced nutrients (proportion of radiolarians) | **Hydrology or upwelling**

Impact of global ocean circulation changes on O_2 distribution not discussed
(well, except Meyers et al. (2012))

How does global O_2 distribution vary with change in orbital configuration ?

6 simulations

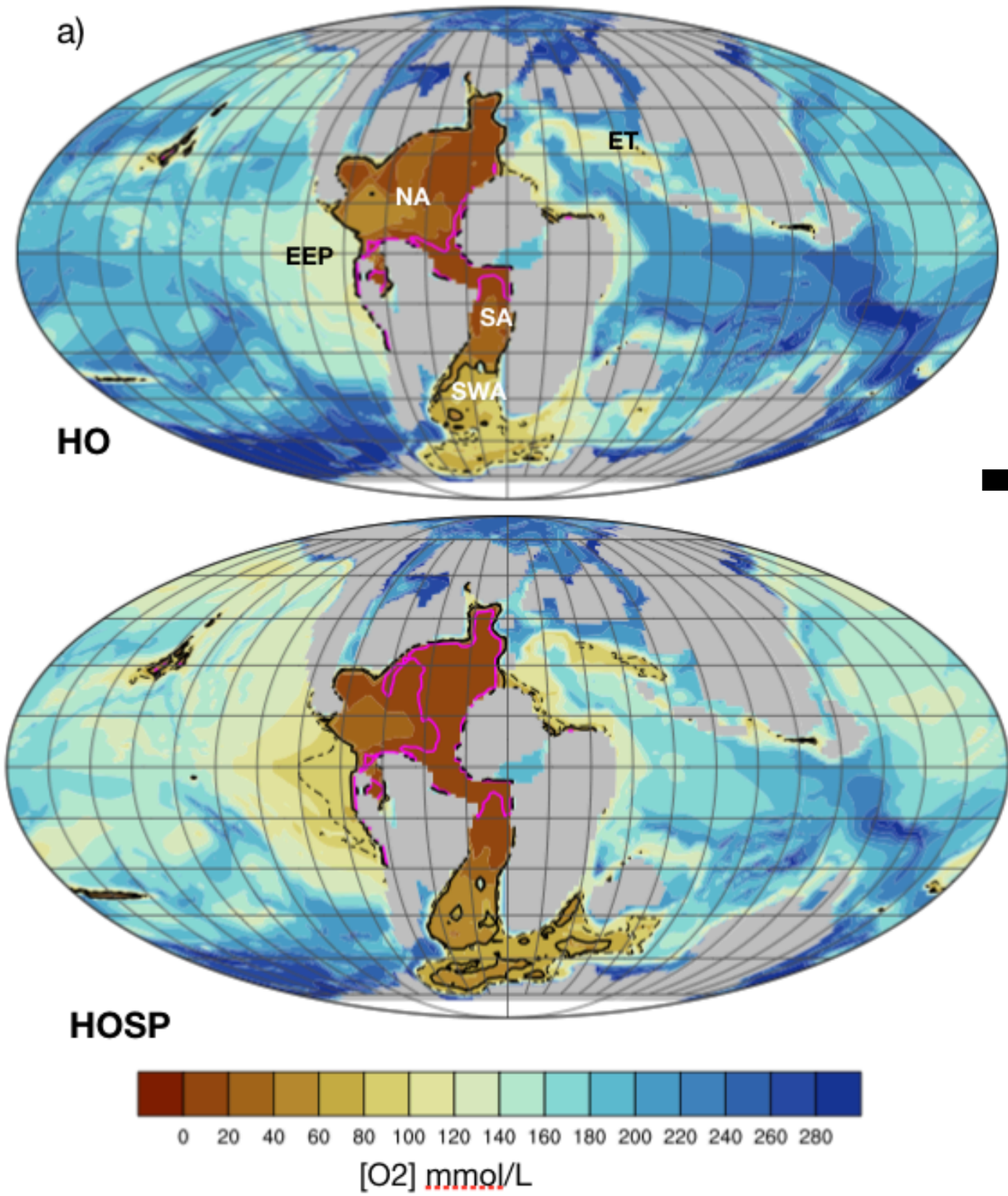
- **2** | 0 Eccentricity + Obliquity extremes
- **4** | Max Eccentricity + Equinox & Solstice perihelion



Ocean-atmosphere Model
Hydrology cycle
Salinity, Temperature
Ocean circulation
(upwelling, intermediate water formation)

