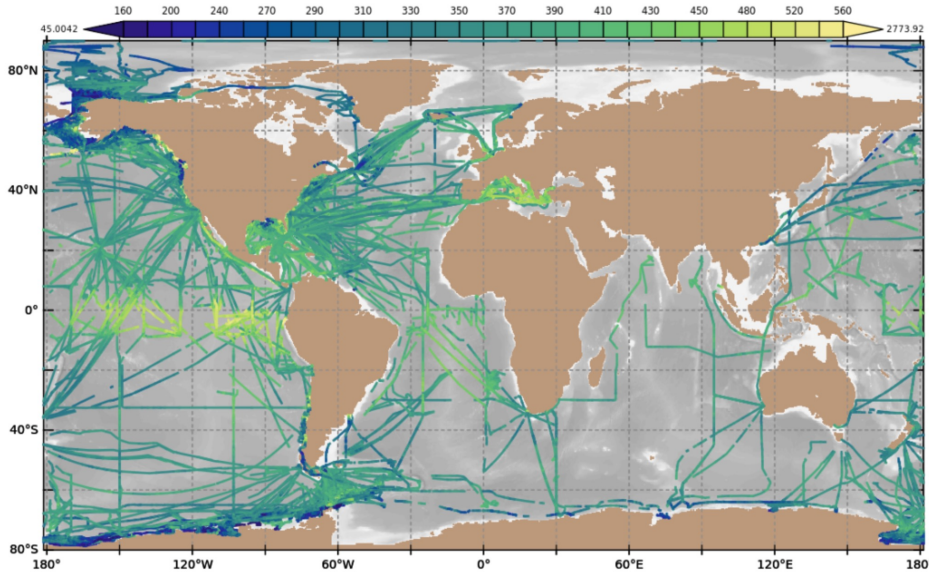


Largest Network of Surface pCO₂ data in the world.

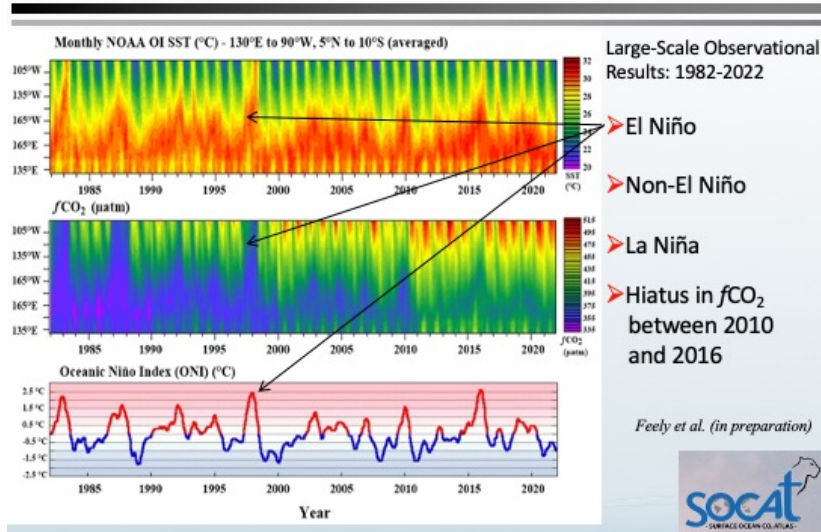
FY 2022
HIGHLIGHTS



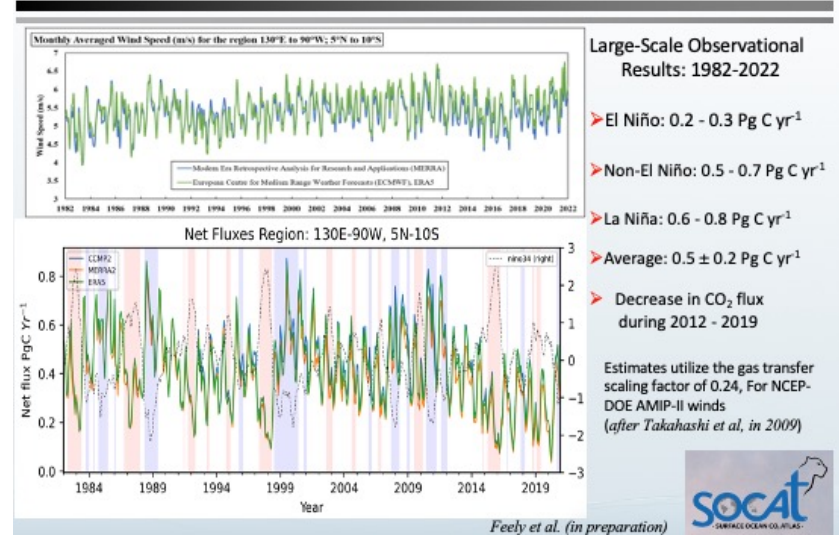
- ~ 8.5 M data points since 2005. Represents 1/4 of world wide data.
- 2020, 2021 and 2022 had a 40% data loss compared to previous years
- Contributes to the GCB-2022 estimate of the still increasing Ocean sink of 2.9 +/- 0.4 GtC/year.

