Global Internal Tides from Multi-Satellite Altimetry

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• Multi-satellite altimetric data

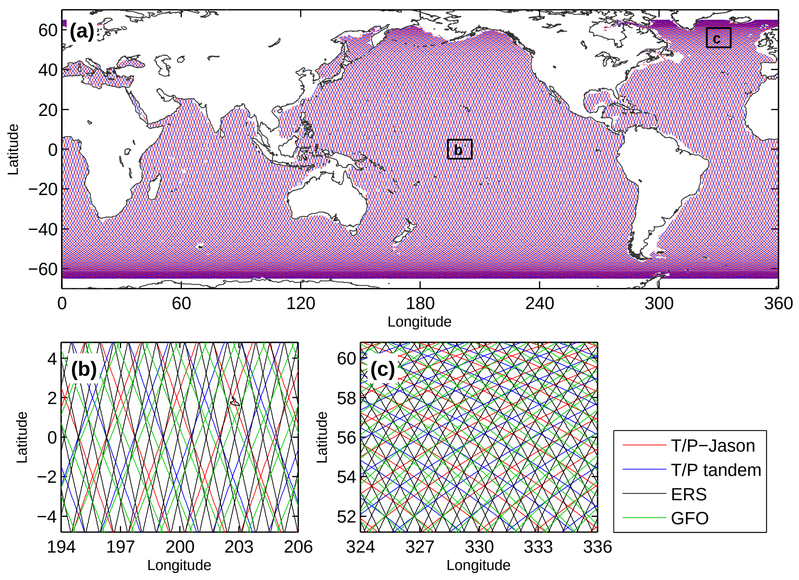

Figure 1. Ground tracks of altimeter satellites: T/P–Jason, T/P–Jason tandem, ERS-1/2-Envisat (ERS), and Geosat-Follow-on (GFO). The much denser ERS and GFO ground tracks are shown only in two zoomed-in subregions (b, c).

• South-north separation

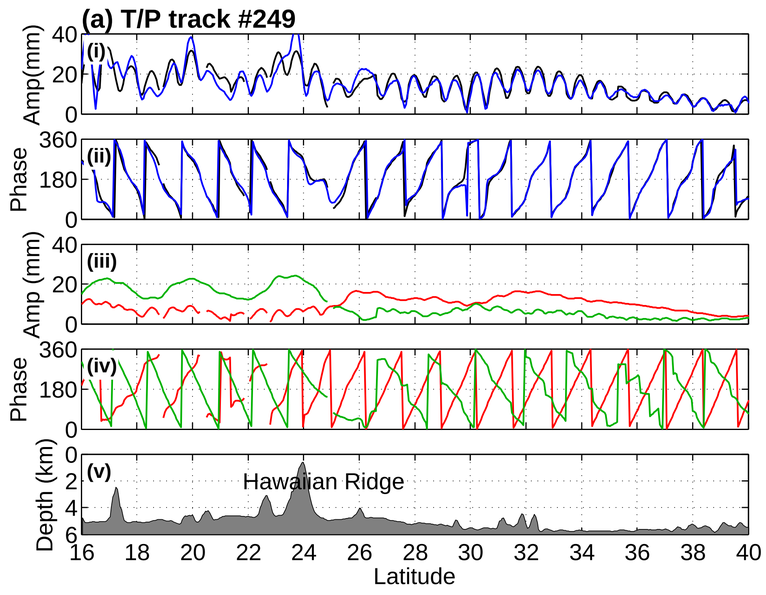

Figure 2. An example of the south-north separation technique. (i, ii) M_2 internal tides obtained from harmonic analysis (blue) and the southward/northward superposition (black). (iii, iv) The separated northward (red) and southward (green) M_2 internal tides.

• Plane-wave fit

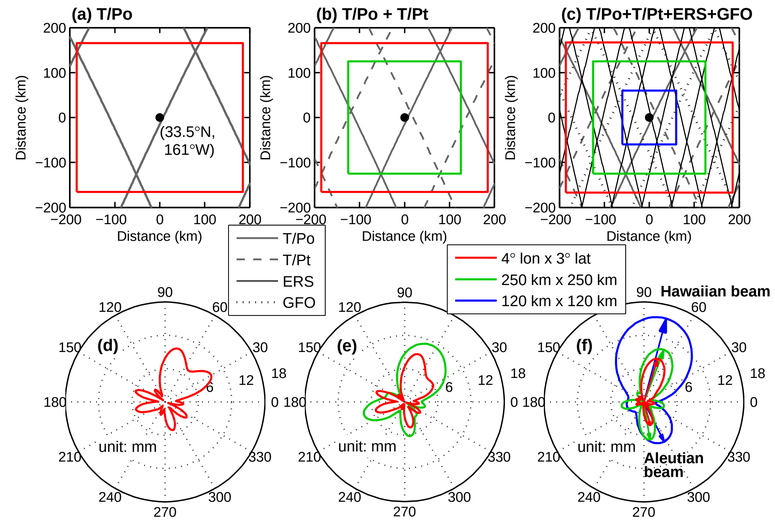

Figure 3. An example of the plane-wave fit technique. (top panels) Combinations of ground tracks: T/P–Jason (thick gray), T/P–Jason tandem (dashed), ERS (thin black) and GFO (dotted). (bottom panels) Resultant amplitude of mode-1 M_2 internal tide versus compass direction. Internal tides are determined from lobes.

