



EGU 2020

Internal Wave Energetics modulated by Indonesian Throughflow at Lombok Strait

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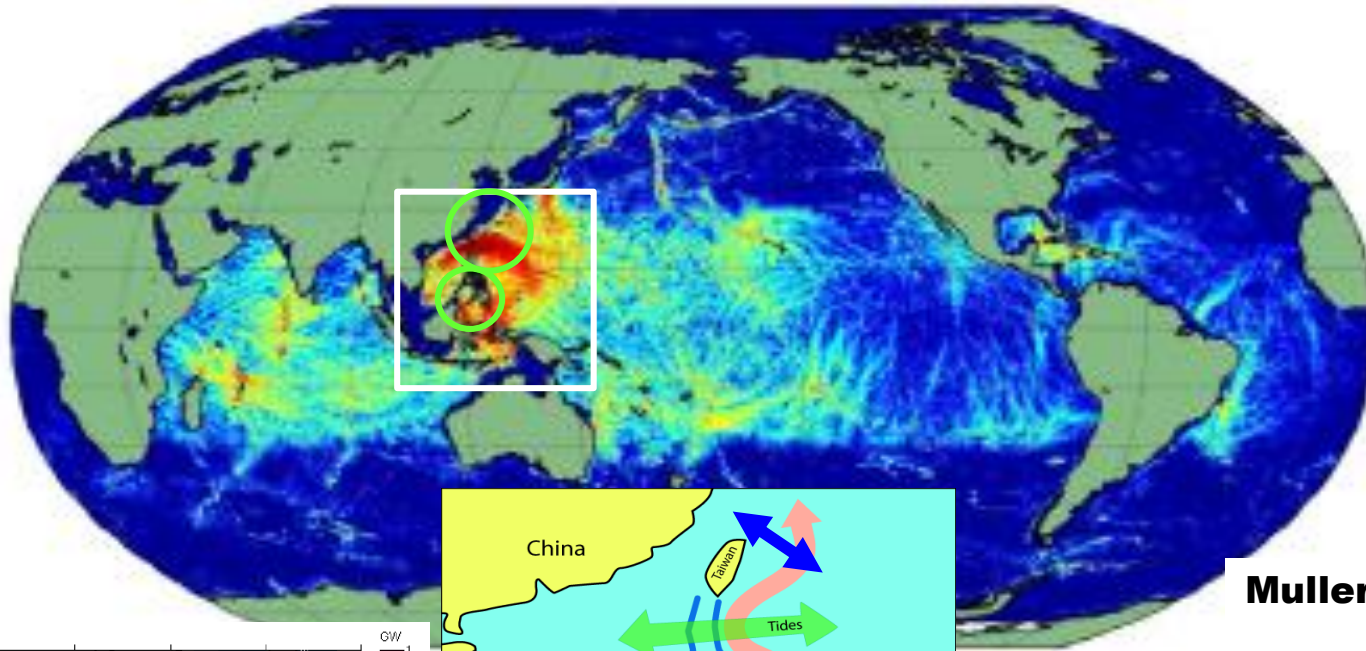
中国科学院海洋研究所

INSTITUTE OF OCEANOLOGY, CHINESE ACADEMY OF SCIENCES

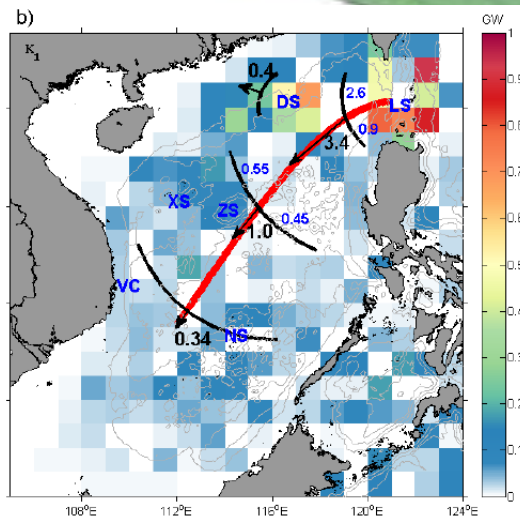


Energetic Internal Tides in Northwestern Pacific

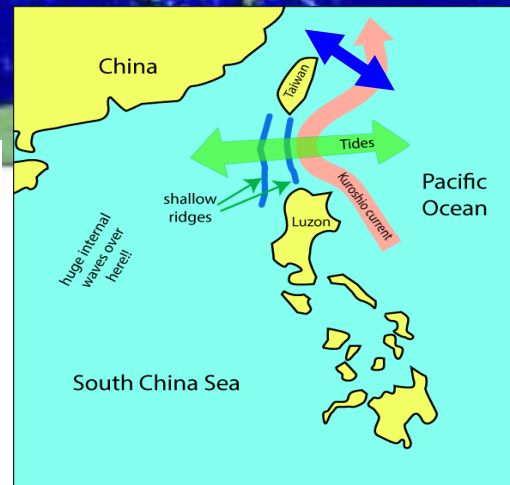
Internal tide and multi-scale circulation interactions



