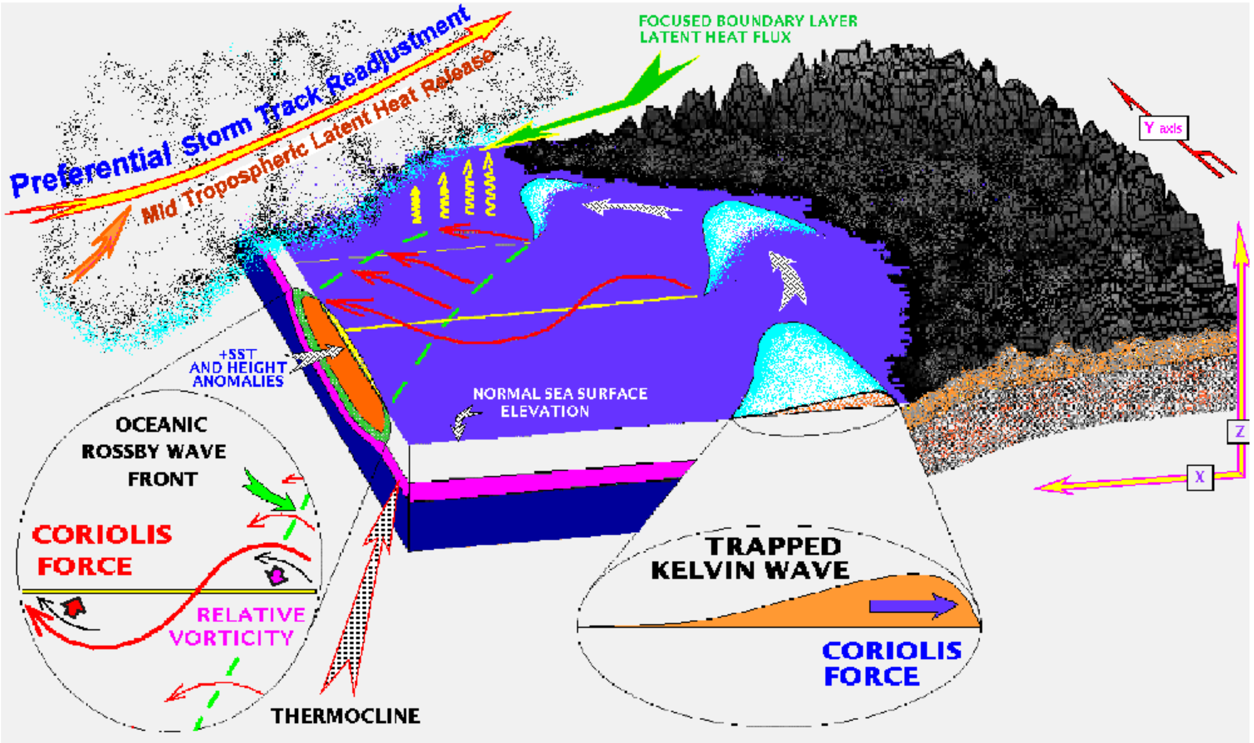
Ondas atrapadas en el ecuador



http://www.nwrfc.noaa.gov/nwrfc/papers/Tech_Memo_Nwswr-253/finfig8.gif

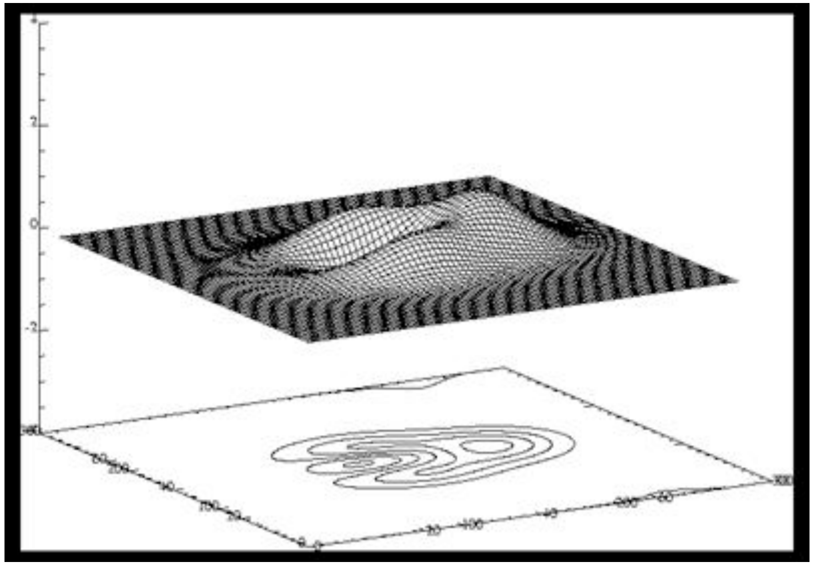
Un poco de ecuaciones

Pizarrón…

Cosas a recordar

WAVES IN THE TROPICAL OCEANS

- Two types of waves that play a key role in the adjustment of the tropical oceans to changes in wind stress are *equatorially trapped Kelvin wave*, and *equatorial Rossby waves*.
- Equatorially trapped Kelvin waves are symmetric with the Equator (see figure below).



