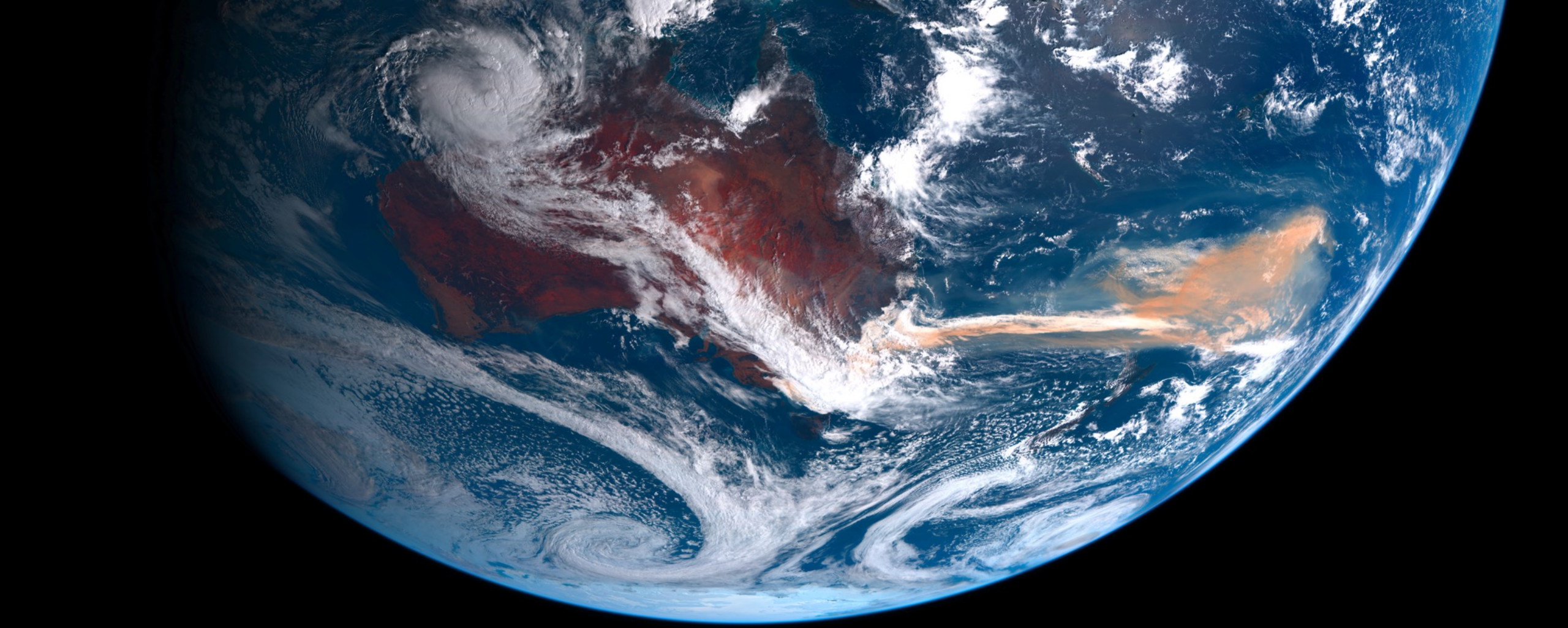
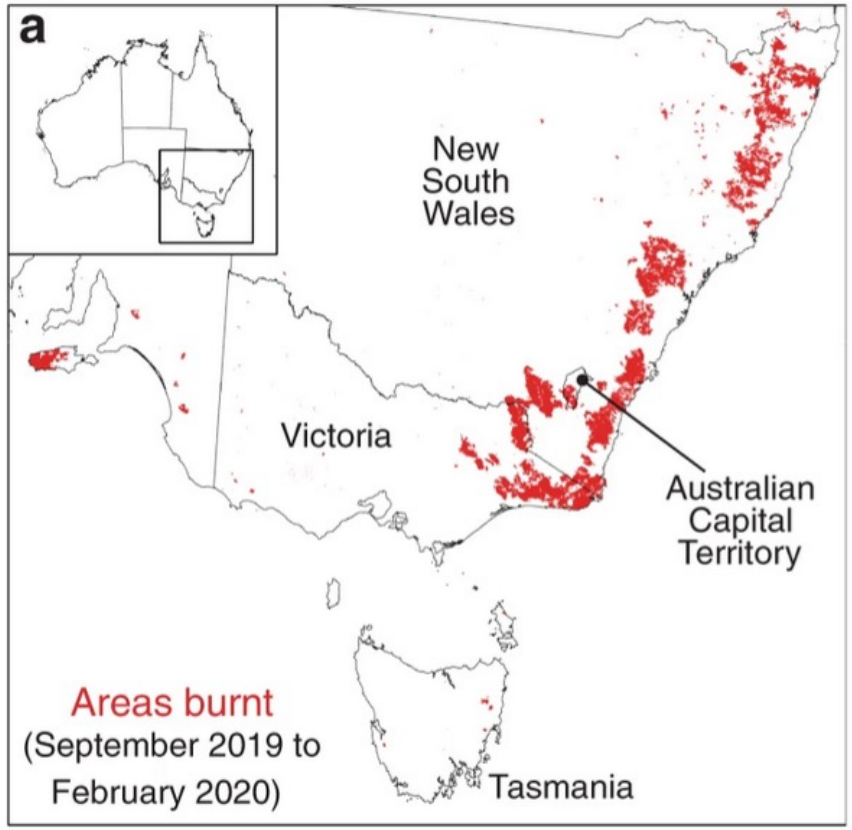


Widespread and unprecedent phytoplankton blooms triggered by 2019-20 Australian wildfires

Ocean Carbon From Space Workshop – February 2022

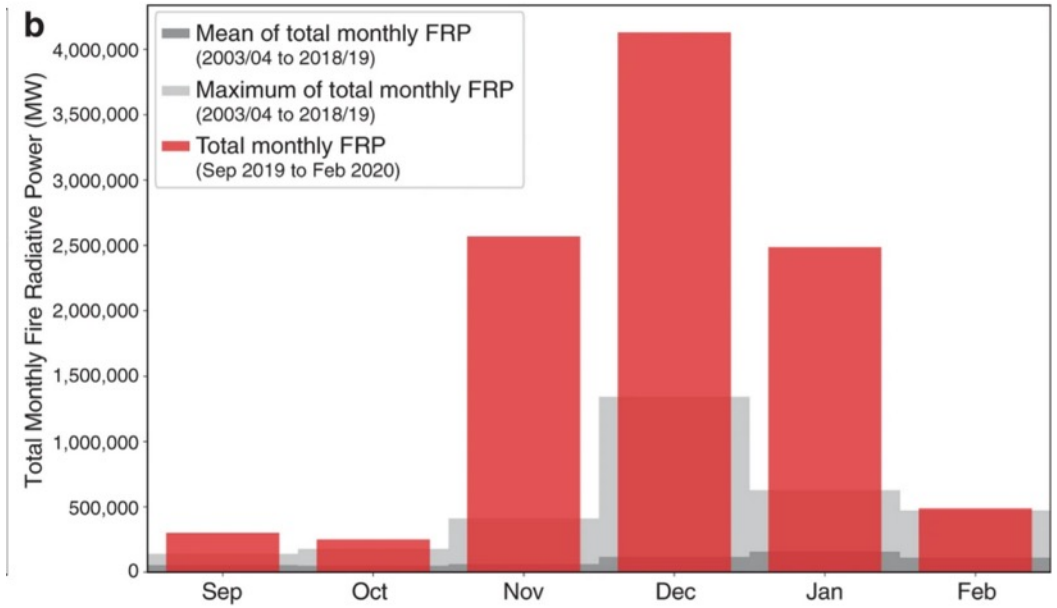
Joan Llort (BSC)