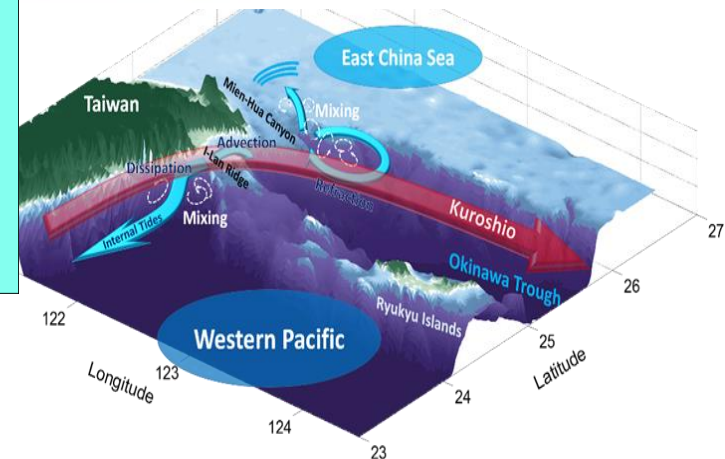
Muller, *OM*, 2013



Xu et al., *JGR*, 2016



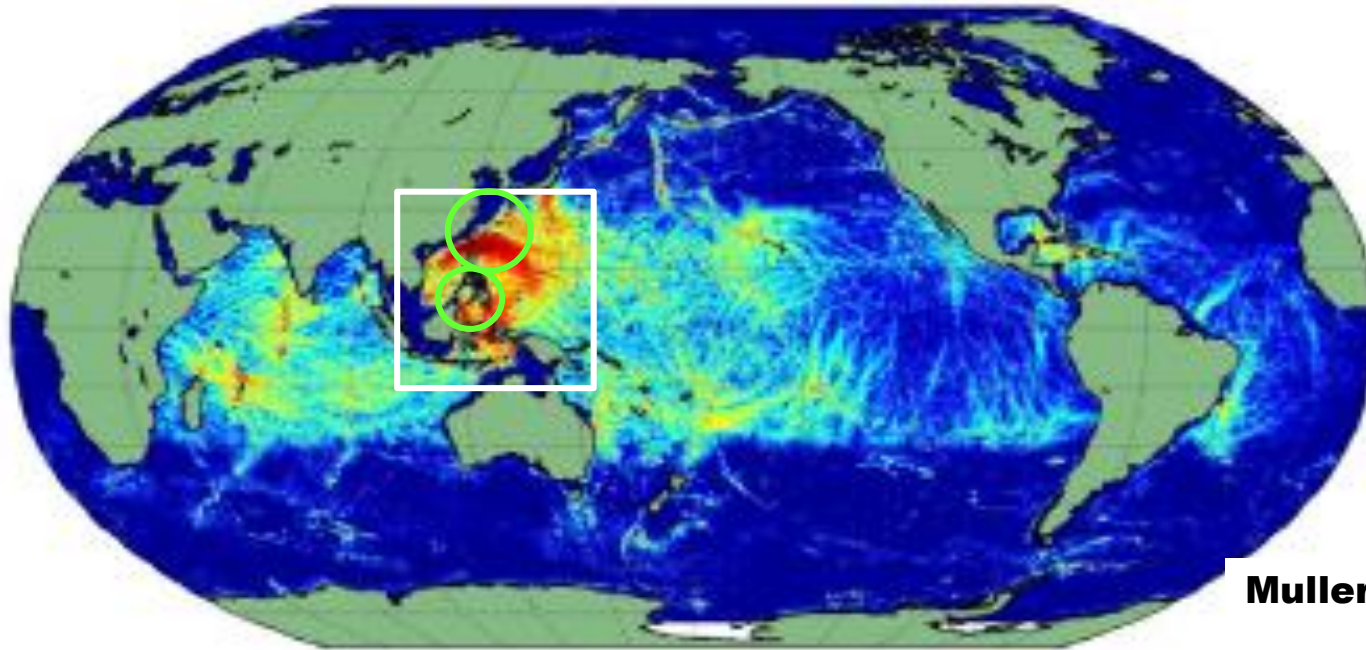
Internal tide energetics
Kuroshio modulation



