Seismic ocean thermometry using CTBTO hydrophone data

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Ocean thermometry

- Argo floats have drastically improved the sampling
- They still suffer from the aliasing effects and have no data below 2000 m

Ocean absorbs more than 90% of the excess energy
Measuring the ocean temperature acoustically

Sound travels faster in warmer ocean.

\[
\frac{\partial \alpha}{\partial T} \approx 5 \text{ m s}^{-1} \text{K}^{-1}
\]

Disclaimer: The views expressed on this presentation are those of the author and do not necessarily reflect the view of the CTBTO.
Replacing active sources with earthquakes

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Protecting whales from the noise people make in the ocean
Dr Jessopp was recently involved in a research project to study the effects of marine seismic surveys on animals such as whales and dolphins.
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Application to Eastern Indian Ocean

Wu et al. (2020)

Trend: $0.044 \pm 0.002$ K decade$^{-1}$  $0.026 \pm 0.001$ K decade$^{-1}$  $0.039 \pm 0.001$ K decade$^{-1}$
Higher Signal-to-Noise Ratios (SNR) of CTBTO hydrophone data

The CTBTO hydrophones show higher SNRs and record much more T-wave data from small earthquakes than DGAR.
Consistent results between DGAR and H08S2
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But much more data from H08S2

2648 earthquakes from H08S2
1060 earthquakes from DGAR

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6-month periodicity

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~10 days variations

![Graph showing travel time anomaly (s) vs. temperature anomaly (K) with data from DGAR and H08S2 from 2005-03-20 to 2005-04-29.]
Conclusions

- We confirm that hydrophones usually have better performance of recording T waves than T-phase stations, in terms of SNR.
- H08S2 and DGAR show consistent SOT results.
- Hydrophone system is a key component of global application of SOT.