Extreme Fire season 2019/20



Figures from Abram et al, 2021

- 74,000 km2
- 715 million tons of CO_2*



** Australia's 2018 anthropogenic CO_2 emissions = 537.4 million tons*

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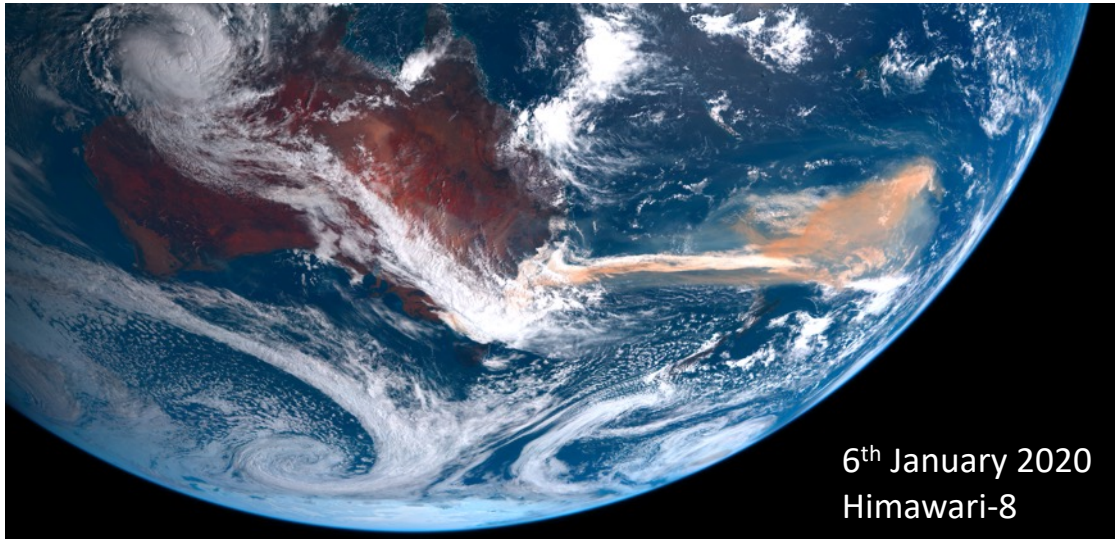
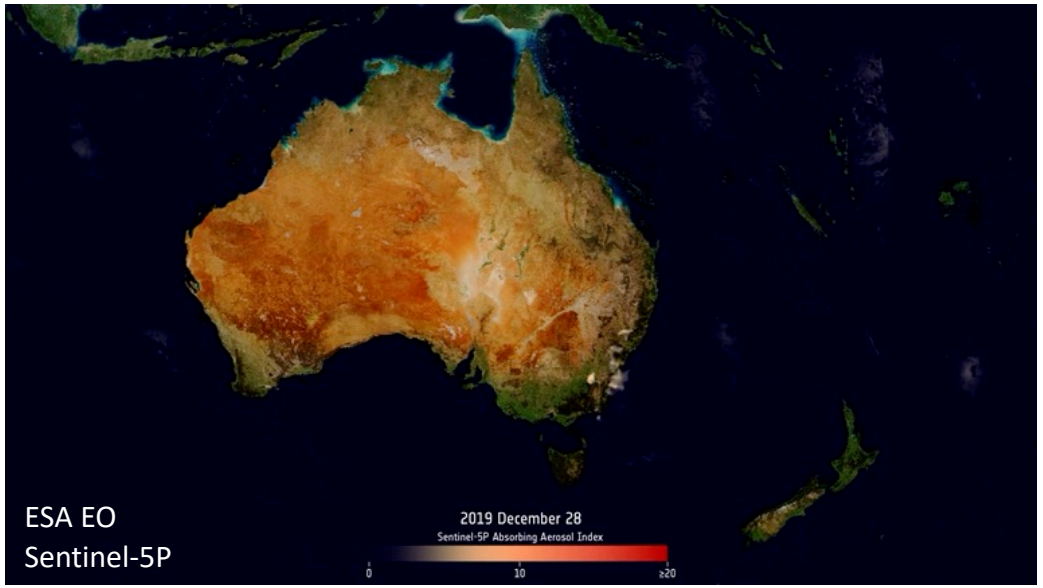
Massive smoke and aerosols emissions





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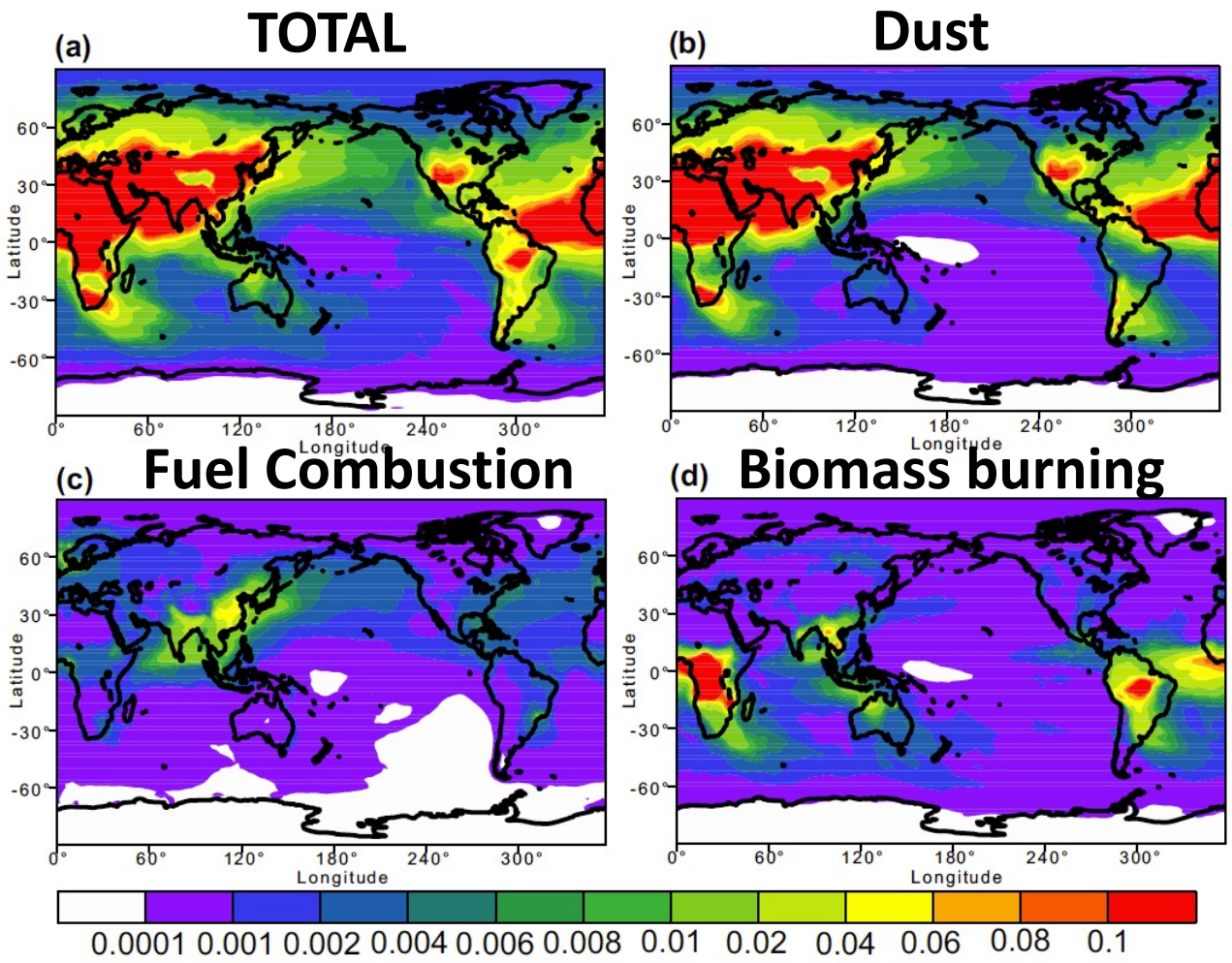
Pyrogenic Fe and phytoplankton



Modelled deposition DFe flux (ng Fe m−2 s−1)

REVIEW ARTICLE OPEN

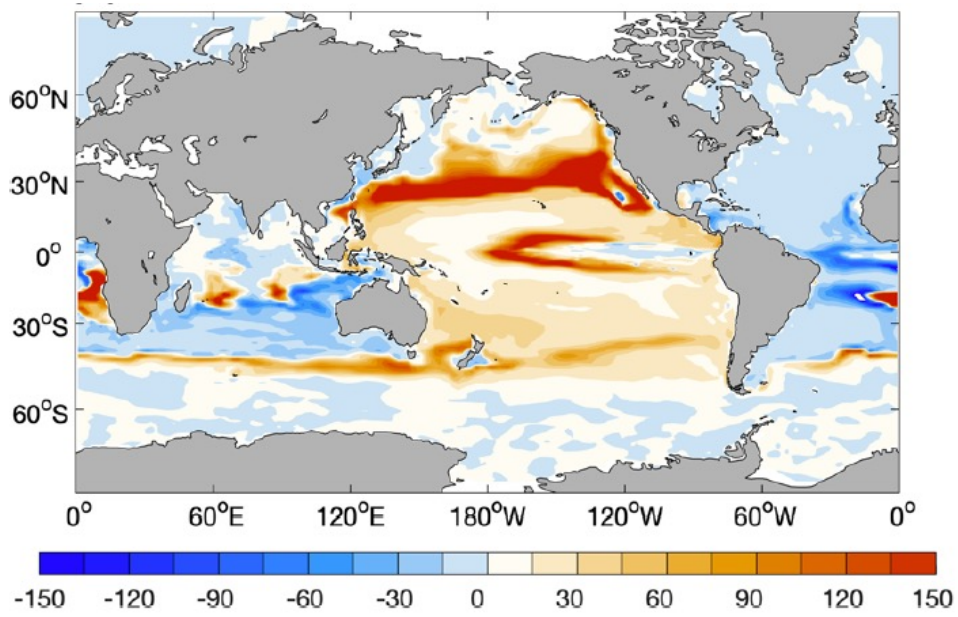
Check for updates

Ocean fertilization by pyrogenic aerosol iron

Akinori Ito[1]✉, Ying Ye[2]✉, Clarissa Baldo[3] and Zongbo Shi[3]✉

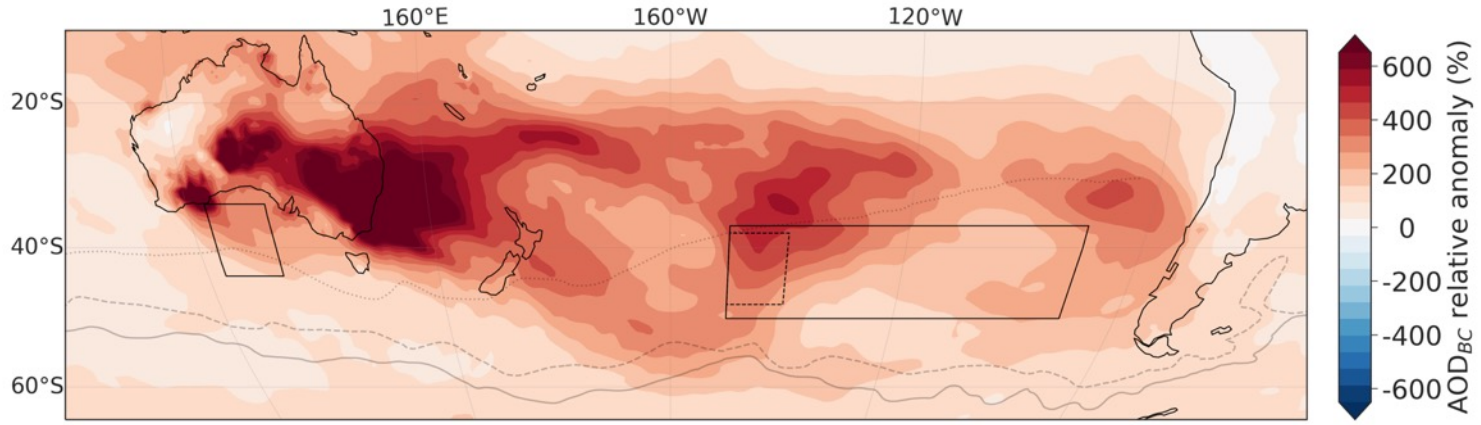
Aerosols supply bioaccessible iron to marine biota which could affect climate through biogeochemical feedbacks. This paper review progresses in research on pyrogenic aerosol iron. Observations and laboratory experiments indicate that the iron solubility of pyrogenic aerosol can be considerably higher than lithogenic aerosol. Aerosol models highlight a significant contribution of pyrogenic aerosols (~20%) to the atmospheric supply of dissolved iron into the ocean. Some ocean models suggest a higher efficiency of pyrogenic iron in enhancing marine productivity than lithogenic sources. It is, however, challenging to quantitatively estimate its impact on the marine biogeochemical cycles under the changing air quality and climate.