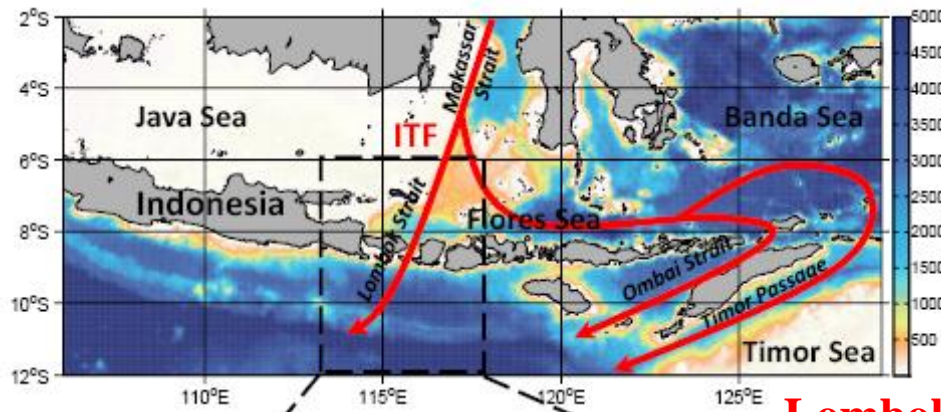
Chang et al., *JGR*, 2019

Energetic Internal Tides in Northwestern Pacific

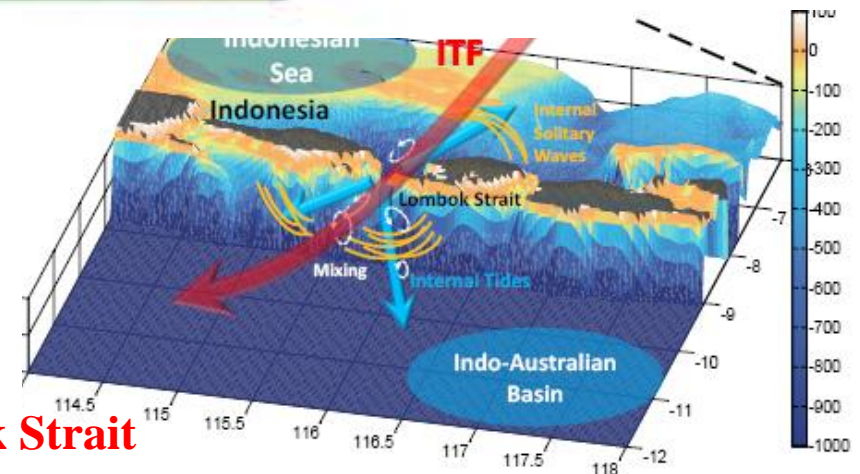
Internal tide and multi-scale circulation interactions



Muller, *OM*, 2013



Lombok Strait

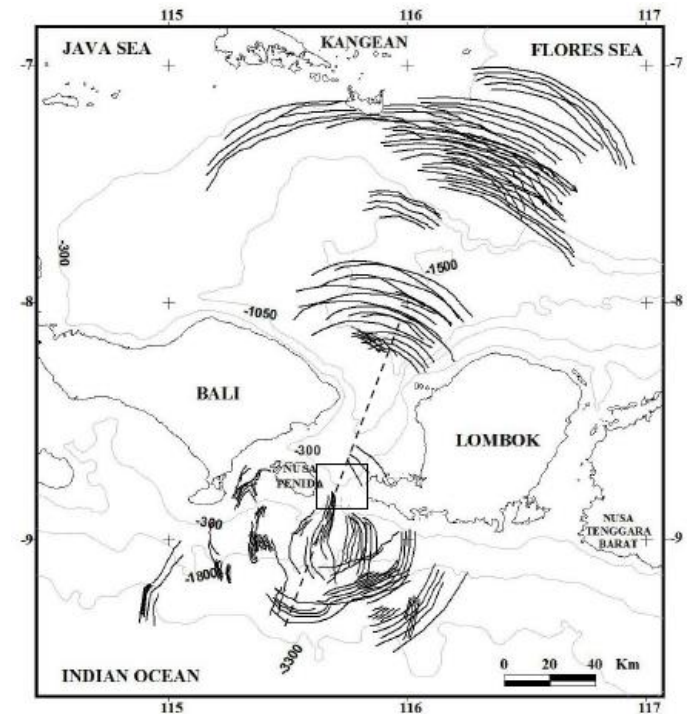
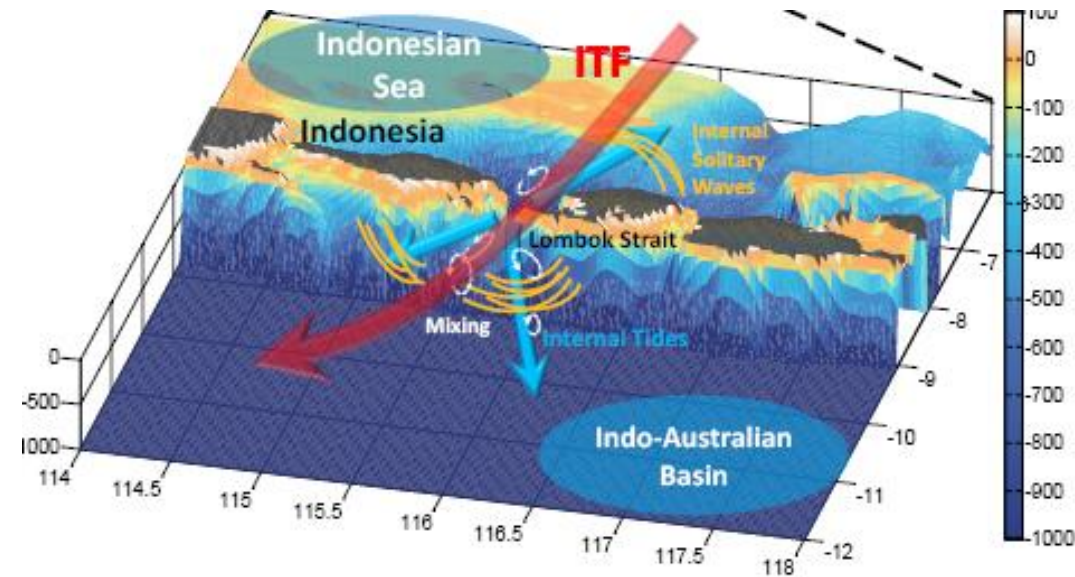


