



Annual Modulation of Diurnal Winds in the Tropical Oceans

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Goal and Motivation

- Characterizing diurnal winds and how they change in different months of the year
 - for a better understanding of diurnal variations in mixed-layer depth
 - to cross-calibrate wind-measuring satellites that have different equator crossing times in order to create climate records
- Framework to assess how satellite-like sampling scenarios (i.e., observations with limited temporal coverage) capture the diurnal signal

Data and methods

• Mooring data (in red in the map)



- Methods:
 - based on diurnal composites (CM)
 - based on harmonic analysis via a least squares fit (LSF), able to isolate annual (i.e., 1 cycle per year) modulation of diurnal variability

Diurnal winds in the tropical ocean are not uniform in time

Example for meridional wind:



Diurnal winds in the tropical ocean are not uniform in time



Diurnal winds in the tropical ocean are not uniform in time



Framework to assess how satellite-like sampling scenarios capture diurnal signal

e.g. 18 sampling scenarios for (red) 10-, (green) 5-, (blue) 3-year long timeseries



e.g. Hourly sampling for case #1, #7, #13

Harmonic analysis via a least squares fit vs Composite analysis



LSF provides a better estimate of the month when the diurnal peak is maximum

Summary

- Diurnal winds in the tropical ocean are not uniform in time
- To estimate the annual modulation of the diurnal signal
 - Recommendation for sampling at least 6 times per day and for a duration of at least 3 years
 - Harmonic analysis via a least squares fit may provide a better estimate than composites

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