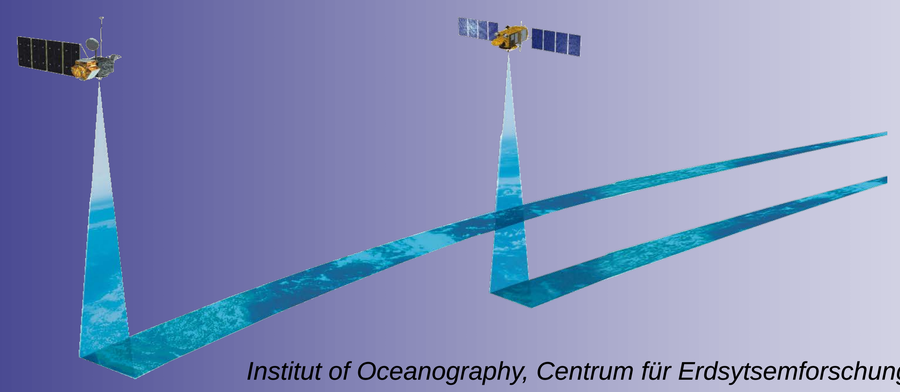
P51

Interdisciplinary Conference of Young Earth System Scientists, 23-25 September 2013, Hamburg, Germany
University of Hamburg • Centrum für Erdsystemforschung und Nachhaltigkeit

Ocean Surface Velocities from Space ...



... looking behind the scenes

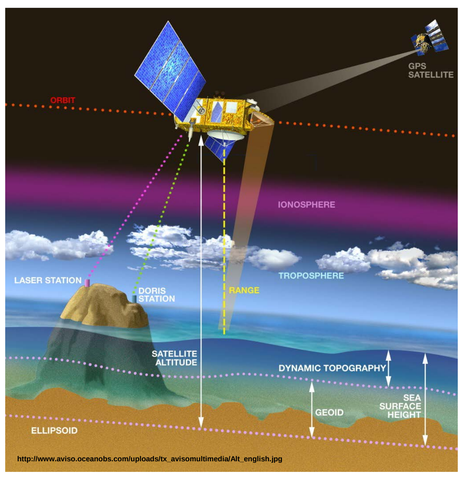
Martin G. Scharffenberg
Institut of Oceanography, Centrum für Erdsytsemforschung und Nachhaltigkeit, University of Hamburg, Germany

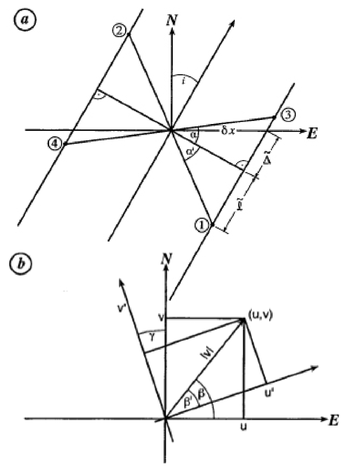
I use satellite altimeter data - Sea Surface Height (SSH) data - to infer large scale geostrophic surface velocity anomalies to verify ocean models and to conduct basic research to understand the upper ocean flow field in general.

Geostrophic velocities for both velocity anomaly components, u and v, were estimated from the 3-year long Jason-1 - TOPEX/POSEIDON (JTP) Tandem Mission from altimetric Sea Surface Height (SSH) data using the "parallel-track-approach" with a 6.2 *km* along-track resolution from September 2002 to September 2005. The large scale geostrophic velocity estimates are necessary to conduct basic research on the understanding of the upper ocean flow field in general, to assess variables as e.g. global Sea Level and to validate and be assimilated into ocean models

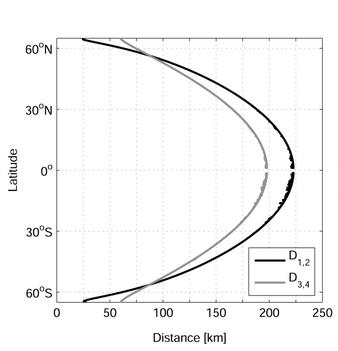
The method allows to infer both velocity components directly from the altimeter observations.