Internal tide/wave energetics and interaction with Indonesian Throughflow (ITF)

Energetic Internal Tide and Internal Solitary Wave at Lombok Strait

North-south asymmetry ISWs: north slope consistent and eastward refraction

south slope multi-direction and smaller scale



ISWs originated from ITs? How about the role of Lombok ITF?

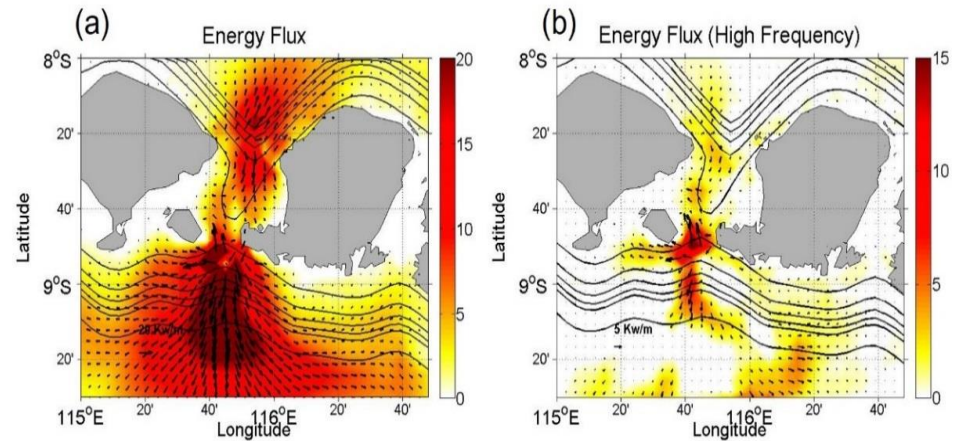
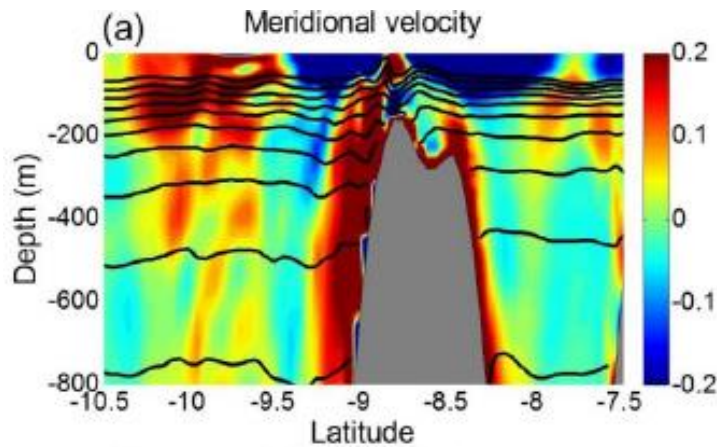


Three-dimensional ROMs Simulation at the Lombok Strait

CTRL Case: include both tidal forcing and ITF

TIDAL Case: include only tidal forcing but not circulation

CTRL Case results



Strong tide-topography generate **internal Lee wave and internal tide**

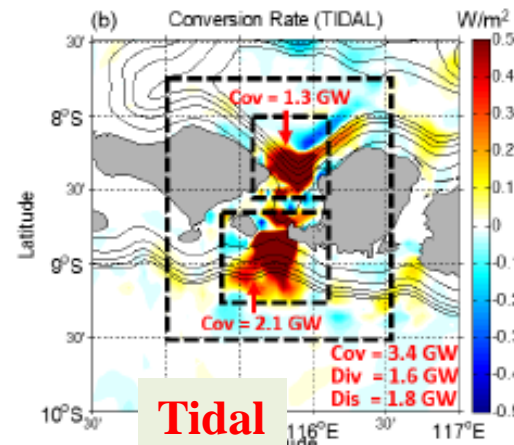
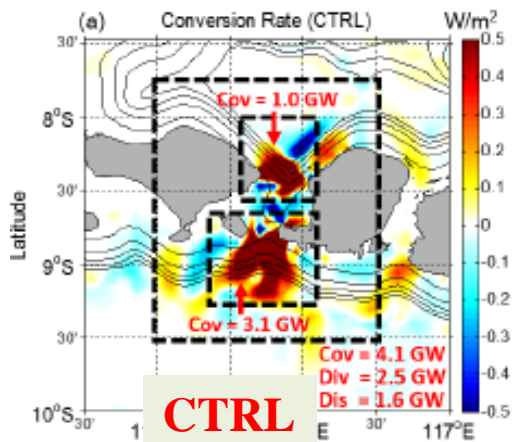
Lee wave mainly near the ridge, **while internal tide radiate outward**