• Results

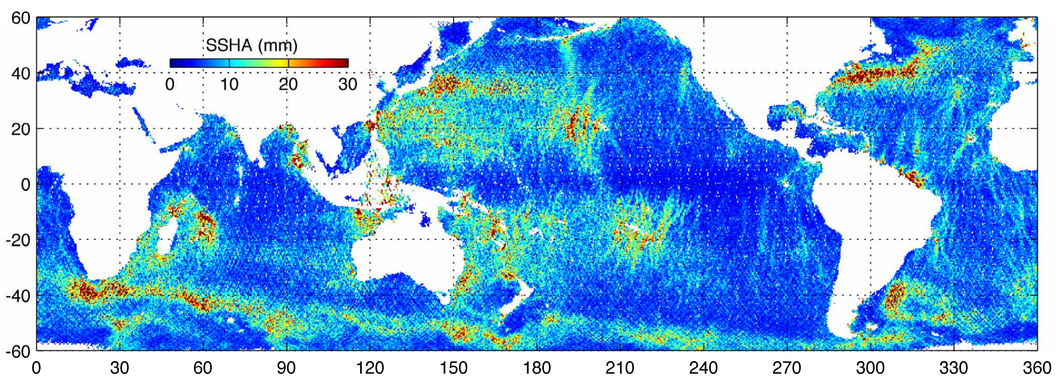

Figure 4. Multi-satelllite M_2 internal tides by harmonic analysis. First, harmonic analysis is conducted at all points along all tracks; then the resultant amplitudes are binned into 0.4° by 0.4° windows.

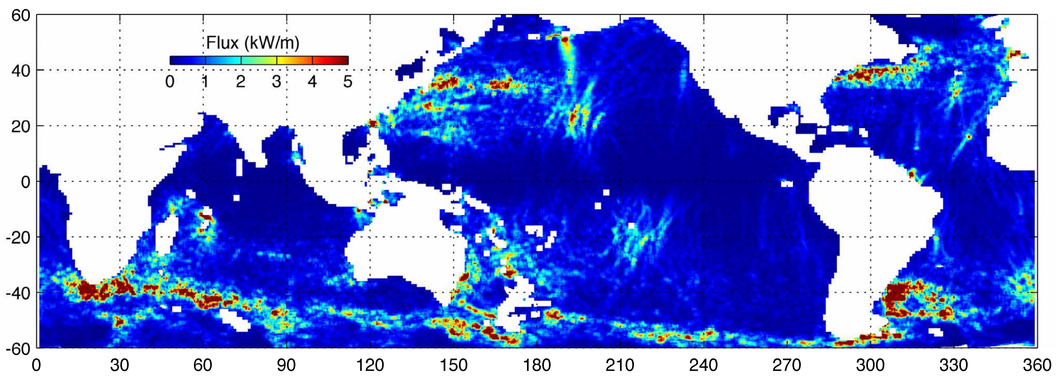

Figure 5. Mode-1 M_2 internal tides from multi-satellite altimetric data using the plane-wave fit technique. The fitting window is 160 km by 160 km, and three internal waves are extracted in each window. Shown here is the sum of energy fluxes of the three extracted internal waves.