npj Climate and Atmospheric Science (2021)4:30; https://doi.org/10.1038/s41612-021-00185-8

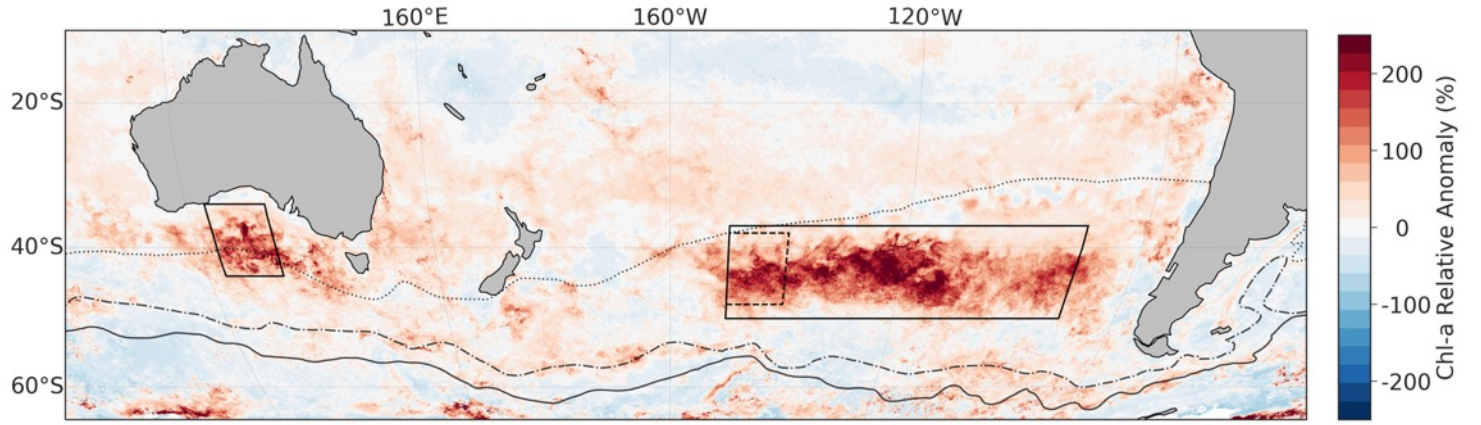


Simulated change in NPP_{nano} (mgC m−2 day−1) induced by Pyrogenic DFe

AOD and Phytoplankton anomalies in 2019/20



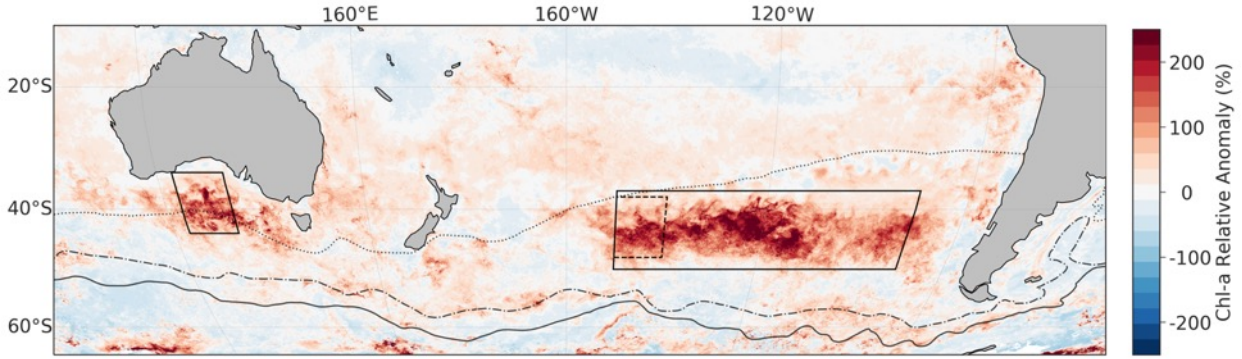
Black-Carbon AOD relative anomaly derived from atmospheric reanalysis (CAMS)

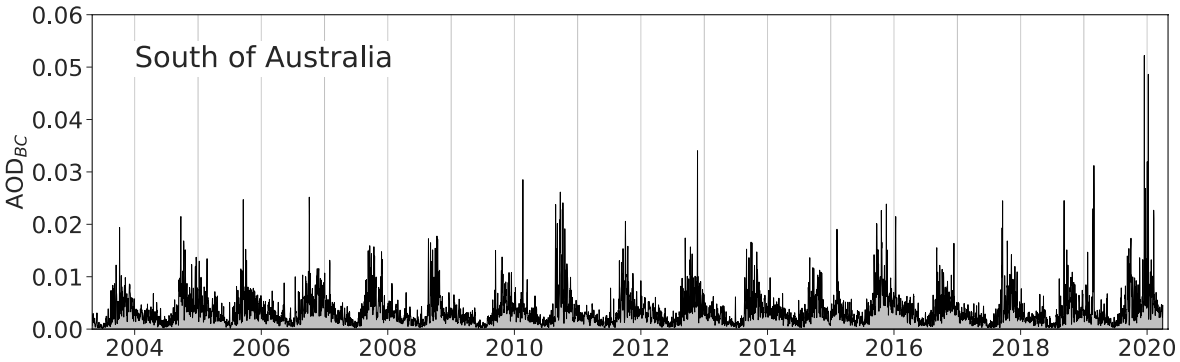


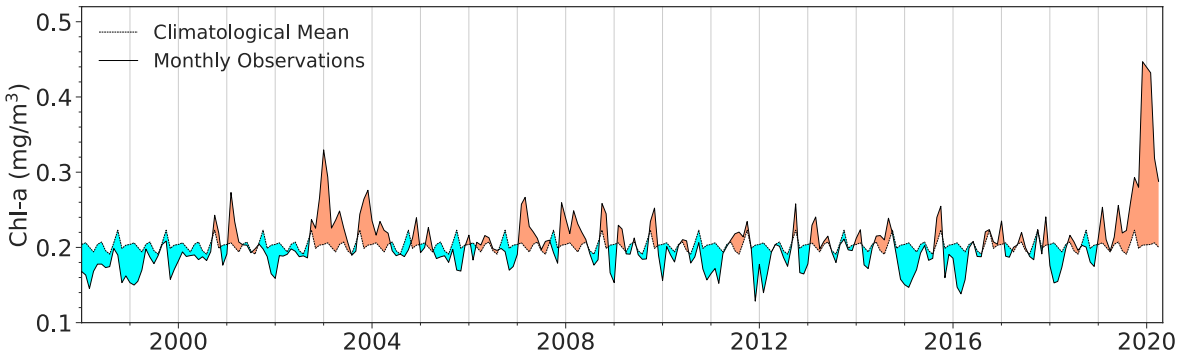
Surface Chl concentration observed from satellite. Relative anomaly computed over a 22-years long records (ESA's OC-CCI)

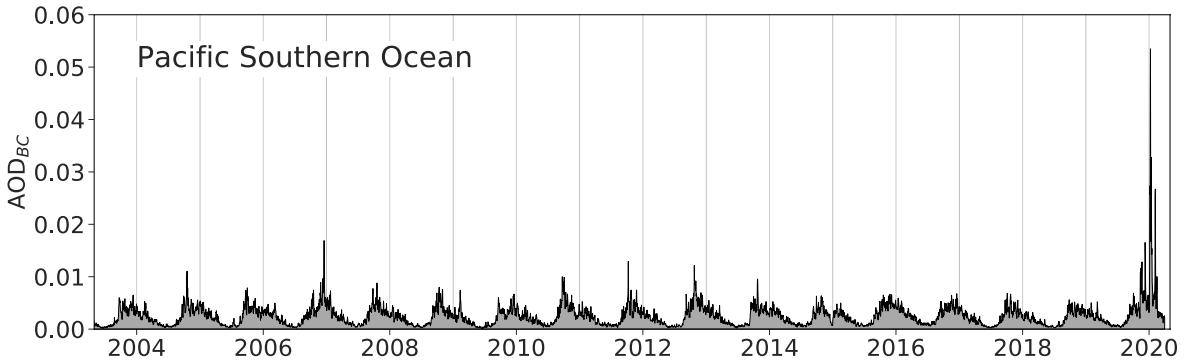
Tang and Llort et al., 2021

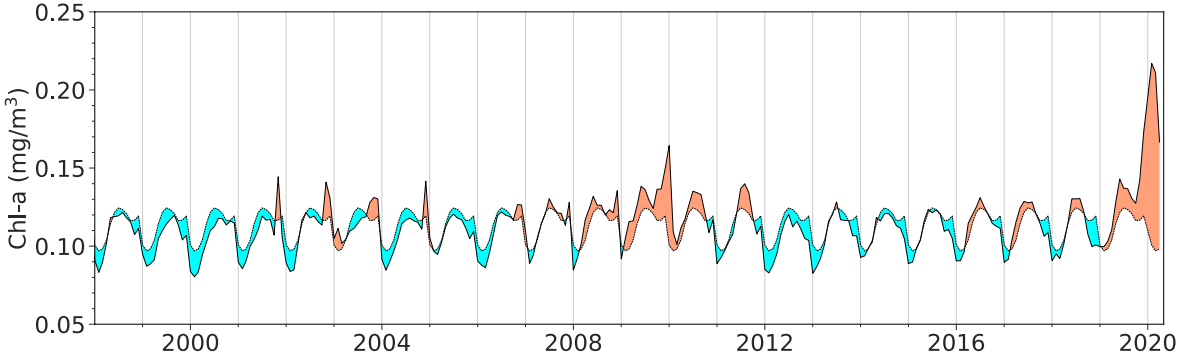
AOD and Phytoplankton anomalies in 2019/20