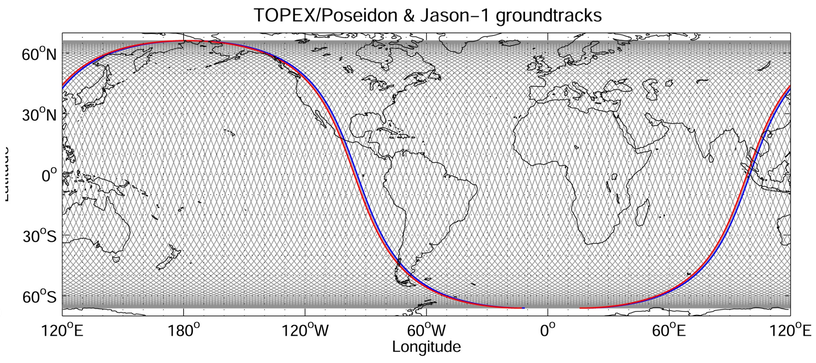
Geostrophic Velocity Calculation





LEFT (a) Schematic of the geometry used to compute orthogonal geostrophic velocity components on the interleaving track from SSH measurements provided along the two tracks to the east and west. (b) Schematic illustrating the orientation of the orthogonal velocity components obtained from the along-track data and their rotation into a local Cartesian coordinate system with zonal/meridional orientation. (STAMMER and DIETERICH, 1999)





TOP LEFT Distances $D_{1;2}$ and $D_{3;4}$ between the SSH measurements (left figure) that are used for the geostrophic velocity calculation as they vary with latitudes.

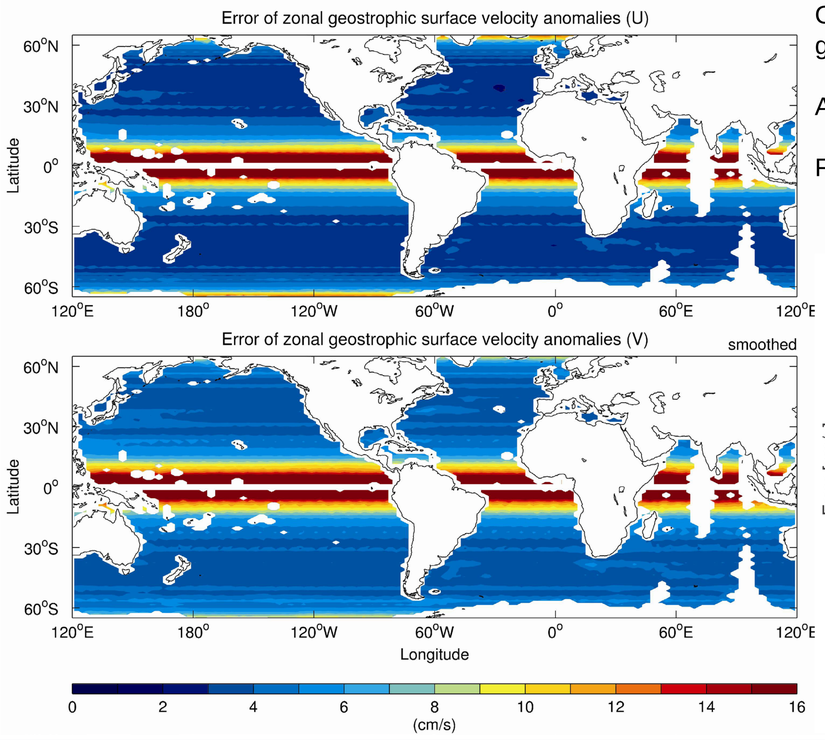
TOP RIGHT Virtual ground track (grey) on which the geostrophic velocities were calculated using the SSH data available from the JTP tandem mission. Exemplary the TOPEX/POSEIDON (red) and Jason-1 (blue) ground-tracks are shown for ARC 1 and 2.