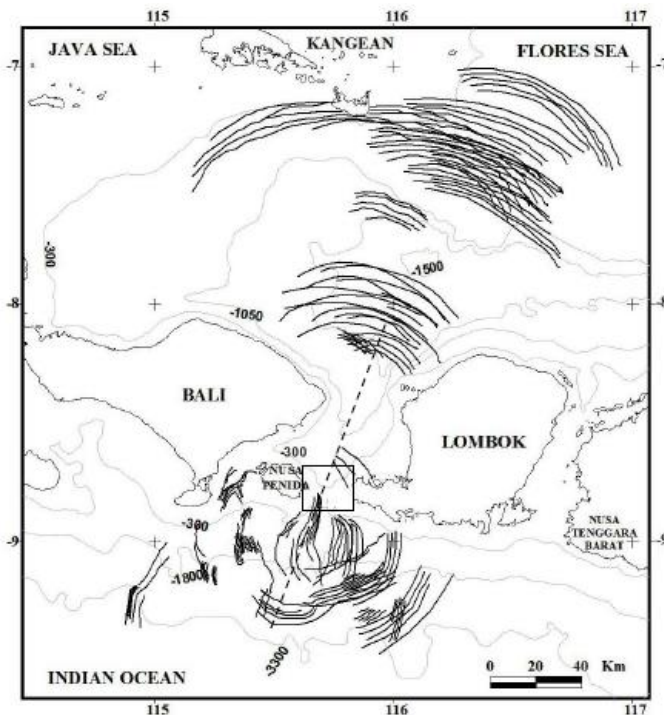
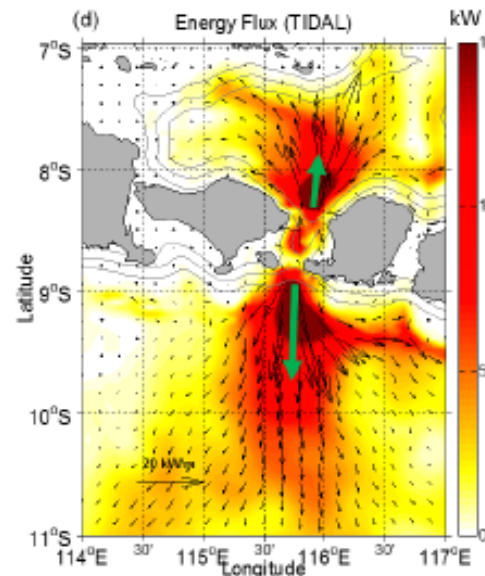
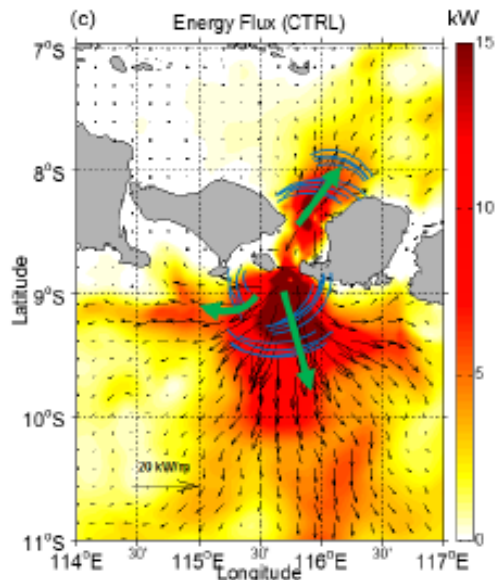
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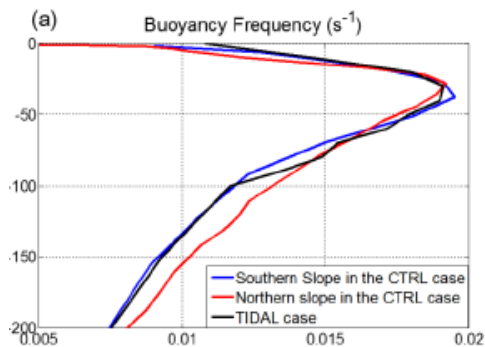
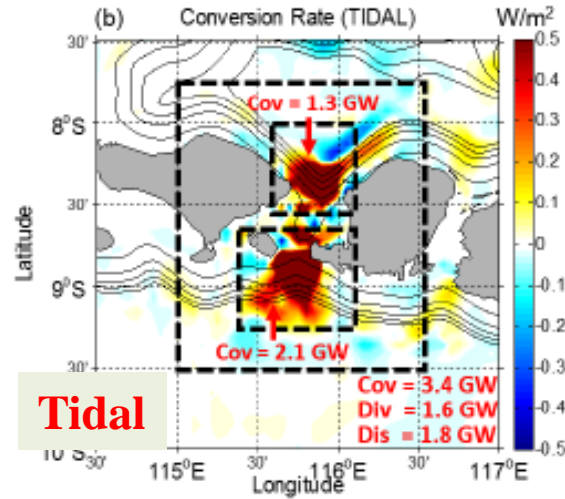
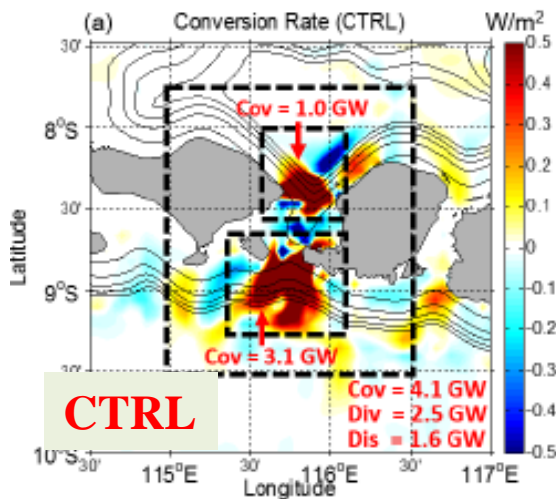
ITF refract northeastward beams