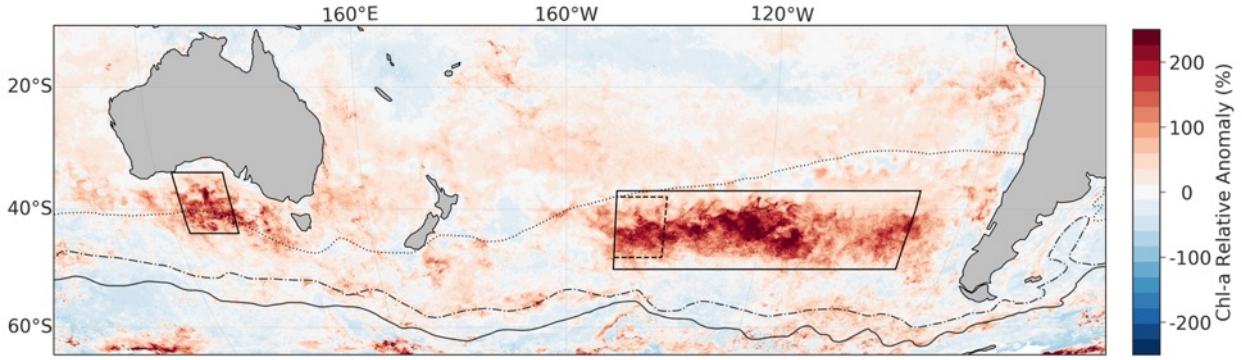


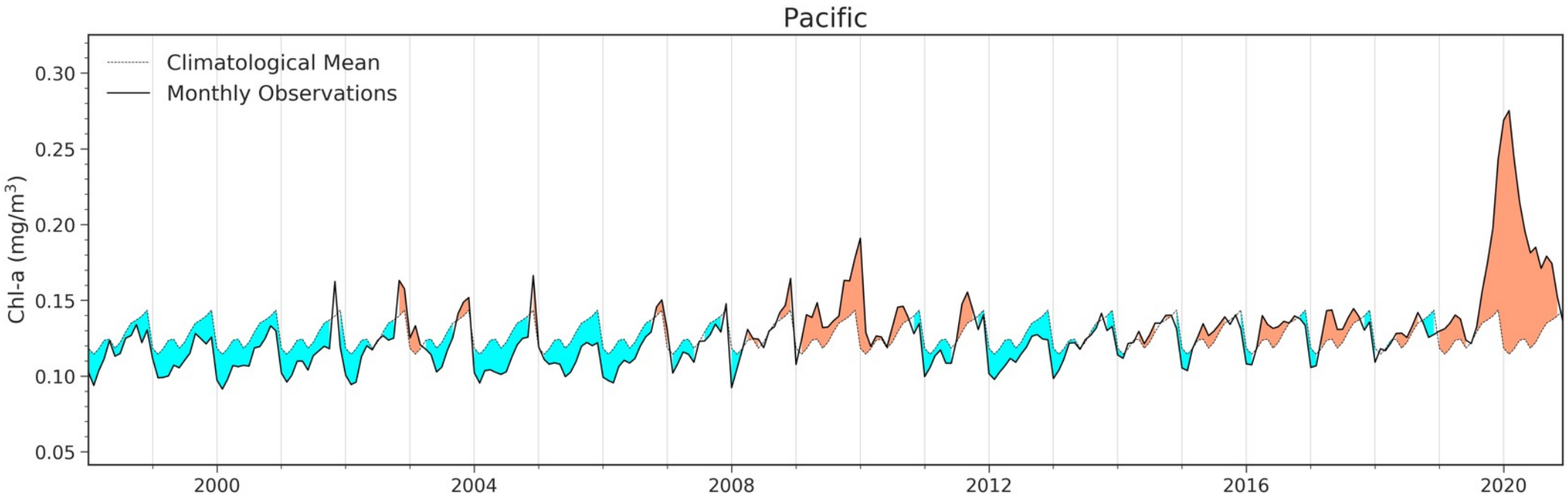




Tang and Llort et al., 2021

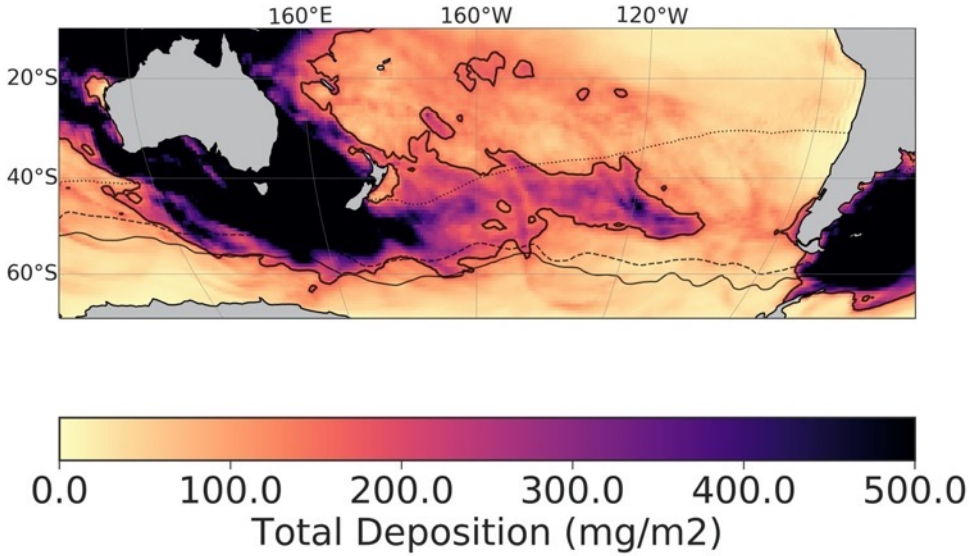
AOD and Phytoplankton anomalies in 2019/20