Equatorial time-series of $f\text{CO}_2$ observations reveals relationship between CO_2 flux and ENSO cycle.

Time vs Latitude plot of SST and $f\text{CO}_2$ in the Equatorial Pacific



Time vs Latitude plots of Wind Speed and CO_2 flux in the Equatorial Pacific

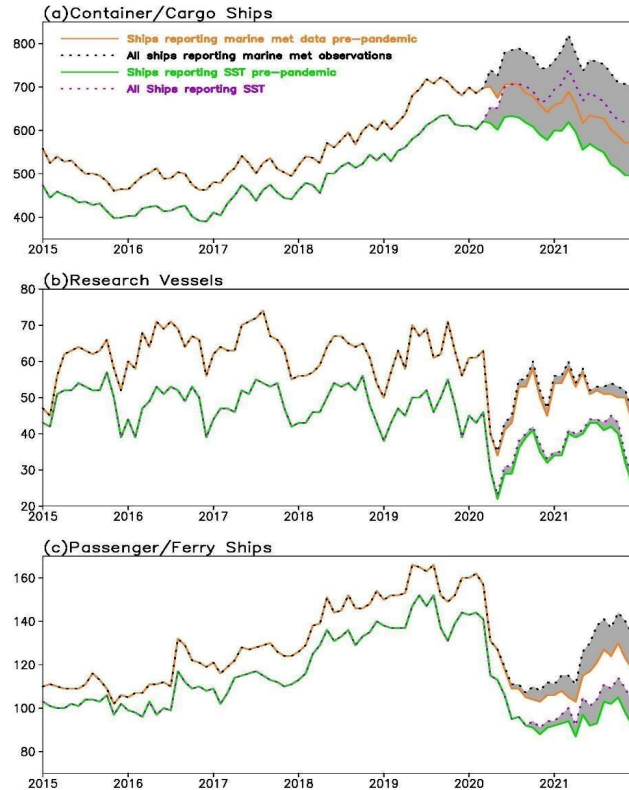


The eastern and central equatorial Pacific are:

- large sources of CO_2 to the atmosphere during non-El Niño and La Niña events (strong trade winds, cold tropical SSTs, and enhanced upwelling)
- near neutral during strong El Niño events (warming of SST, large-scale weakening of the trade winds, decrease in upwelling)
- weak sources during weak El Niño events.