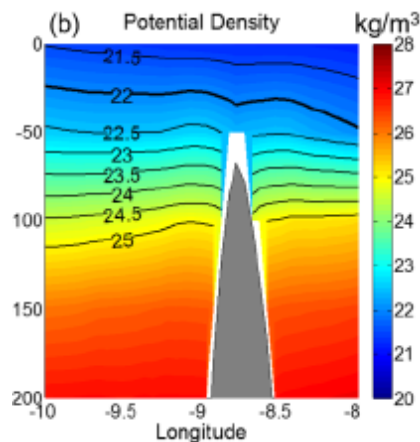
Three-dimensional ROMs Simulation at the Lombok Strait

ITF impacts IT generation via:

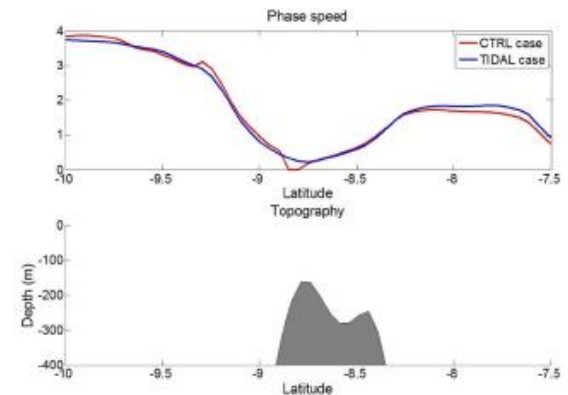
- 1) the asymmetric distribution of the stratification intensity;
- 2) the tilting pycnocline associated with the horizontal density gradients;
- 3) the advection effect of the background current.



