Fluctuations in deep-ocean heat content and steric sea level observed from Deep Argo floats

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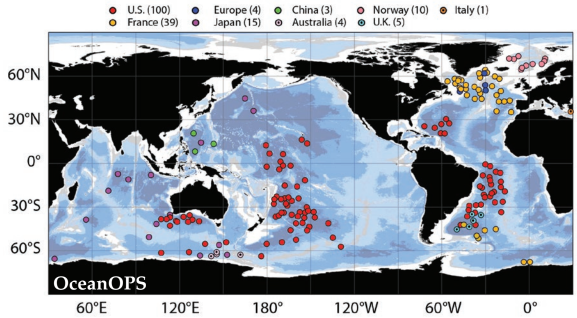
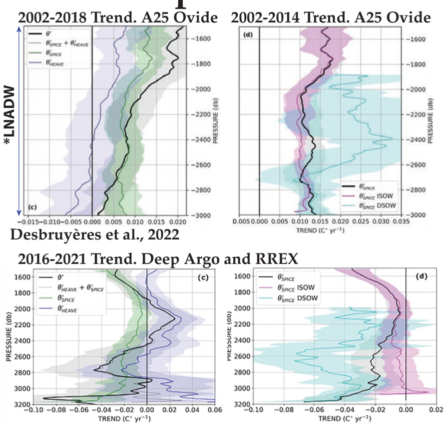
Deep Argo array



- 181 Deep Argo floats are currently active
- Deep Argo data are publicly available in near-real time within 24 hours, and highest quality delayed mode 12 months after observation
- A global 1200-float Deep Argo array can provide 5° latitude x 5° longitude x 10-day full-depth ocean sampling, and significantly improve assessment and predictions of ocean heat content and sea level change

Warming-to-cooling reversal of LNADW in the subpolar North Atlantic Basin

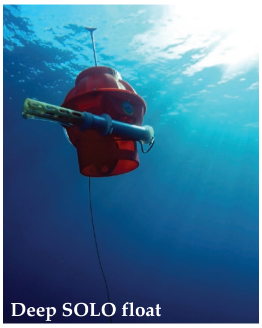


*Lower North Atlantic Deep Water (LNADW)

- LNADW in the Irminger Sea has significantly warmed between 2002-2018
- LNADW trends
$\theta' = 0.010 \pm 0.004$ °C yr^{-1}
$\theta_{SPICE} = 0.008 \pm 0.003$ °C yr^{-1}

- LNADW cooling between 2016-2021 interrupted the warming phase
- LNADW trends
$\theta' = -0.017 \pm 0.019$ °C yr^{-1}
$\theta_{SPICE} = -0.016 \pm 0.006$ °C yr^{-1}
- Deep Argo results are consistent with OSNAP mooring data

Float and sensor performances

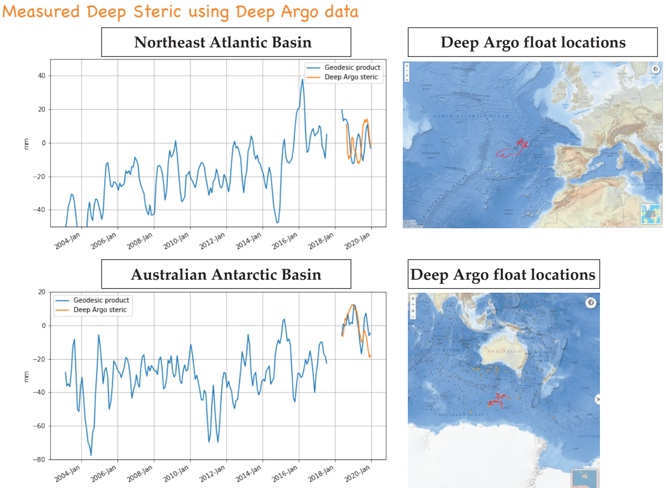


- Averaged float lifetime > 4 years
- Deep Argo floats can profile pressure, temperature and salinity to 4000-m or 6000-m depth depending on the float model
- Ability to detect the bottom and to measure under the ice
- Capability to park near the bottom to minimize drift outside of deployment regions
- Improved SeaBird Scientific CTD shows 0.001°C, 0.003-0.004 PSS-78, ±1.25 dbar TSP accuracies, similar to repeat hydrography
- Additional Deep Argo float and CTD models are under development
- Some Deep Argo floats are equipped with dissolved oxygen sensors

Sea level budget using Deep Argo

Estimated Deep Steric = Sea Level – Upper Steric – Ocean Mass

Measured Deep Steric using Deep Argo data

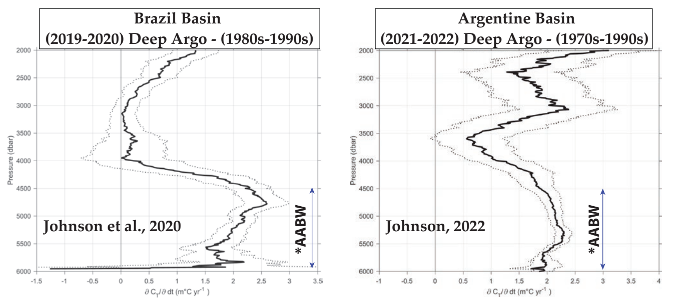


Consistency between deep steric estimates from independent datasets shows

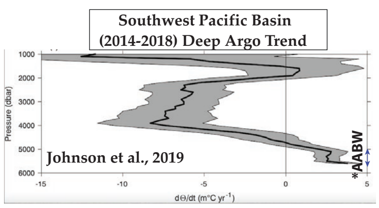
(1) Capability to significantly reduce errors in the sea level budget by increasing deep-ocean sampling

(2) Deep Argo's ability to resolve deep-ocean thermosteric and halosteric variability

Warming of AABW in the Southwest Pacific and Southwest Atlantic Basins



- AABW warming is 2.1±0.4 m°C yr^{-1} in the Brazil Basin and 2.1±0.2 m°C yr^{-1} in the Argentine Basin, similar to estimates from the 1980-2010s



- AABW warming in the Southwest Pacific Basin is 3±1 m°C yr^{-1} and may have accelerated since the 1990s

- Deep-ocean warming trends are quantified with more certainty using Deep Argo profiles than repeat hydrography sections due to increased sampling

*Antarctic Bottom Water (AABW)

References

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