Effect of the Pandemic

FY 2022 HIGHLIGHTS

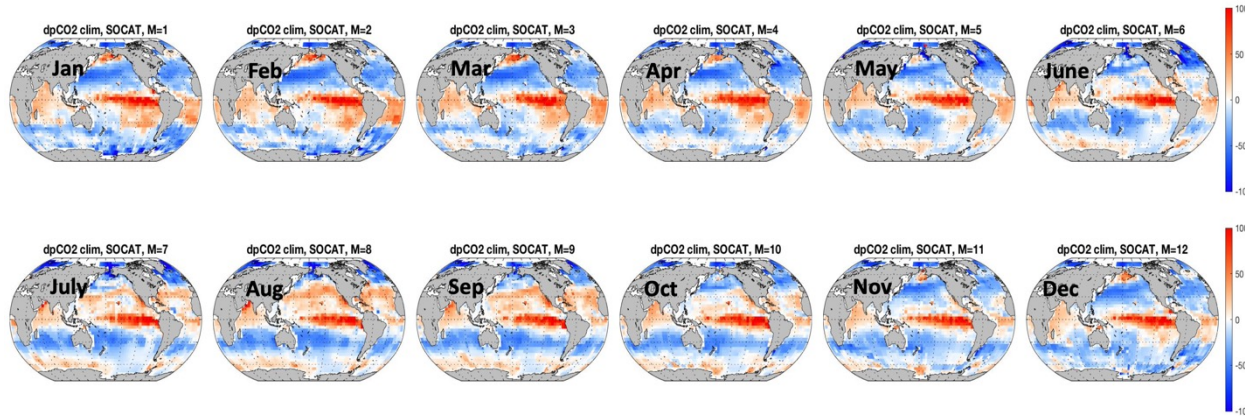


- 2020, 2021 and 2022 had a 40% data loss compared to previous years
- Similar to VOS ships reporting met data (left figure), passenger and cargo ships responsible for most of SOOP-CO2 data loss
- Passenger ships stopped sailing whereas cargo ships restricted access

Number of ships with independent WMO call sign numbers since 2015 in the ICOADS R3.0.2 near real-time collection.
(Shaded Area = loss of capacity during pandemic
Figure 2 in Boyer et al. (2023) accepted in BAMS

Updated “Takahashi” Climatology

FY 2022 HIGHLIGHTS

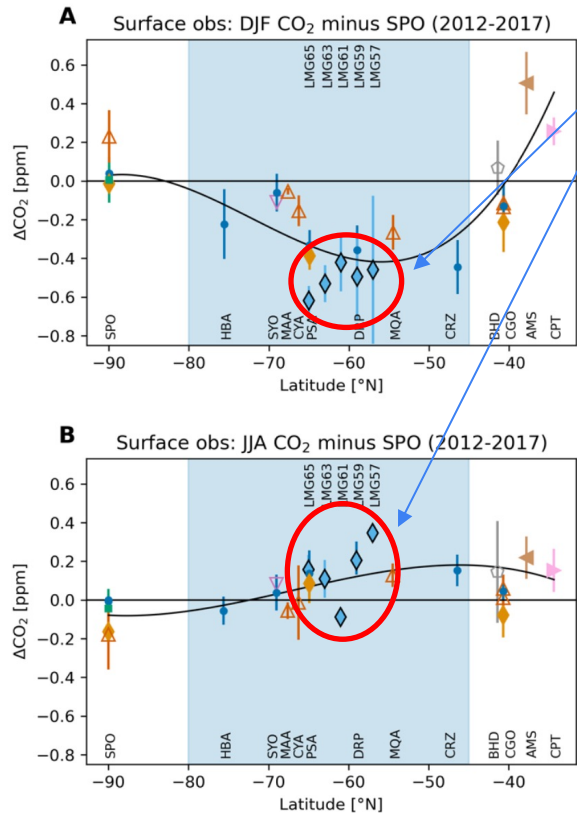


Updated climatological maps of $\Delta p\text{CO}_2$ created using the Takahashi approach (Takahashi et al., 2009) and the SOCAT version 2022 database including the more than 8.5 million observations collected by the SOOP $p\text{CO}_2$ from ships program. (Fay et al. in preparation)

- Constructed using both the LDEOv2019 and SOCATv2022 databases
- Has several times the number of observations used to create the last climatology (Takahashi et al. 2009)
- constructed using $\Delta p\text{CO}_2$ ($p\text{CO}_2\text{oce} - p\text{CO}_2\text{atm}$) rather than $p\text{CO}_2\text{oce}$, avoiding the time normalization procedure used in Takahashi et al. (2009)

Atmospheric measurements from ships used in atmospheric studies

FY 2022
HIGHLIGHTS



- Measurements from ships quality comparable to Surface Monitoring Stations and Aircraft Campaigns.
- Ship measurements from the *ARSV Laurence M. Gould*, funded by GOMO.
- Ship-based measurements extend back to 2005 and are utilized due to extensive temporal coverage.
- This analysis estimates a net uptake of CO₂ south of 45°S. Consistent with ship-based estimates but stronger than recent estimates based on profiling-float observations.

From Long, M., et al. (2021), Strong Southern Ocean Carbon Uptake Evident in Airborne Observations, *Science*.