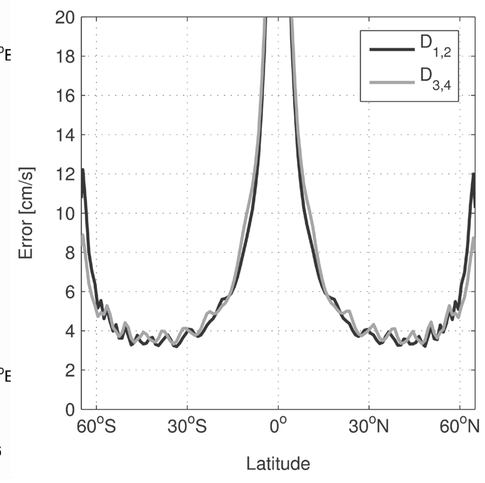
Errors and Uncertainties

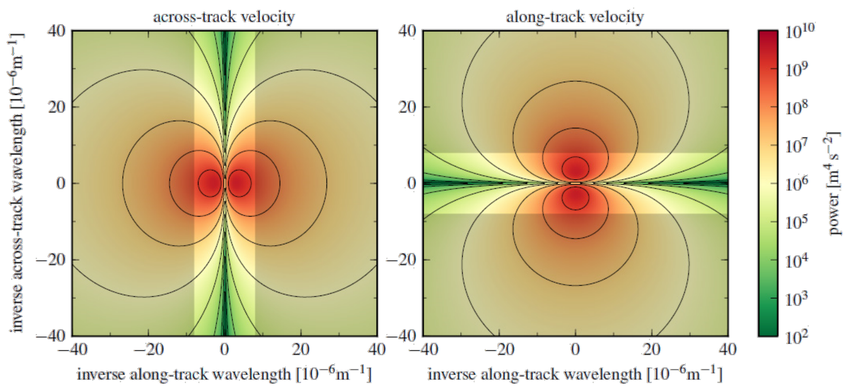
Necessary Corrections:

Propagation corrections (ionospheric, wet tropospheric, dry tropospheric)
Ocean surface corrections (sea state, electromagnetic bias)
geophysical corrections (ocean-, solid earth- and polar tides, loading effects)
Atmospheric corrections (inverse barometer correction)

Formal Error propagation shows pronounced latitudinal dependence and nother latitudinal dependence due to calculation procedure. **LEFT**, **BOTTOM**

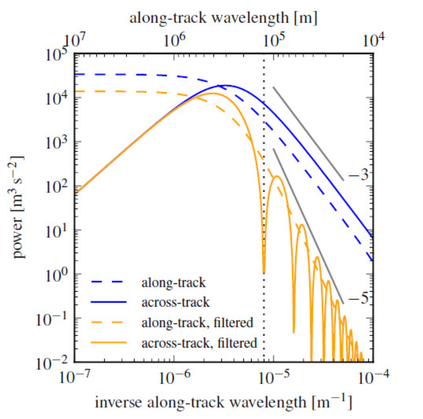




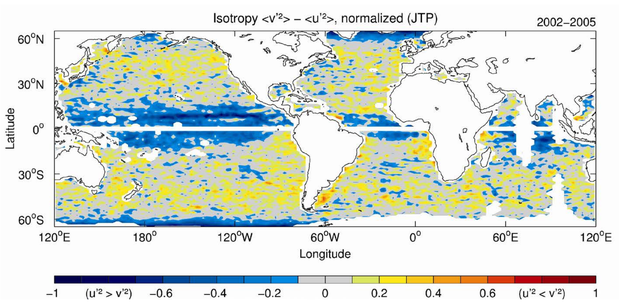


TOP Two dimensional wavenumber spectra of SSH for across track and along track components
Shaded areas indicate the filtered part of the SSH spectra when the geostrophic velocity spectra are calculated. The filter originates from the sample characteristics of the satellite measurements

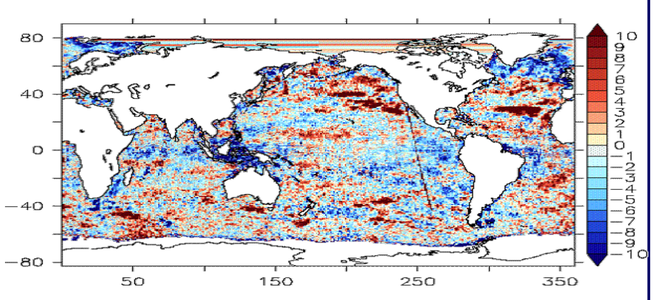
RIGHT Analytical model spectra (BLUE) showing the filter effect (ORANGE) due to the sampling characteristic of the satellite measurement for the along-track and across-track component.

