Inter-Ocean Exchanges and Regional Sinks of Heat during the Warming Hiatus

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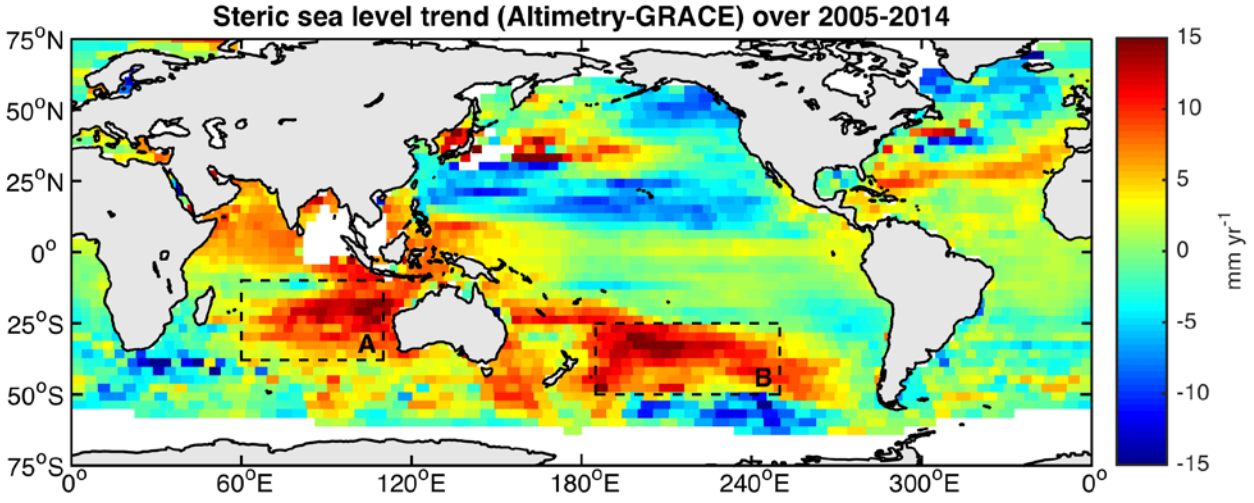
Global warming is a consequence of the Earth's radiative imbalance: our planet is absorbing more energy from the Sun than it radiates back to space. The imbalance can be due to natural variability as well as to anthropogenic influence (emission of greenhouse gases, landscape transformation that changes the reflectivity of the earth's surface, etc.). The ocean, covering 71% of the Earth's surface, serves as the main energy reservoir. The well-established global mean sea level rise is one of the most certain indicators of global warming. The sea level rise reflects both the thermal expansion of the entire water column (due to ocean warming) and the freshwater input from melting glaciers (mainly in Greenland and Antarctica). The latest reports based on high-accuracy satellite altimetry measurements available since 1992 indicate that sea level has been steadily increasing at the rate of 3.3±0.4 mm yr^{-1}. In contrast to sea level, the global surface temperature rise reportedly slowed down after 1998 and entered a more stable period termed "hiatus". A suite of studies has attempted to explain this slowdown by redistribution of heat between the near-surface and deeper layers of the ocean and between different oceanic basins. A more recent study, however, claims that the apparent "hiatus" is a possible artifact of data biases. Regardless of whether "hiatus" is real or not, the question of surplus heat sequestration, in particular, by the deep ocean remains actual. The focus of this research project is to better understand the inter-ocean exchanges of heat, freshwater and carbon using global ocean-sea ice coupled models, in-situ hydrographic data and satellite-based sea level data.



Satellite-based steric sea level trend over 2005-2014 obtained by subtracting GRACE Mascons data from altimetry records. Prior to computing the difference, altimetry fields were smoothed over 3°×3° Mascons and interpolated onto a 0.5° grid. Dashed rectangles A and B outline two regions in the South Pacific Ocean and Indian Ocean where the sea level increased much faster than other regions; the surface area of each region is about 16 million km^2.