Air-sea Interaction Regional Initiative in the Northern Indian Ocean

Ocean Monsoons and Mixing

Summer Monsoon winds

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earth.nullschool.net
More than half the world’s population in this region

...highest (per capita) impact of air-sea processes and largest human susceptibility to climate change
Motivation: Monsoon Prediction

Global models have biases — various aspects of the Monsoon:
• Oceanic Mixed layers not well represented (deep cold bias)
• Sub-seasonal variability is important, but not captured by models.

Air-sea fluxes of heat and moisture?
• Sea surface temperature, MLD?
• Ocean boundary layer processes not well understood
Bob Weller, Tom Farrar, Debasis Sengupta, M. Ravichandran, R. Venkatesan

- WHOI Mooring at 18N
- 2015 Upper ocean structure - A-S flux estimates
- 2016 Eddy co-variance flux measurements
Mesoscale circulation
N-S salinity gradient

Strong stratification

Multiple layers
Stratification (T-s structure) affects air-sea interactions

Model: Tommy Jensen, NRL
Density stratification due to
Top: Salinity
Lower: Temperature

Observations: ASIRI cruise 2013
Shroyer et al. 2015
Ph.D. thesis G.V. Spiro-Jaeger
Difficult to extract heat from freshwater stratified ocean

-150 W/m² cooling: 18-days from a process study ocean model

Modeling: Spiro-Jaeger, Ph.D. thesis
Process Study Ocean Model
Mixed layer instability of a freshwater front responding to wind-driven Ekman transport
(Mahadevan et al.)
Air-sea fluxes of heat /moisture depend on the upper ocean vertical structure

- Shallow layers, strong stratification, freshwater
- Dispersal of surface freshwater - generation of stratification, fronts play a role, wind direction matters
- Mixing (or the lack of it)

What are the processes that set the upper ocean structure?