PO45M-08

Nonlinear internal wave generation in the South China Sea

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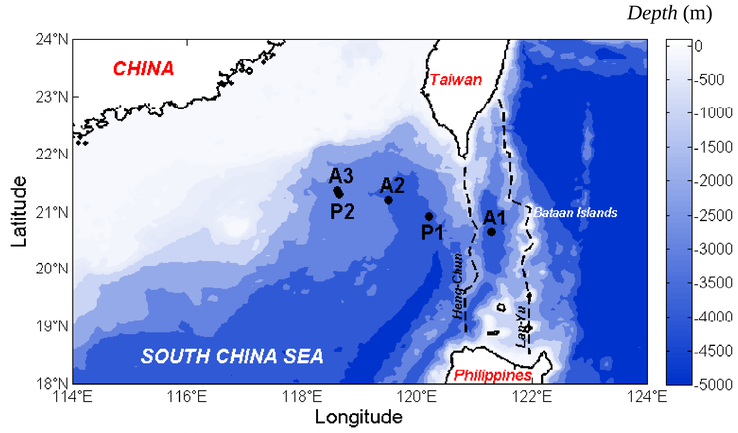
Steepening internal tides in the South Chin Sea generate large amplitude nonlinear internal waves (NLIW). Six months of inverted echo sounder measurements reveal their properties and relationship to barotropic forcing in Luzon Strait.



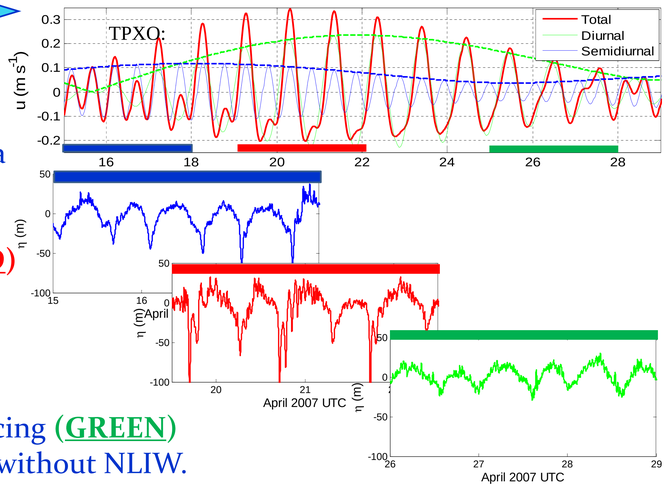
I. NLIW pattern generation

Observations

For dominant semidiurnal (M2+S2+N2+K2) tidal forcing (**BLUE**), the internal tide evolves to a cusp shape with single large NLIW.

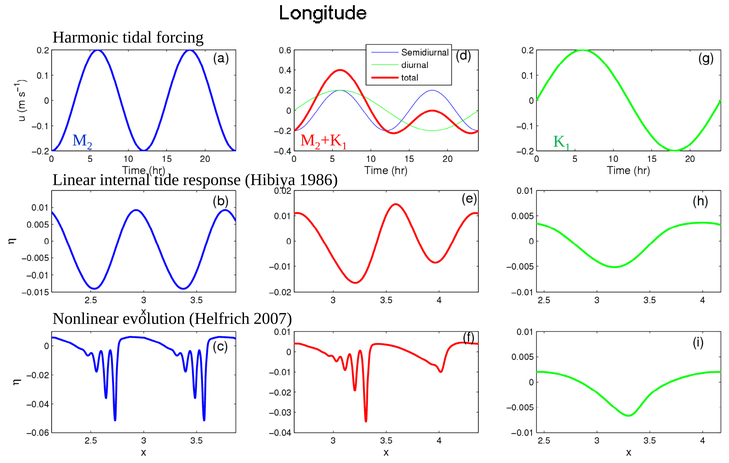
A large diurnal tidal inequality (**RED**) leads to alternation between rank-ordered wave packets and a single large wave.

Primarily diurnal (K1+O1+P1+Q1) forcing (**GREEN**) generates semidiurnal internal tides without NLIW.