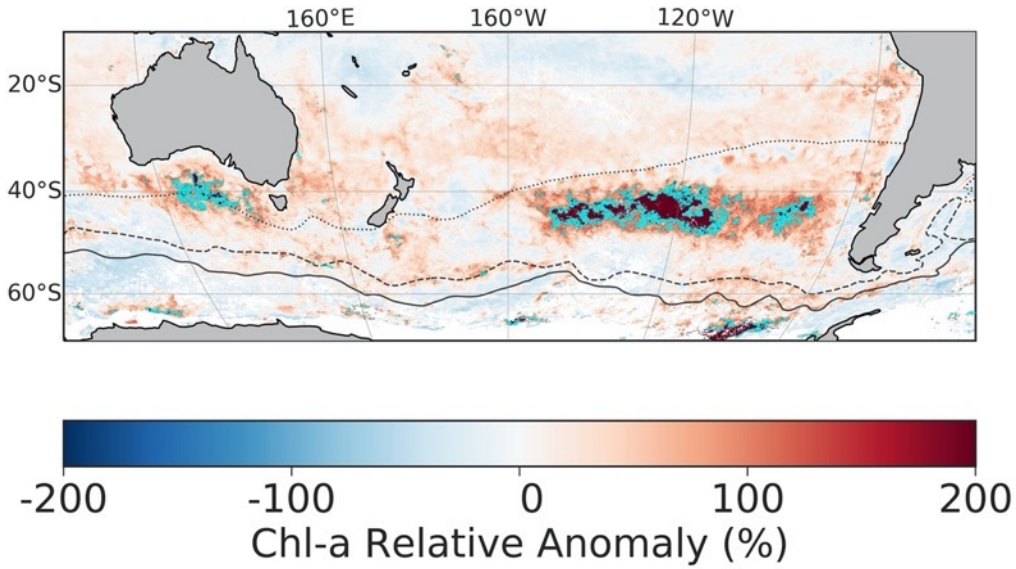


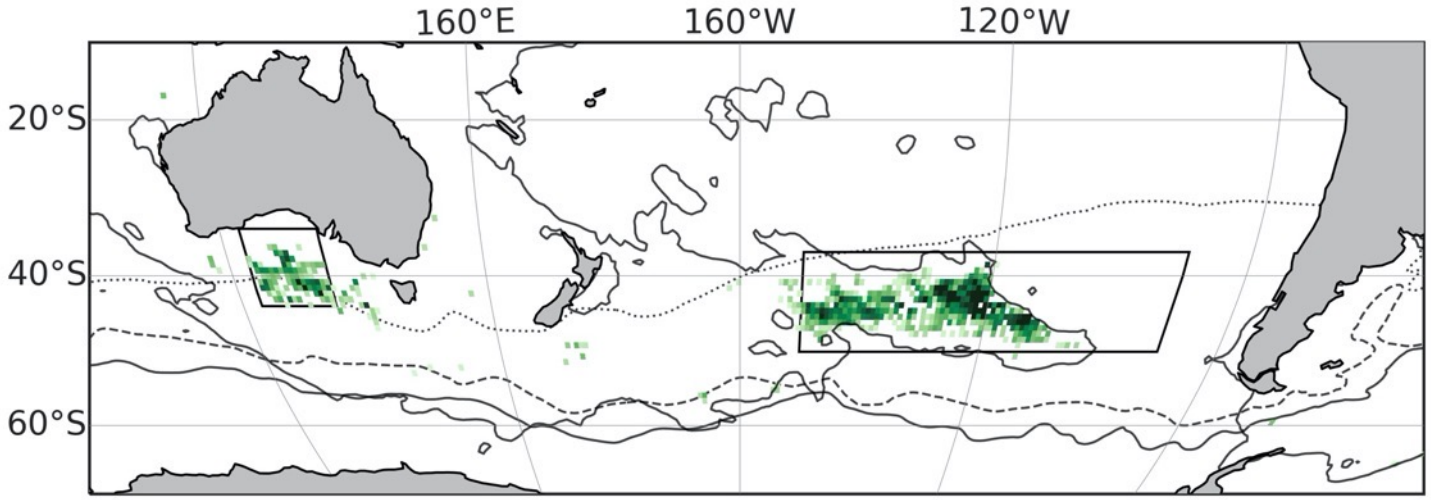


Chl-a anomaly lasted more than 12 months!!

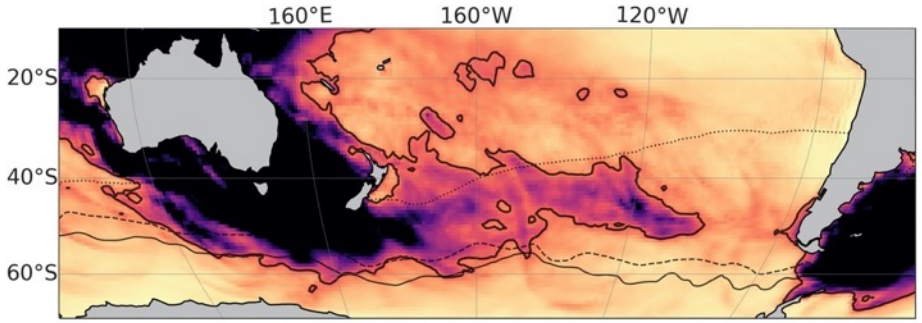
Deposition flux to delimit fertilisation hot-spots