PISCES Model
Productivity
OMZ
Seafloor O2

sarr@cerege.fr



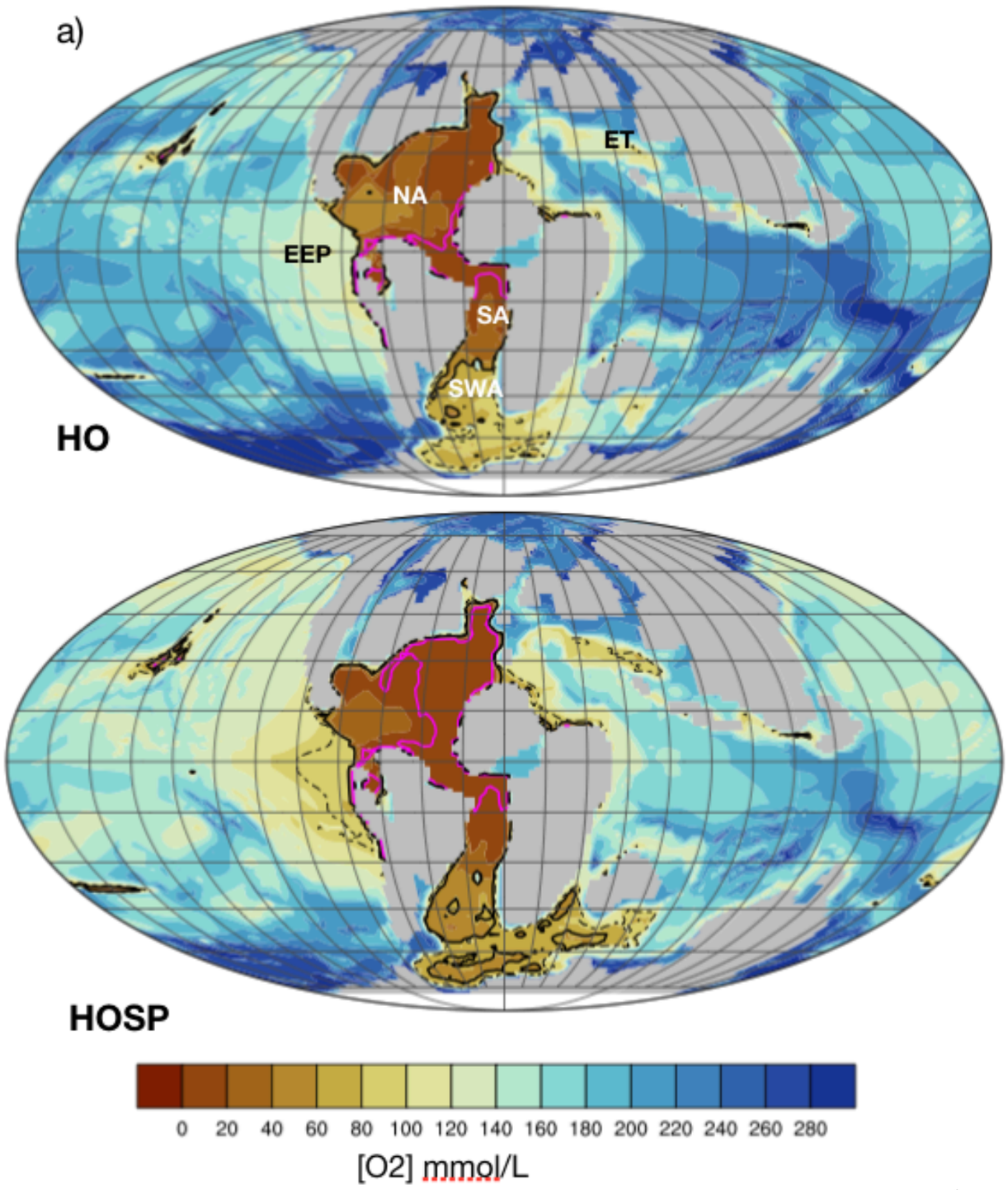
0 Eccentricity

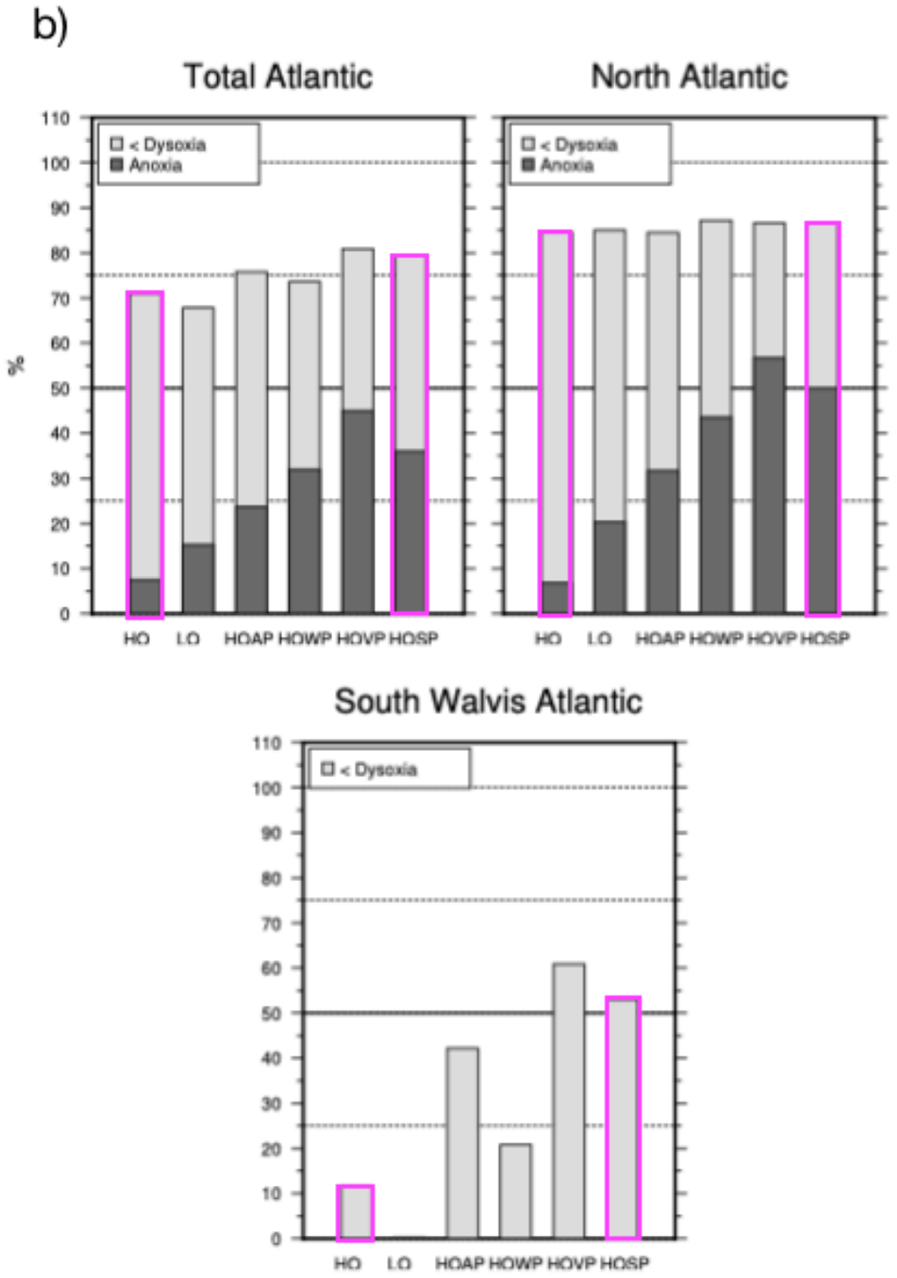
➡ Deoxygenation expand at the seafloor at high eccentricity in the **Atlantic basin** especially

Max Eccentricity

Sarr et al., subm.

➡ Anoxia can reach > 50 % of North Atlantic water masses under some configurations