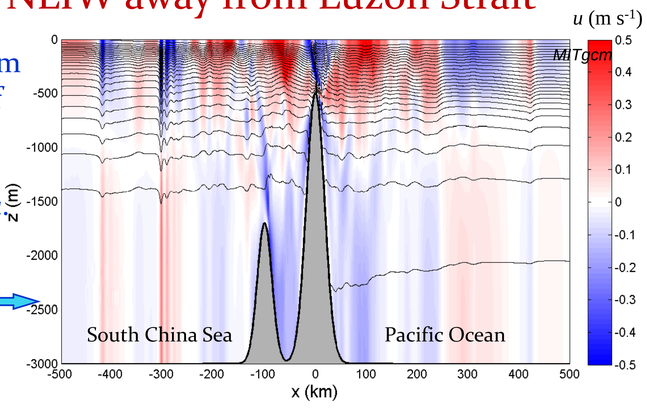
Model

Linear internal tide generation (Hibiya 1986) coupled to a **fully nonlinear** evolution model with **rotation** (Helfrich 2007), simulates the **BLUE**, **RED** and **GREEN** patterns.

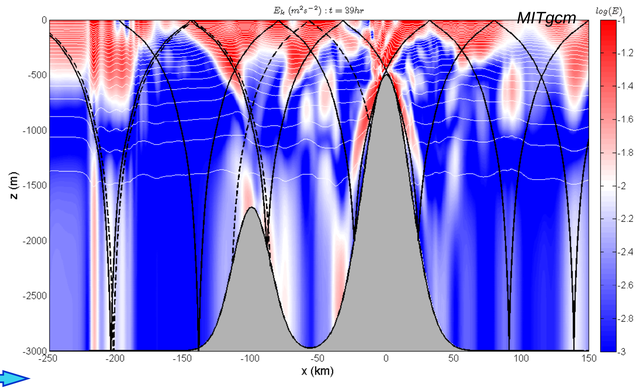


II. Asymmetric radiation of NLIW away from Luzon Strait

(1) The **thermocline tilt** resulting from the Kuroshio enhances nonlinearity of waves propagating westwards into the South China Sea, but reduces waves propagating eastwards into the Pacific.

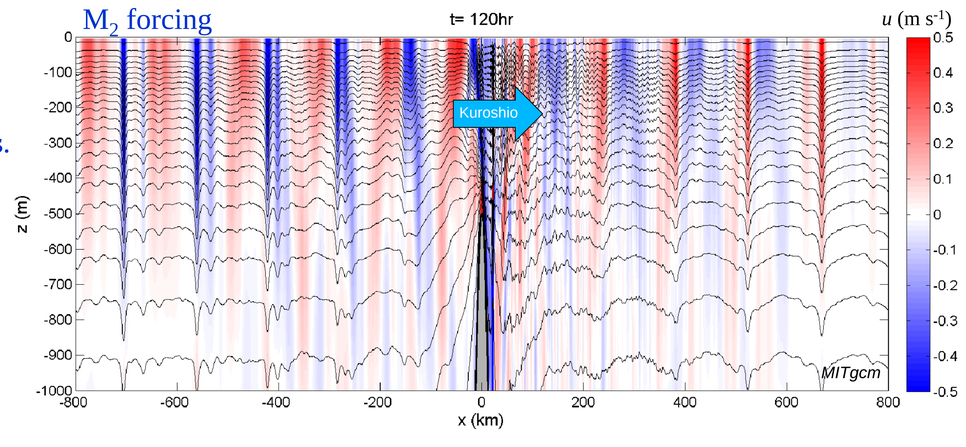


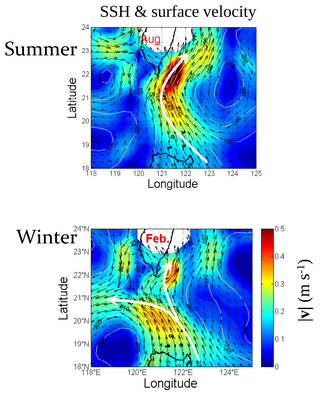
(2) Intensification of M2 internal tides propagating westwards into the South China Sea: **Separation** of the two ridges in Luzon Strait is close to the M2 wavelength. The internal M2 tide generated at the western ridge is **in phase** with the internal tide generated at the eastern ridge, enhancing westwards propagation and strengthening the nonlinear transformation. Corresponding eastwards propagation from the western ridge is blocked by a supercritical slope on the eastern sill.



III. Seasonal variability and the Kuroshio intrusion

NLIW are reduced in **winter**. Model (MITgcm) calculations show that this is primarily caused by the **Kuroshio intrusion**, not **stratification** changes. Doppler shift of internal tide generation reduces amplitude of waves traveling west.





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