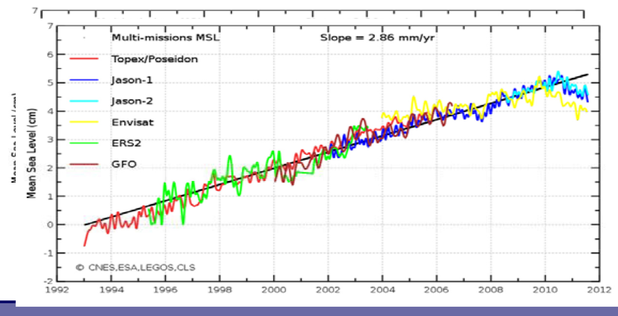


Isotropy

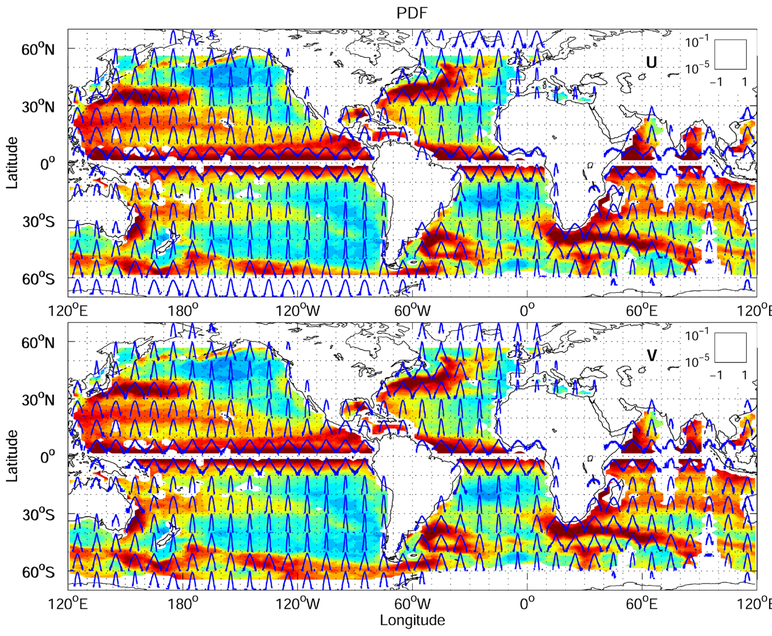


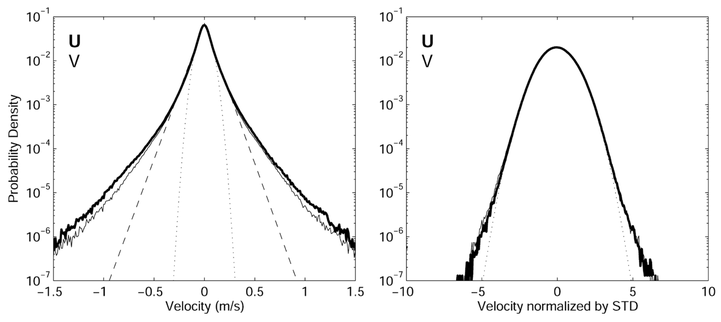
Sea Level



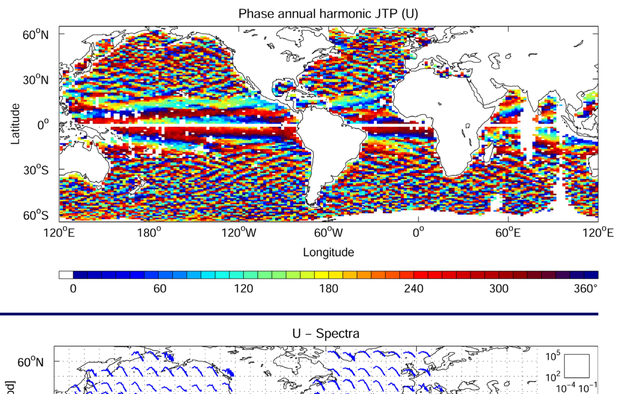


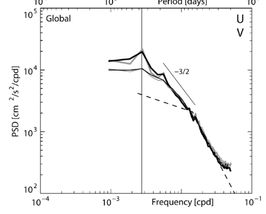
PDF and EKE

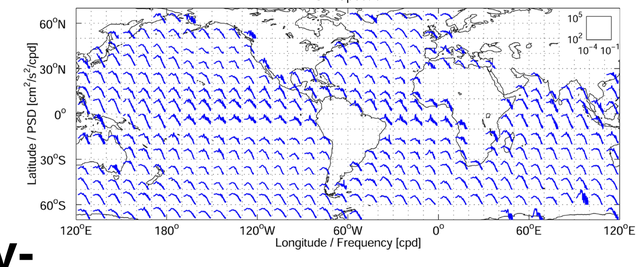




Seasonal cycle







Frequency-Wave-number spectra