*asymmetric
stratification*



tilting pycnocline

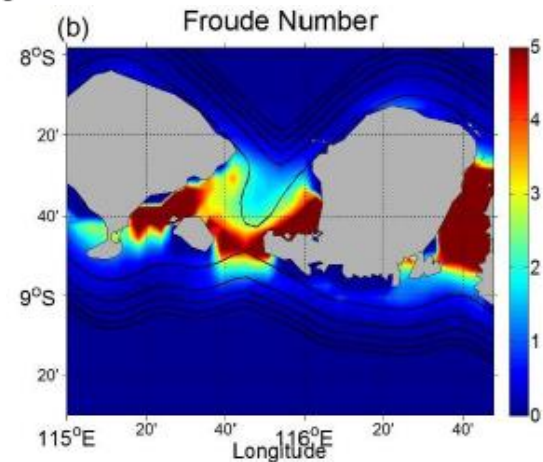
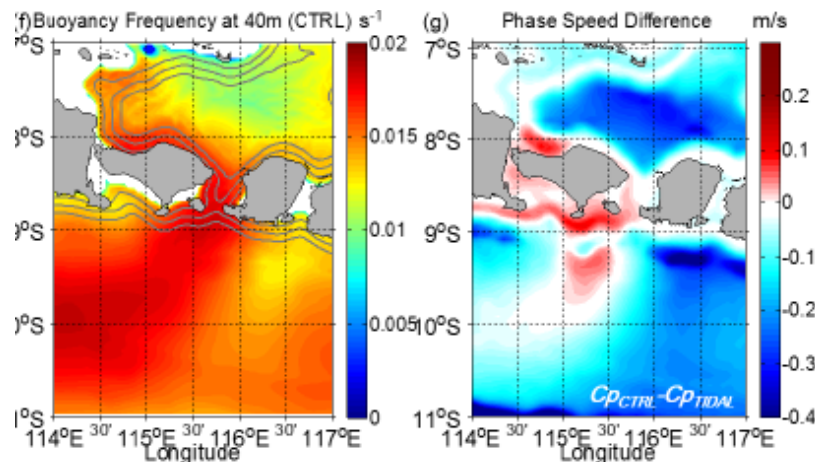
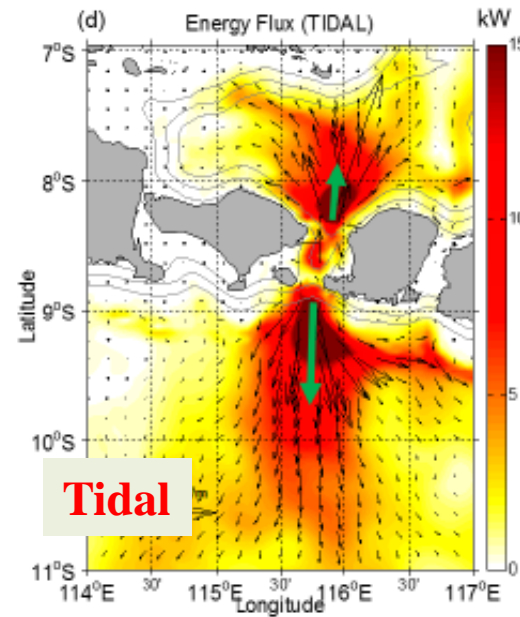
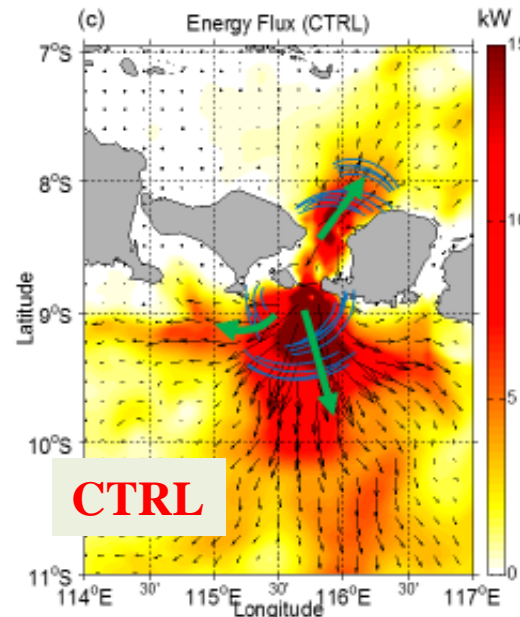


advection effect

Three-dimensional ROMs Simulation at the Lombok Strait

ITF refracts IT propagation via:

- 1) *refraction by the horizontal density gradients*
- 2) *advection by the background current (Doppler shifting)*