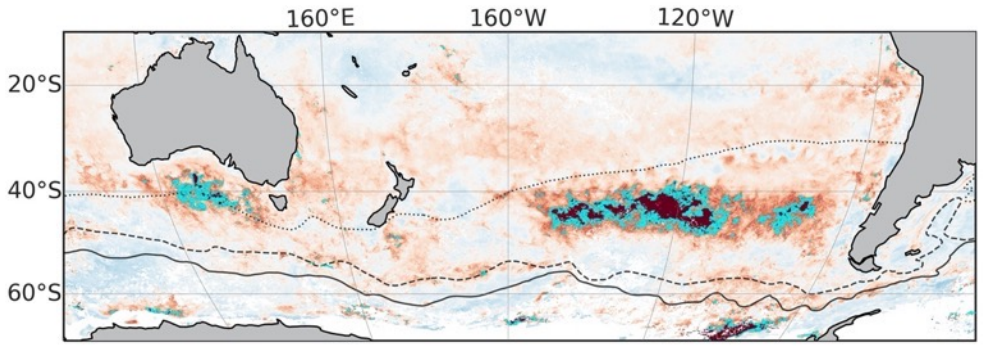




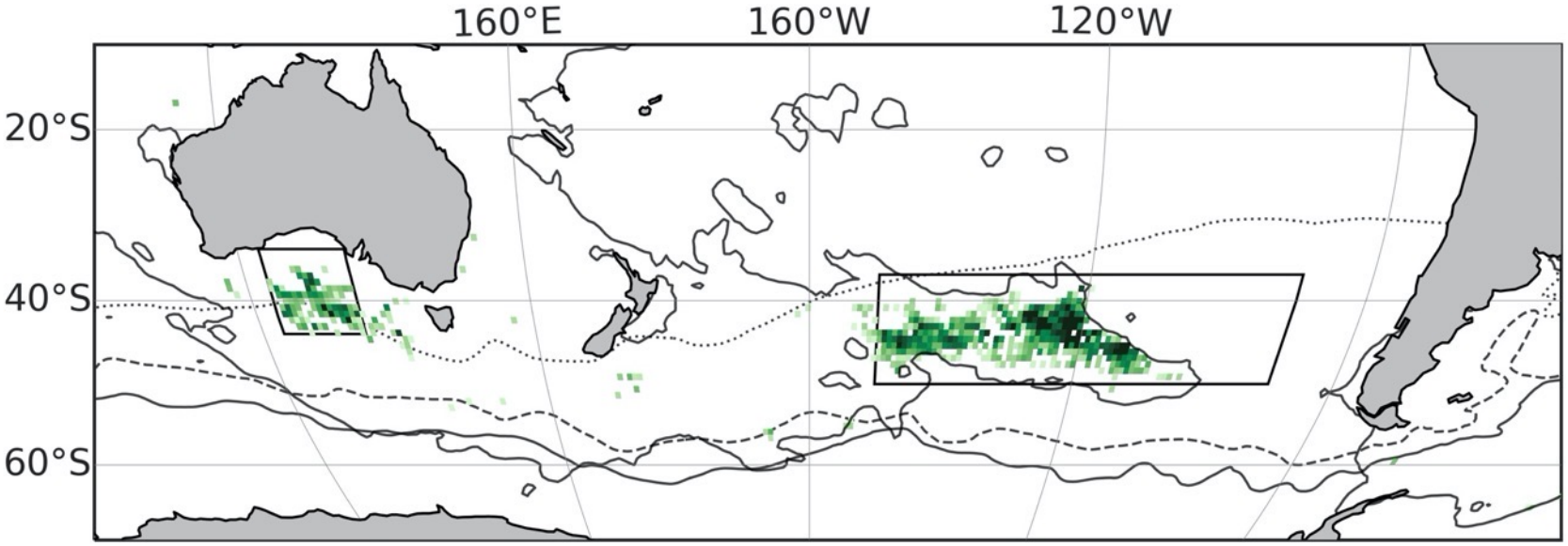


Deposition flux to delimit fertilisation hot-spots

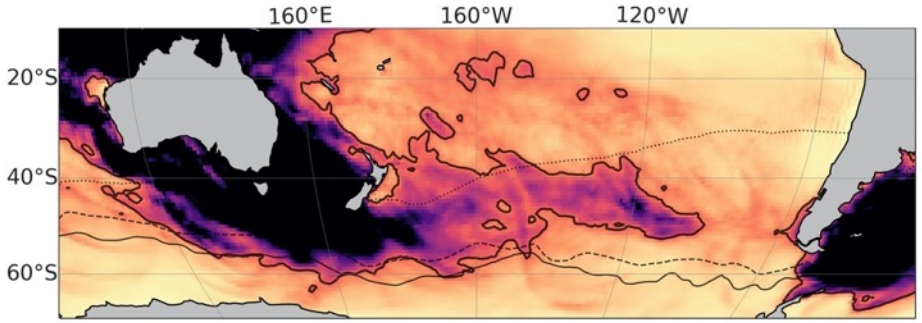


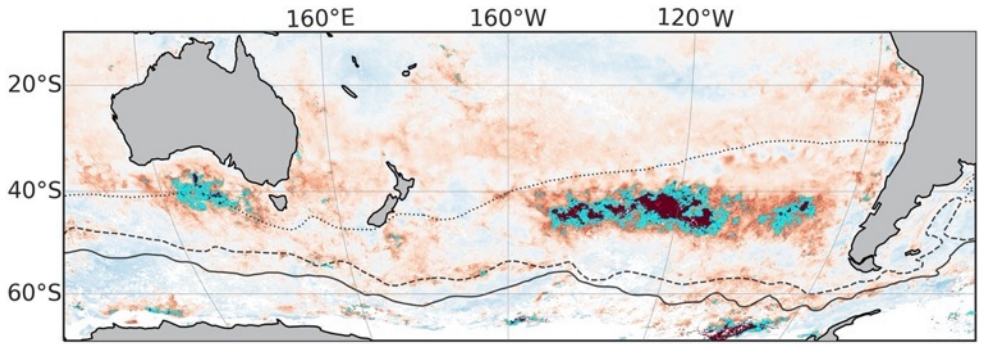


1. Spatial correlation ≠ Causation

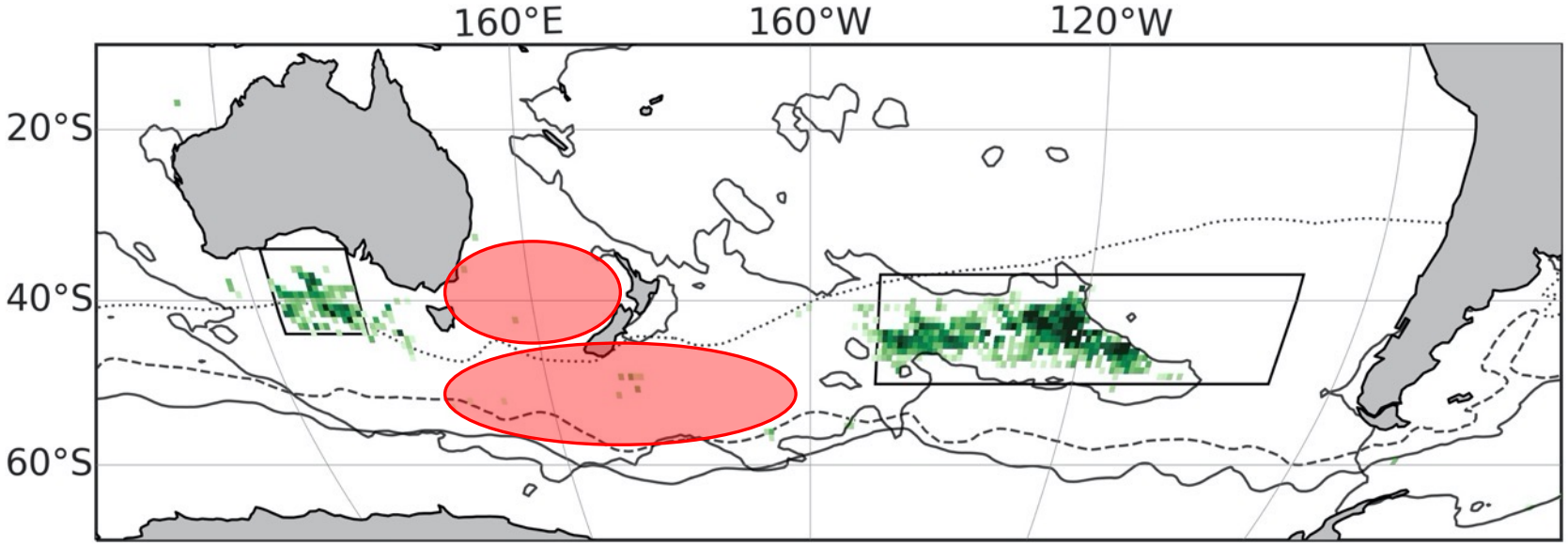


Deposition flux to delimit fertilisation hot-spots





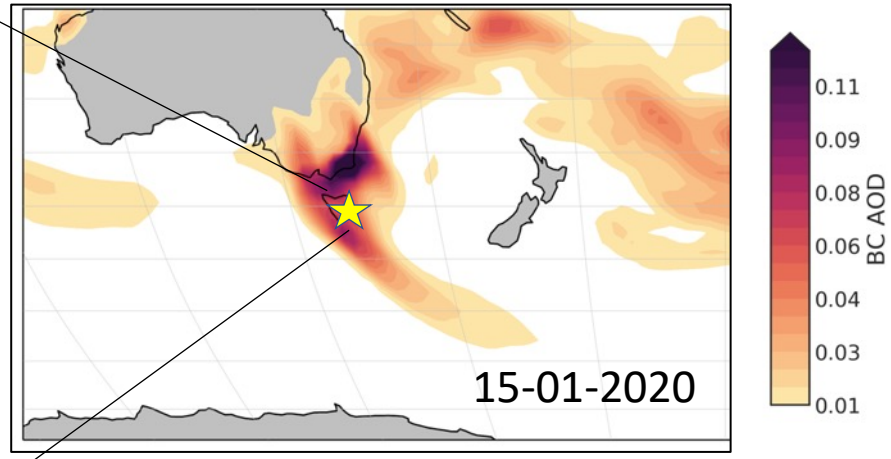
1. Spatial correlation ≠ Causation
2. Why high deposition does not always induce a Chl-a response?



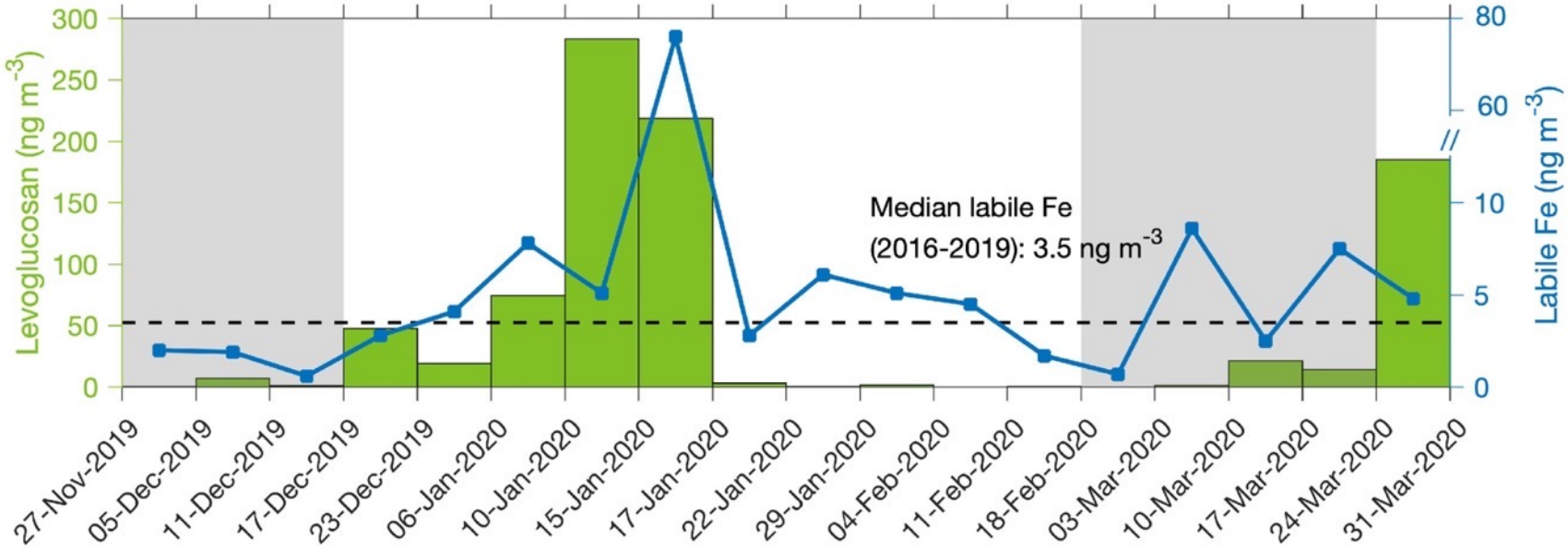
Iron and levoglucosan content in aerosols

High TFe and LFe in aerosols sampled when
a smoke plume from wildfires crossed the station.

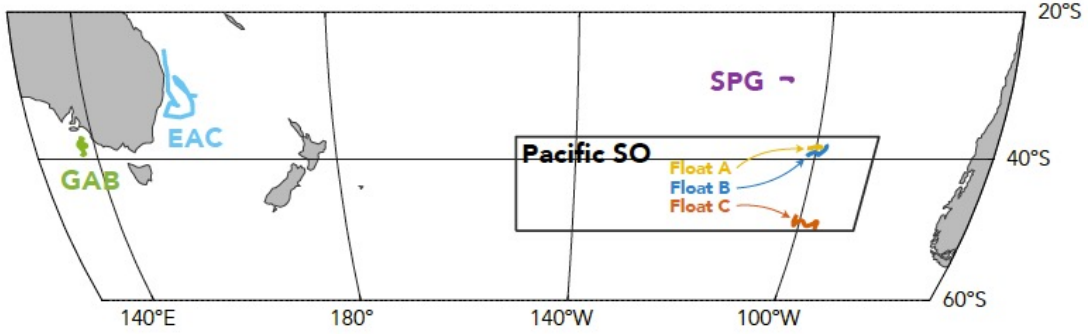
High concentrations of Levoglucosan too
(tracer for biomass burning origin)



M. Perron, A. Bowie (IMAS-UTAS)



Satellite data + *In-situ* data = causation



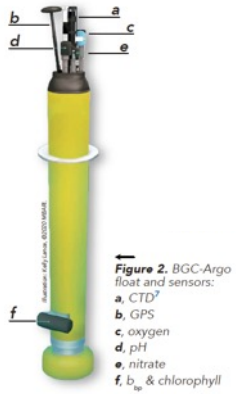
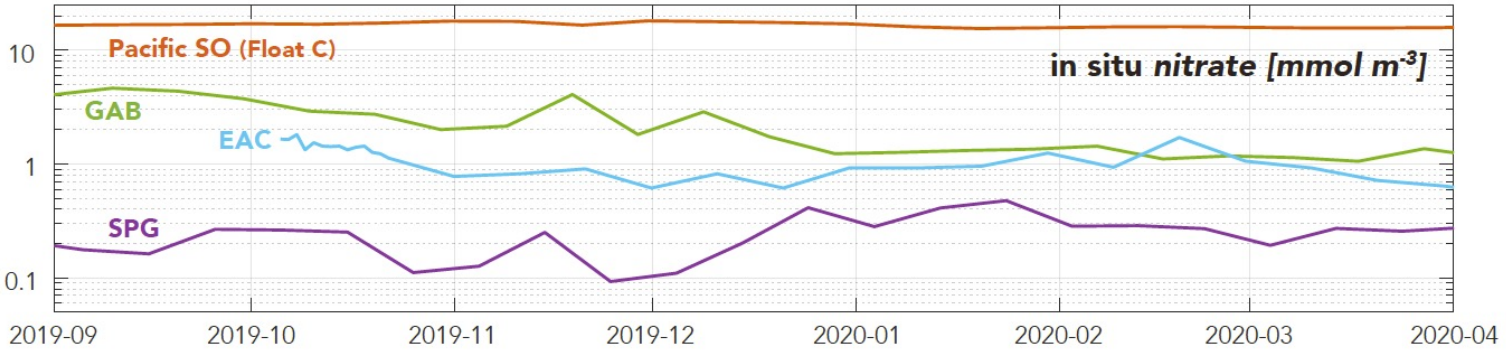


Figure 2. BGC-Argo float and sensors:
a, CTD
b, GPS
c, oxygen
d, pH
e, nitrate
f, b_{bp} & chlorophyll



Floats equipped with nitrate sensors showed HNLC conditions inside anomalies.

