Climate modulates internal wave activity on Dongsha Atoll, northern South China Sea

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The northern South China Sea is home to the world’s largest internal waves.
Various scales of internal wave (IW) studies

- Individual IWs, their dynamics, generation processes
- Weeks- to months-long records of IW frequency, variability
- Multi-year IW climatologies, and their relation to ocean conditions
- Projections of future IW activity

Space

Time

Instrument moorings & meter-scale models

Data assimilation & >kilometer-scale models
Various scales of internal wave (IW) studies

- Individual IWs, their dynamics, generation processes
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This talk focuses on:

- Instrument moorings & meter-scale models
- Data assimilation & >kilometer-scale models
Internal waves collide with Dongsha Atoll

A typhoon in the Luzon Strait “turned off” the internal waves

Snapshots of Luzon Strait stratification via ARGO floats

3739 Floats
5–Sep–2016
Snapshots of Luzon Strait stratification via ARGO floats

Luzon Strait temperature:

Luzon Strait stratification:
Snapshots of Luzon Strait stratification via ARGO floats

Dongsha fore reef:

July 2014

ARGO

Period (hr)

06/15 06/22 06/29 07/06 07/13 07/20 07/27

0 24

0 12

0 4

0 1

℃

20 25 30

06/15 06/22 06/29 07/06 07/13 07/20 07/27

July 2015

ARGO

Period (hr)

06/15 06/22 06/29 07/06 07/13 07/20 07/27

0 24

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Dongsha internal wave climatology shows seasonal variability coherent with Luzon Strait stratification.
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Stratification from SODA (Simple Ocean Data Assimilation):

**Dongsha temperature:**
- Fore reef
- Fore reef daily mean
- Regional SST

**Luzon Strait stratification:**
- Temperature (°C)
- Salinity
- N (s⁻¹)
Luzon Strait stratification increased over historical period

DeCarlo et al. (2015) using data from Simple Ocean Data Assimilation (SODA)
Climate models project increasing stratification in the Luzon Strait over the 21st century.

DeCarlo et al. (2015) in Geophysical Research Letters
Climate models project increasing stratification: increasing internal wave activity?

Multi-model ensemble:

By year 2300:

- Increased amplitude?
- Seasonal expansion?
Conclusions

- Water-column stratification in the Luzon Strait influences internal wave activity on Dongsha Atoll
- Simple Ocean Data Assimilation (SODA) shows Luzon Strait stratification has increased since 1900
- CMIP5 models capture historical stratification trend, and project this trend will continue