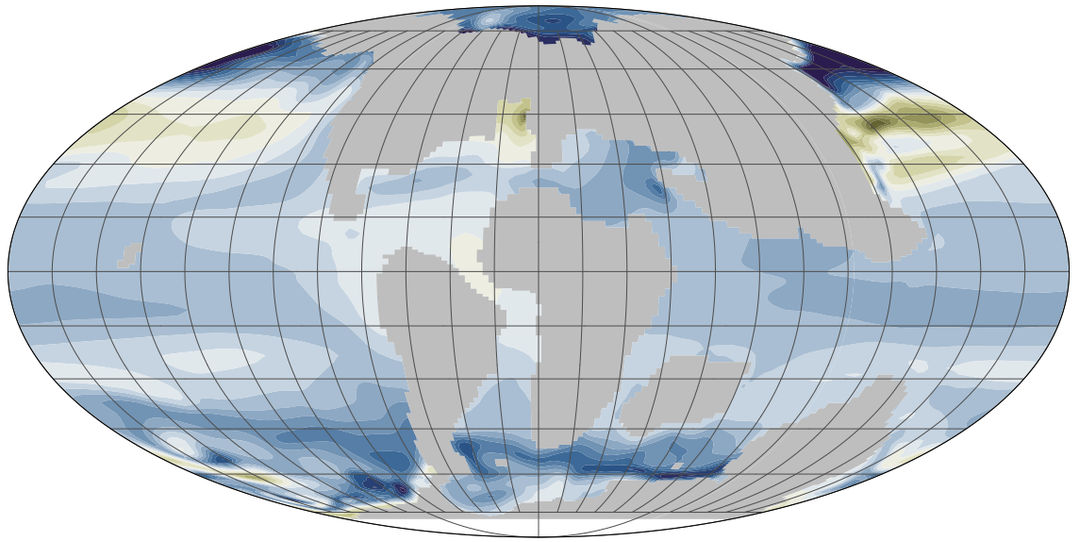




➡ Both obliquity, eccentricity and precession impact the oxygenation

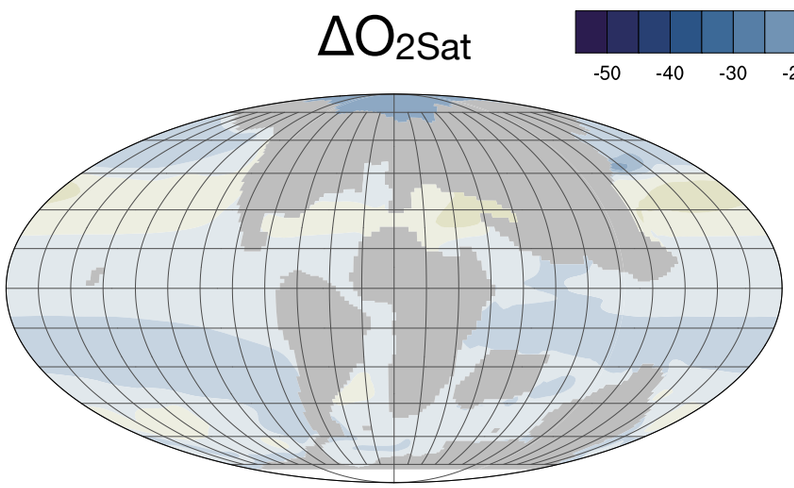
Sarr et al., subm.

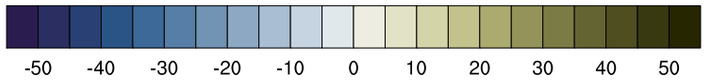
ΔO_2



➡ Signal is mostly driven by change in Apparent Oxygen Utilization. Global pattern in **ΔO_2 mimics change in ventilation**