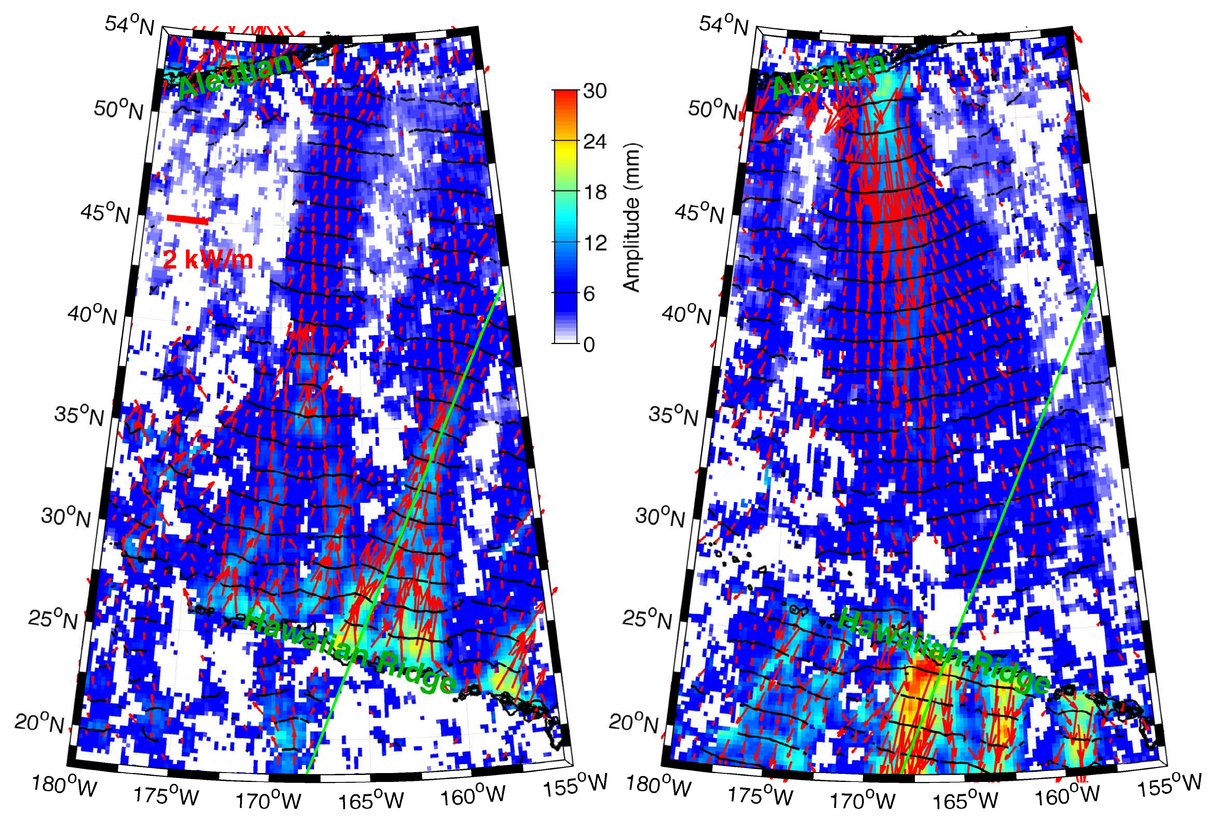

Figure 6. Mode-1 M_2 internal tidal beams from the Hawaiian and Aleutian ridges, estimated from multisatellite altimetry by the plane-wave fit technique. The colors denote amplitude, and the black contours are phase lines (at an interval of one wavelength) for the largest northbound (left panel) or southbound (right panel) waves. The red arrows denote energy flux. White patches indicate regions of poor fits and/or amplitudes less than 3 mm.

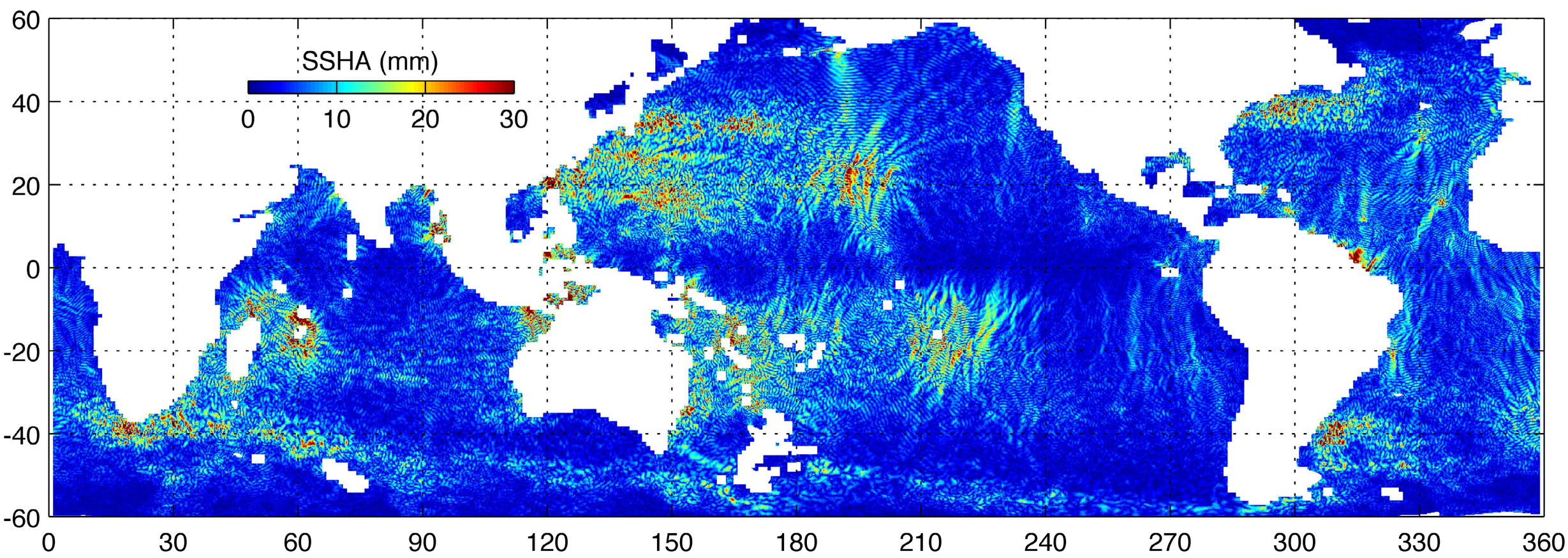

Figure 7. The sea surface height signals of mode-1 M_2 internal tides, from the superposition of three waves extracted by the plane-wave fit technique.