Jakob Weis
jakob.weis@utas.edu.au
@jakob_weis

UNIVERSITY of TASMANIA
IMAS
Institute for Marine and Antarctic Studies

OBP03 Ocean Biology/Biogeochemistry Posters (OB07)

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Time: 2:00 AM | **Date:** 3/4/2022 | **Room:** Room 16

Lead Organizer: Andrea Fassbender, (andrea.j.fassbender@noaa.gov)

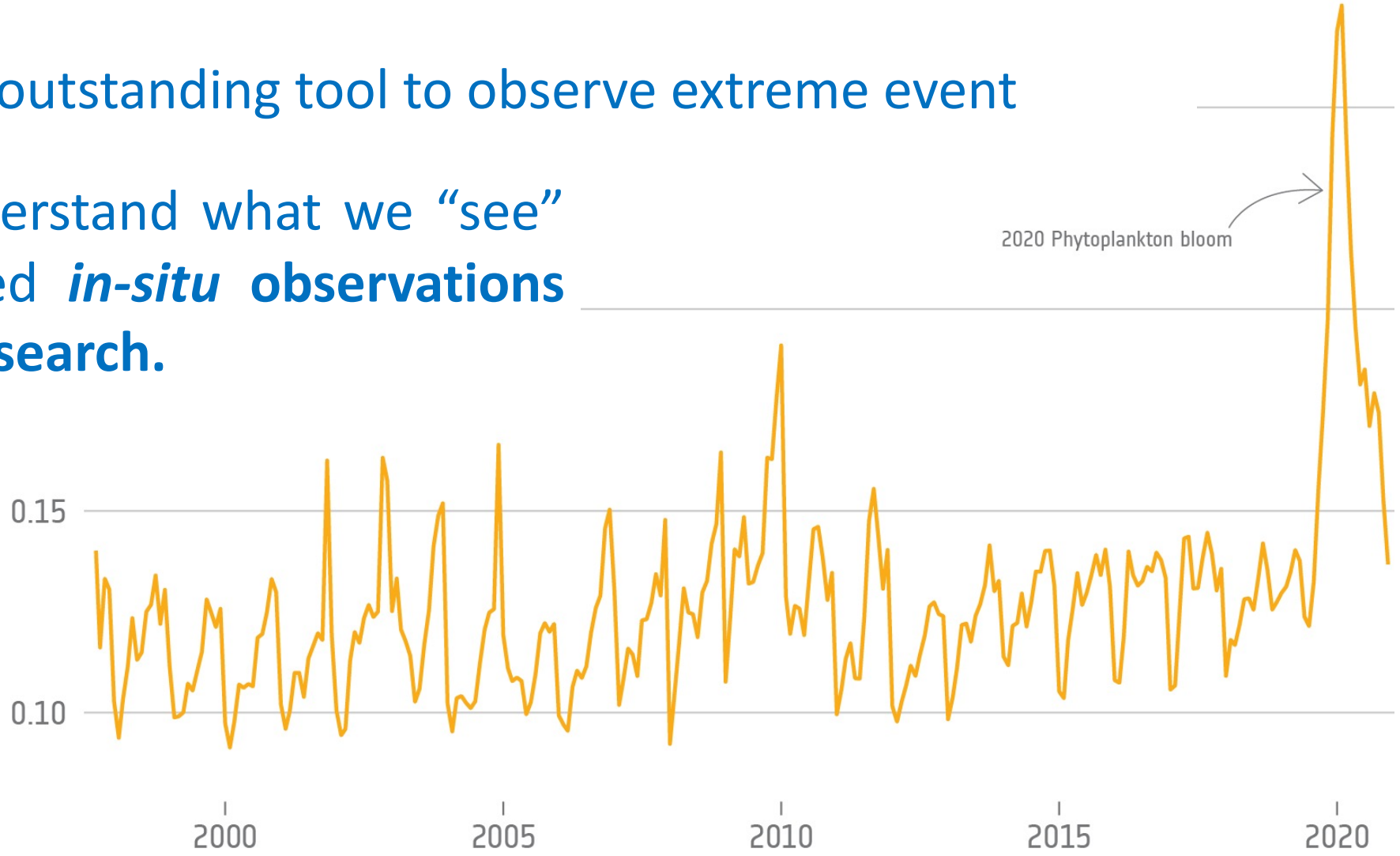
Posters for oral session OB07 Research Opportunities from a Global Biogeochemical Argo Fleet

OCEAN SCIENCES MEETING | 24 FEBRUARY – 4 MARCH 2022 ONLINE EVERYWHERE

Preparing the unprecedented

Satellite data are an outstanding tool to observe extreme event

Yet, in order to understand what we “see” from space we need ***in-situ*** **observations and fundamental research.**



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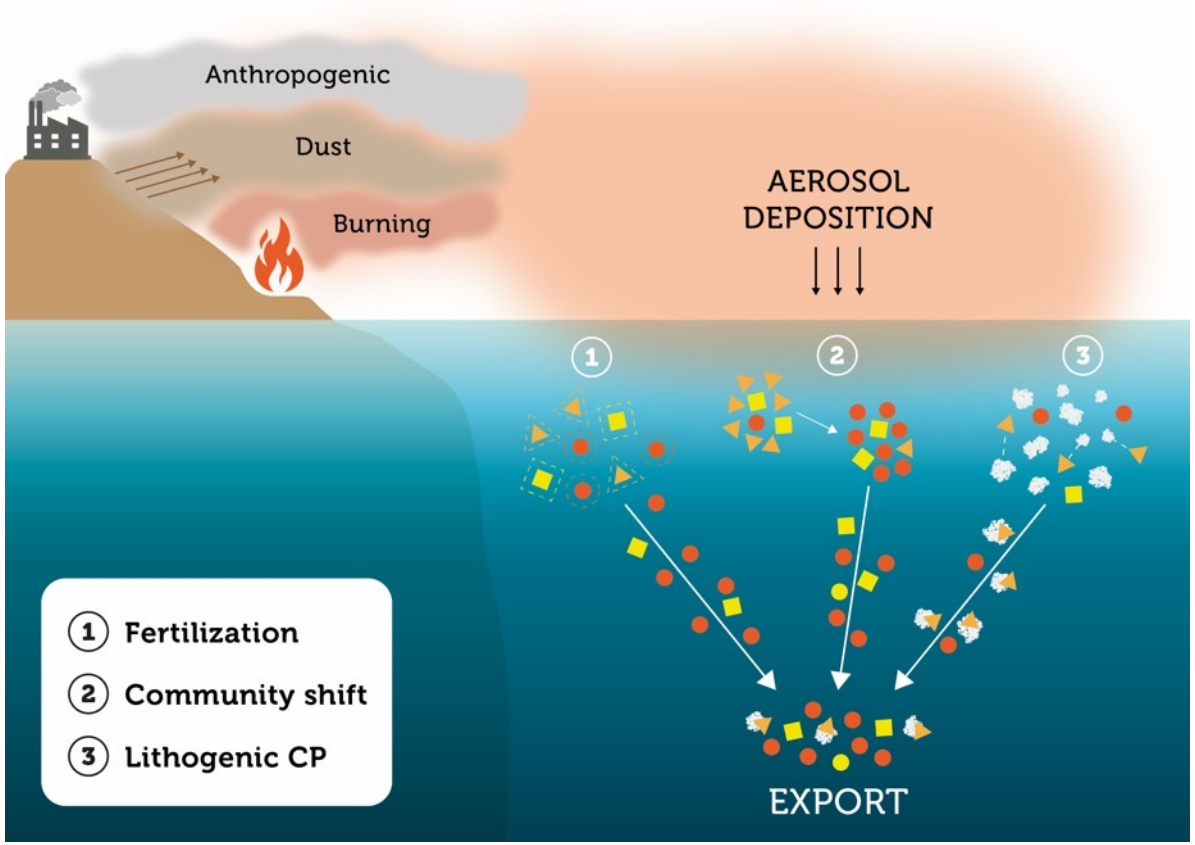
Priorities on the aerosols-oceanBGC link

1 to 5 years from now

Observing the full impact of aerosols on the BCP

- Remote estimates of phytoplankton community composition, physiology, DOC, DIC and PIC
- Remote estimates of the ecosystem's metabolic state



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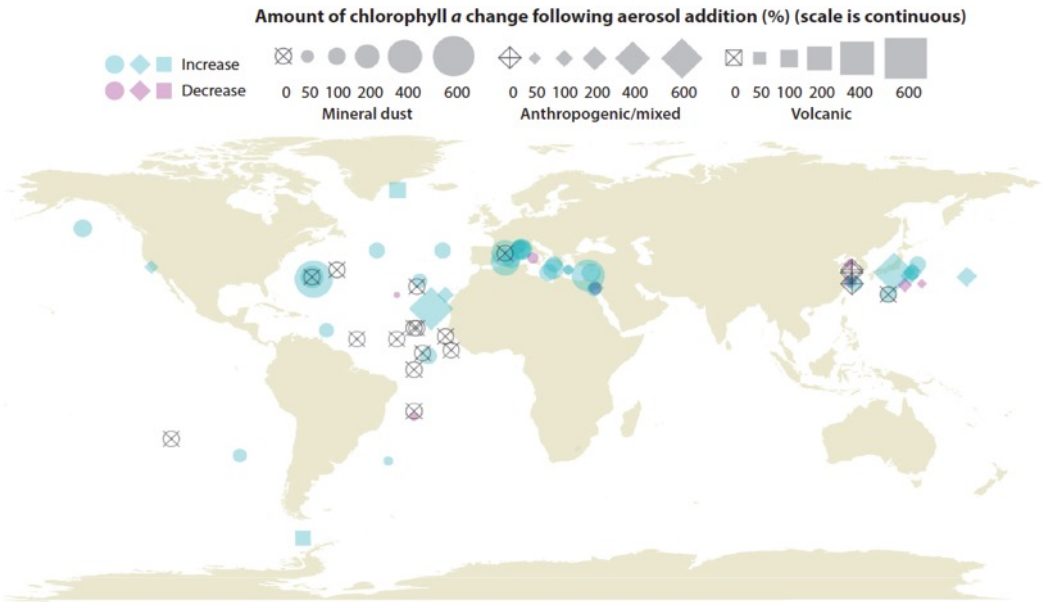