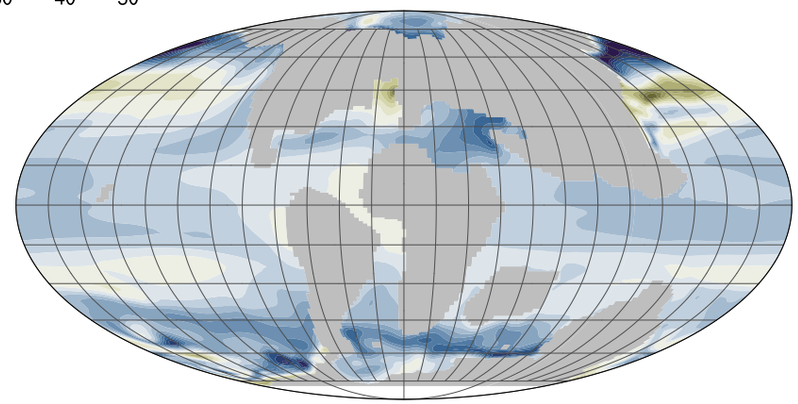
ΔO_{2Sat}



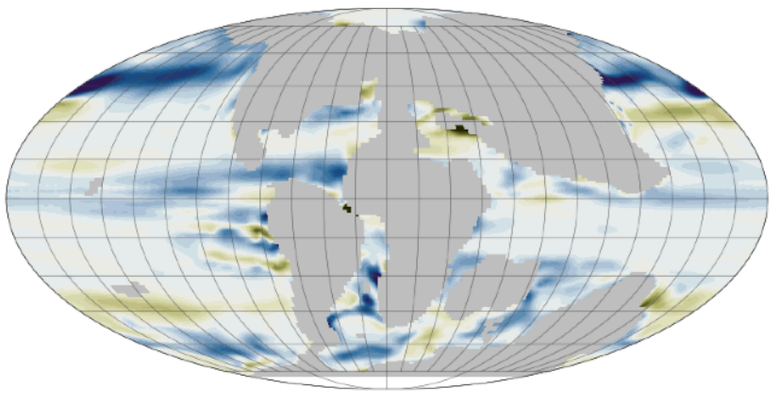


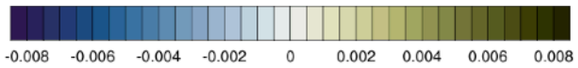
+

$\Delta AOU^*(-1)$

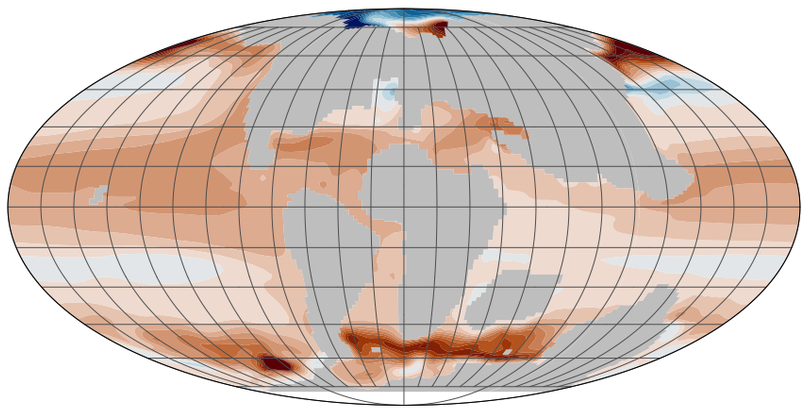


$\Delta Export\ P.$





$\Delta \tilde{Water\ Age}$

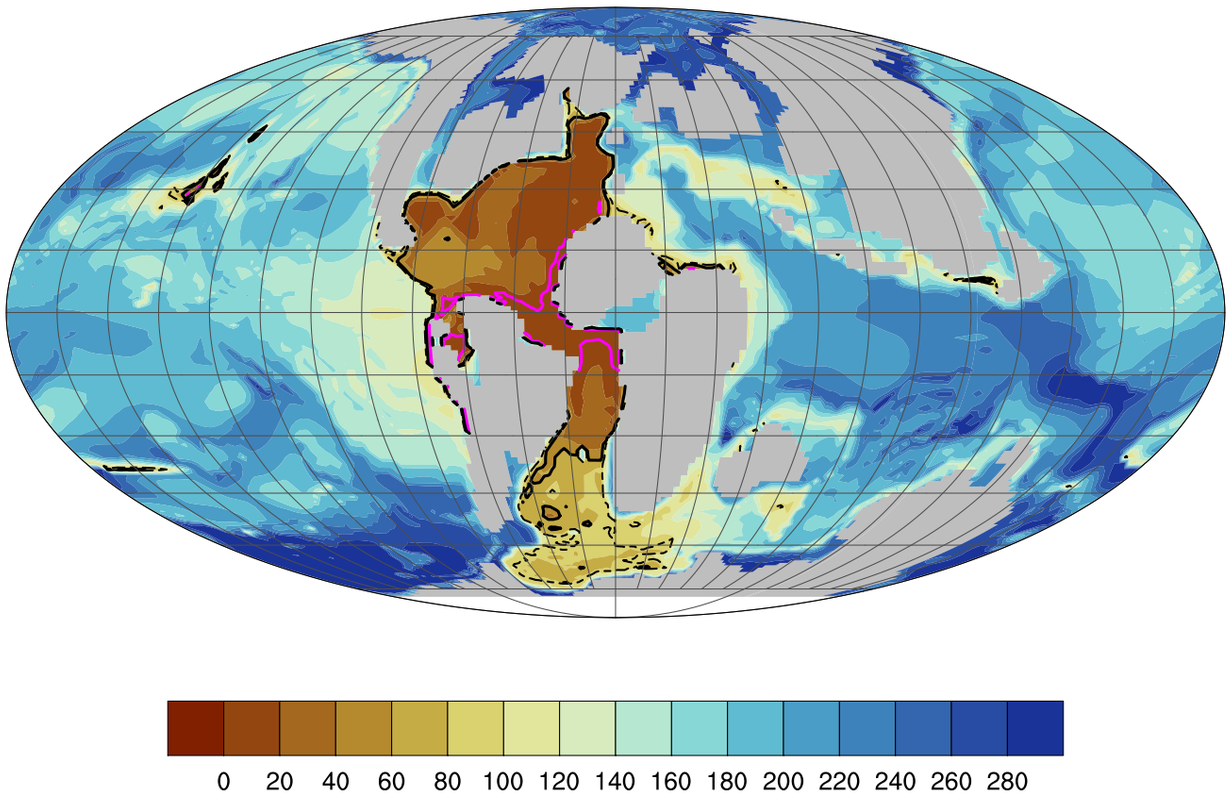


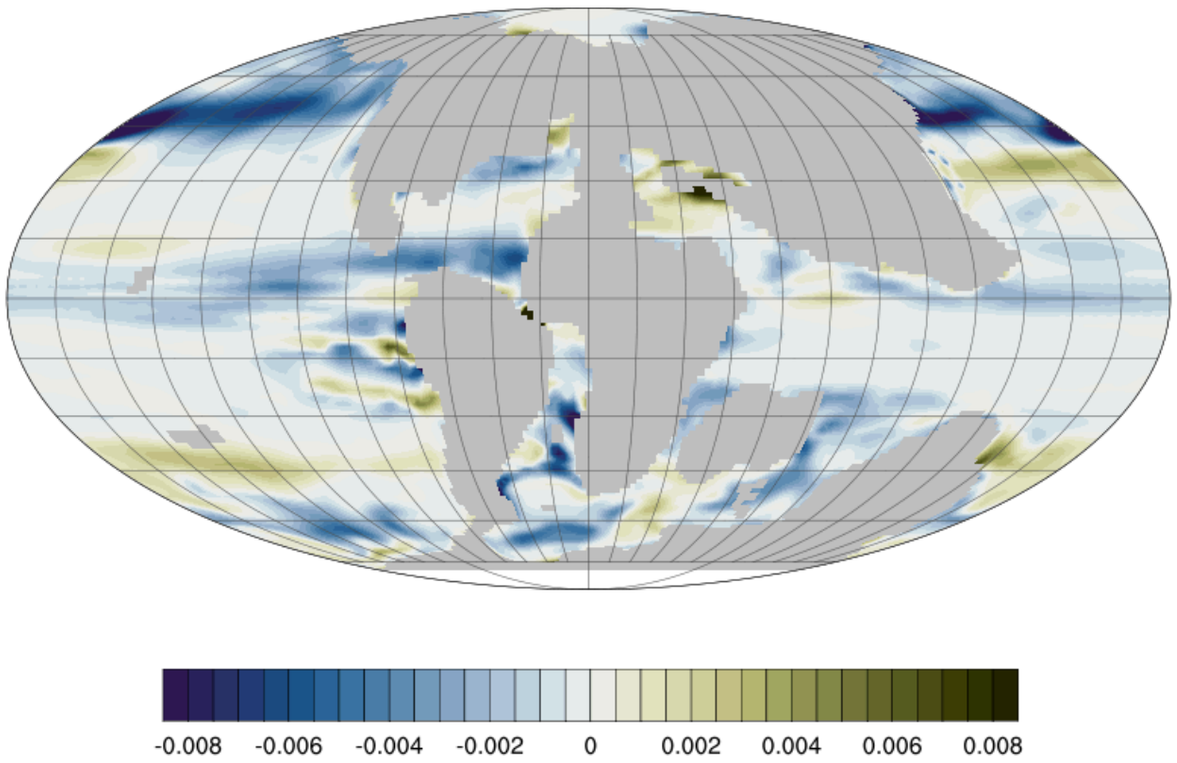
Sarr et al., subm.

sarr@cerege.fr

Small change in ventilation can drive strong change in deoxygenation trend at basin scale
especially in enclosed basins

‘Background’ signal that superimposed with local dynamics
(eg. enhanced biological activity due to stratification, nutrient supply…)





Sarr et al., subm.