The equatorially trapped Kelvin wave is non-dispersive, and travels eastward at the same velocity as a shallow-water gravity wave

$$c = \sqrt{gH}$$

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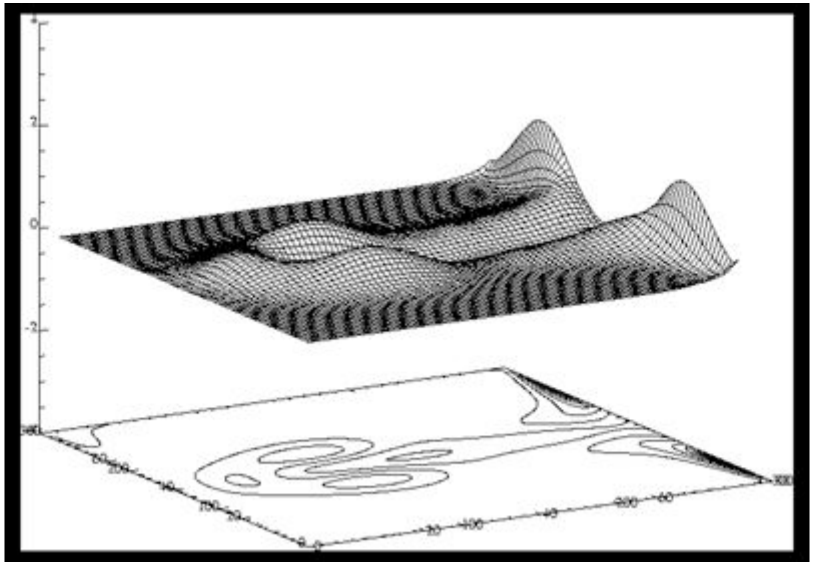
o The equatorial Kelvin wave is similar to the regular Kelvin wave in that it leans against a boundary. However, instead of physical boundary, it is a *dynamic boundary* caused by the change in sign of *f* across the Equator.

- When the equatorially trapped Kelvin wave impacts the eastern boundary of the basin it reflects as two coastally trapped Kelvin waves, and a long equatorial Rossby wave (see figure below).



- Rossby waves have a westward phase velocity.
  - Rossby waves are dispersive, with a westward group velocity for long waves, and an eastward group velocity for short waves.
  - When a long Rossby wave impacts on the western boundary it reflects as short Rossby waves.
  - The short Rossby waves attenuate quickly, so **that energy tends to collect along the western boundary**.
- Kelvin and Rossby waves can also occur in two-layered or multi-layered fluids, and so can have barotropic as well as baroclinic modes.

SSH Anomaly

Video, fuente: http://www.youtube.com/watch?v=VNefCmc3_1Y

15 years of sea surface height anomaly (in mm) from merged TOPEX/Poseidon and Jason-1 datasets ranging from january 1993 to december 2007.

Note the persistent structures like the western boundary currents (Kuroshio, Gulf, Brazil-Malvinas confluence, East-Australian) and the Antarctic Circumpolar Current. Look at the great oceanic gyres. See the discrete seasonal change between the northern and the southern hemispheres. Watch the massive effect of the 1997 El Niño and 1998 La Niña over the surface height. Note especially the westward propagating slow Rossby waves and the faster reflected Kelvin waves, object of my study.

Finally if you look carefully, notice how the sea surface tends to become more and more red over the years, which means the ocean level is rising.

Music 'Remember The Name' courtesy of Inki

Connection to El Nino Southern Oscillation

The overall ENSO cycle can be explained as follows (in terms of the wave propagation throughout the Pacific Ocean): ENSO begins with a warm pool traveling from the western Pacific to the eastern Pacific in the form of Kelvin waves (the waves carry the warm SSTs) that resulted from the MJO.

After approximately 3 to 4 months of propagation across the Pacific (along the equatorial region), the Kelvin waves reach the western coast of South America and interact (merge/mix) with the cooler Peru current system.
This causes a rise in sea levels and sea level temperatures in the general region.
Upon reaching the coast, the water turns to the north and south and results in El Nino conditions to the south.
Because of the changes in sea-level and sea-temperature due to the Kelvin waves, an infinite number of Rossby waves are generated and move back over the Pacific.

Fuente: wikipedia

Rossby waves then enter the equation and, as previously stated, move at lower velocities than the Kelvin waves and can take anywhere from nine months to four years to fully cross the Pacific Ocean basin (from boundary to boundary).

And because these waves are equatorial in nature, they decay rapidly as distance from the equator increases; thus, as they move away from the equator, their speed decreases as well, resulting in a wave delay.

When the Rossby waves reach the western Pacific they ricochet off the coast and become Kelvin waves and then propagate back across the Pacific in the direction of the South America coast.

Upon return, however, the waves decrease the sea-level (reducing the depression in the thermocline) and sea surface temperature, thereby returning the area to normal or sometimes La Nina conditions.