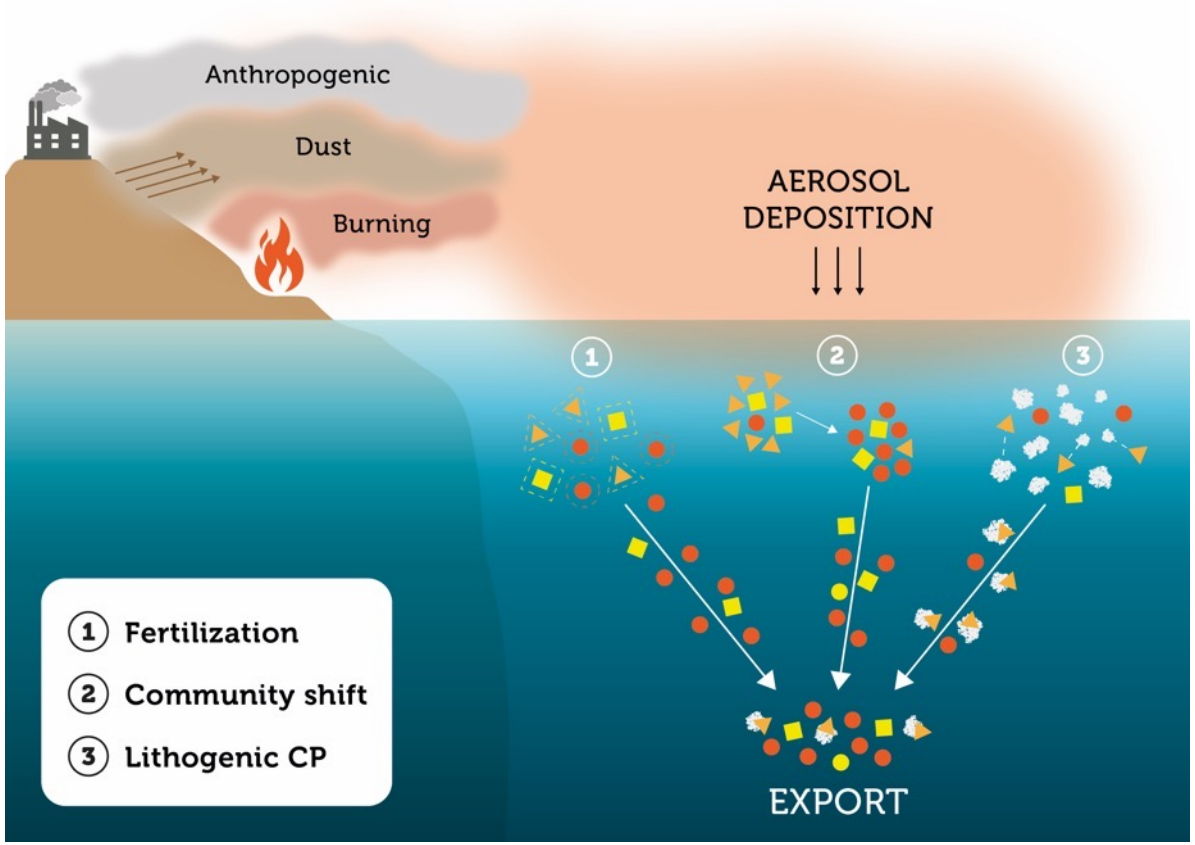

Hamilton et al, 2022

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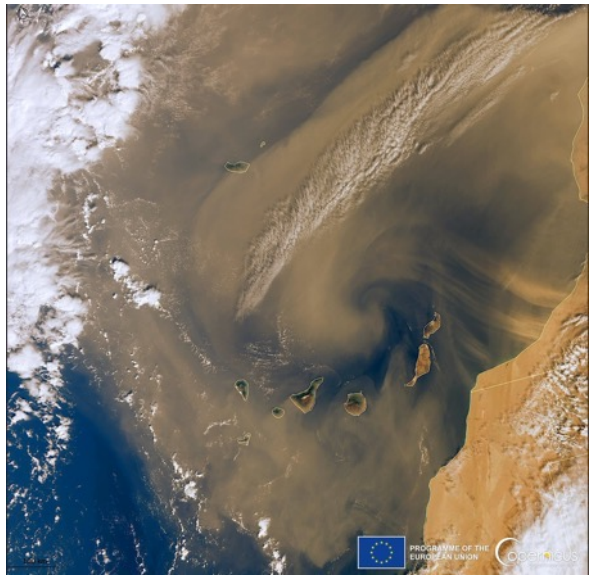
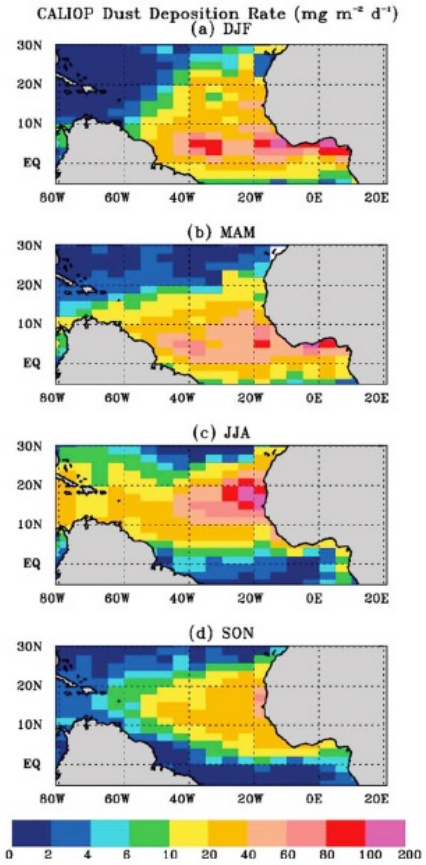
5 to 10 years



DOMOS: DUST-OCEAN MODELLING & OBSERVING STUDY



Yu et al, 2019

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Priorities on the aerosols-oceanBGC link

1 to 5 years from now

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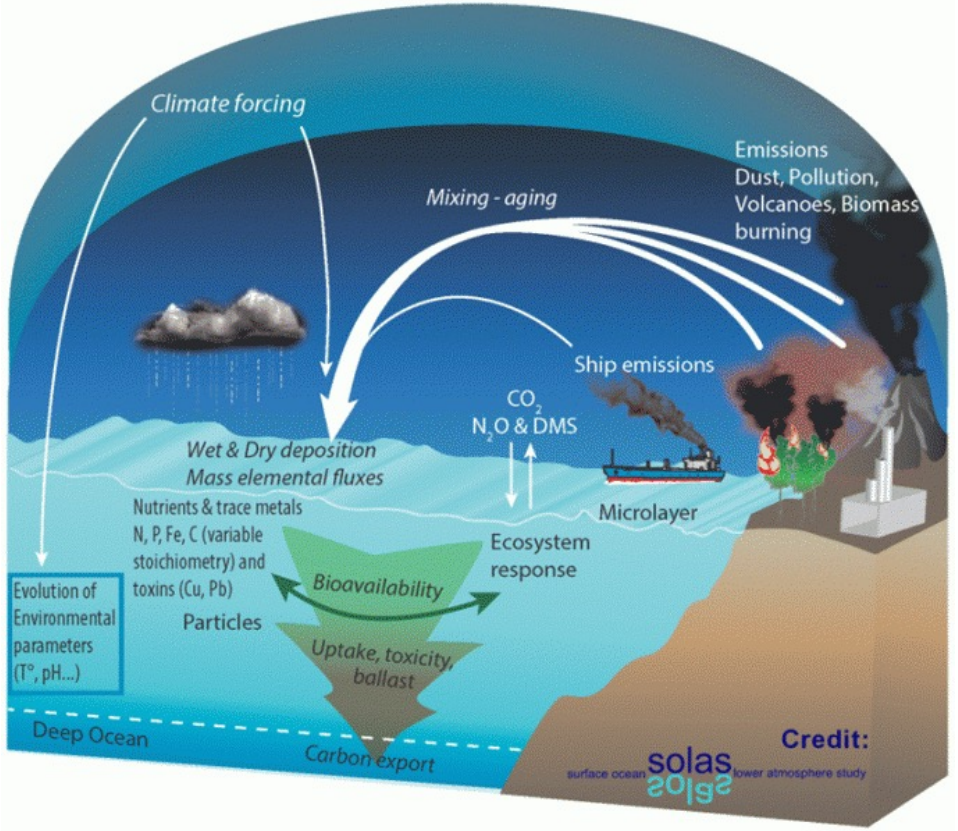
5 to 10 years

Capturing the complete story

- Characterizing aerosols at source
- Monitoring atmospheric chemical processes
- Real-time deposition over the ocean
- Autonomous platforms to capture export mechanisms



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Thank you

Australian Government
Australian Research Council

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European Commission
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