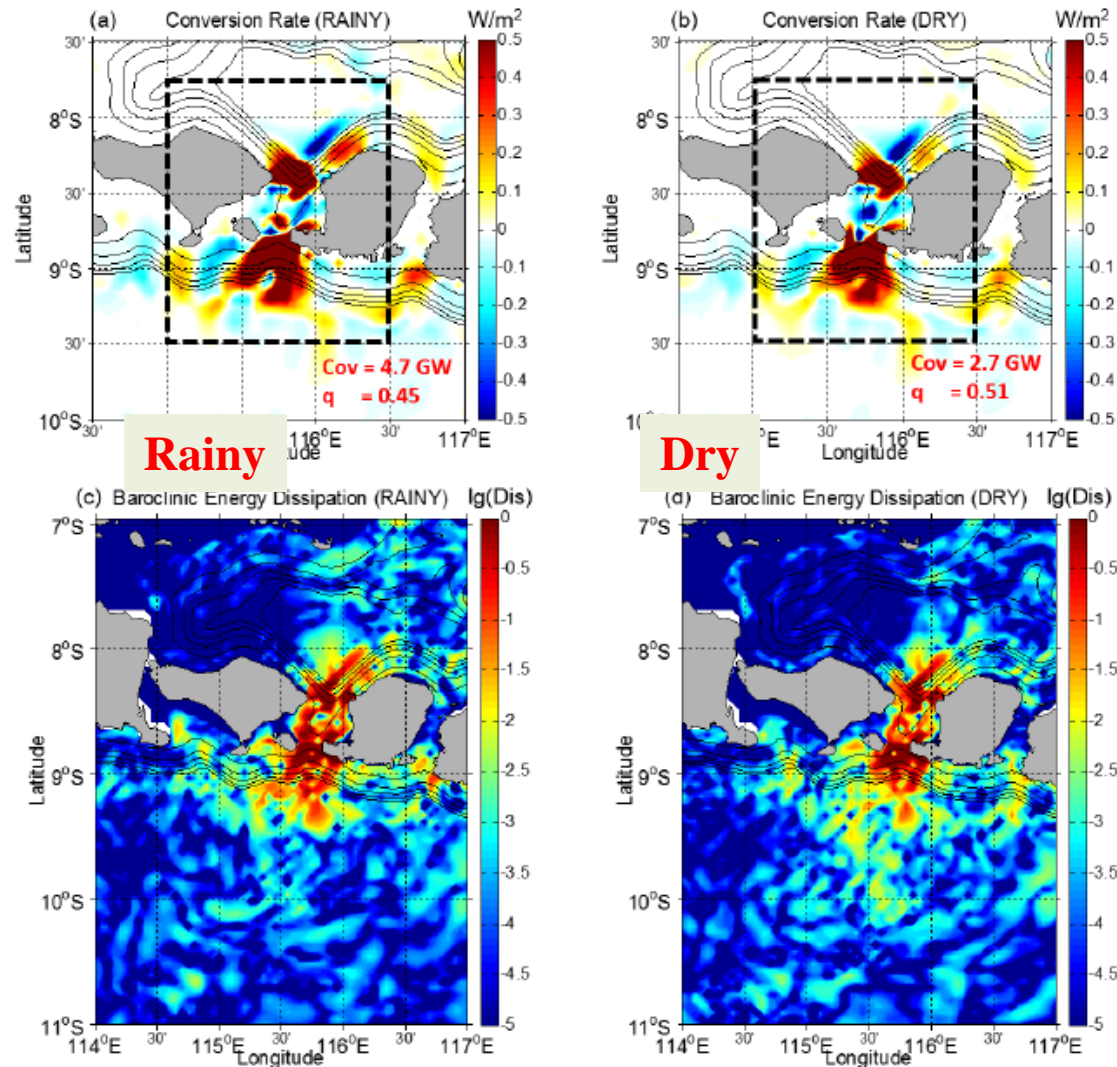
Refraction by density gradient

advection effect

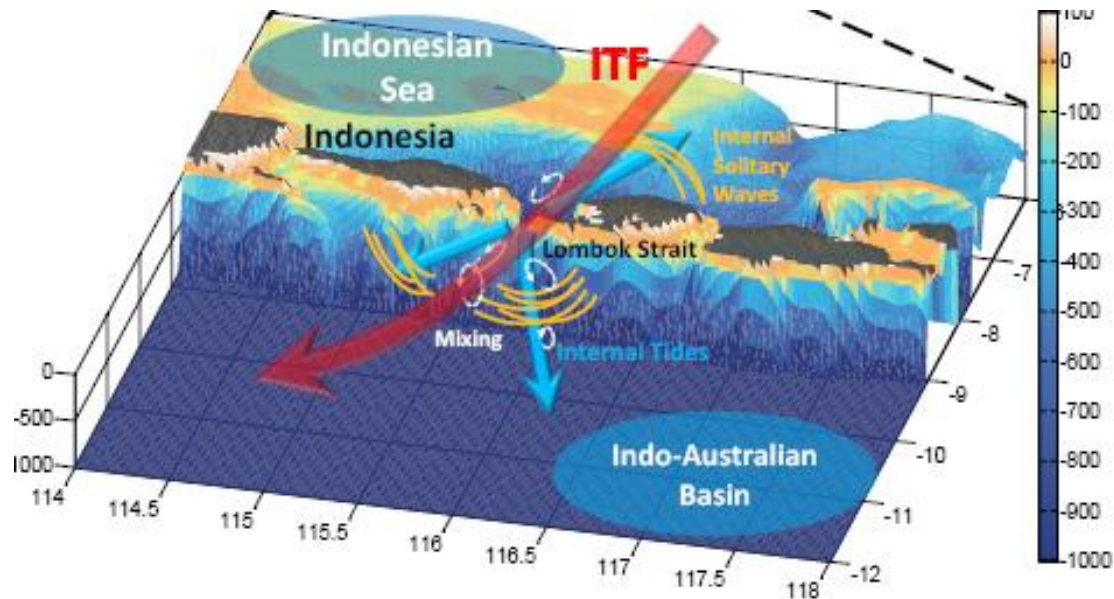
Three-dimensional ROMs Simulation at the Lombok Strait

IT energetics and dissipation exhibit seasonal variation:

- 1) *ITF variability*
- 2) *Air-sea interaction*



Concluding Remarks



- ◆ Strong tide-topography interactions at LS generate Lee waves and internal tides.
- ◆ The ITF enhances the north-south asymmetric internal tide generation and propagation.
- ◆ Radiating internal tide accounts for the occurrence of internal solitary waves.
- ◆ Complex dynamics and energetics of internal wave and mixing needs further investigation.

Thanks!

