GPS ESTIMATES OF VERTICAL LAND MOTION FOR ALTIMETER CALIBRATION

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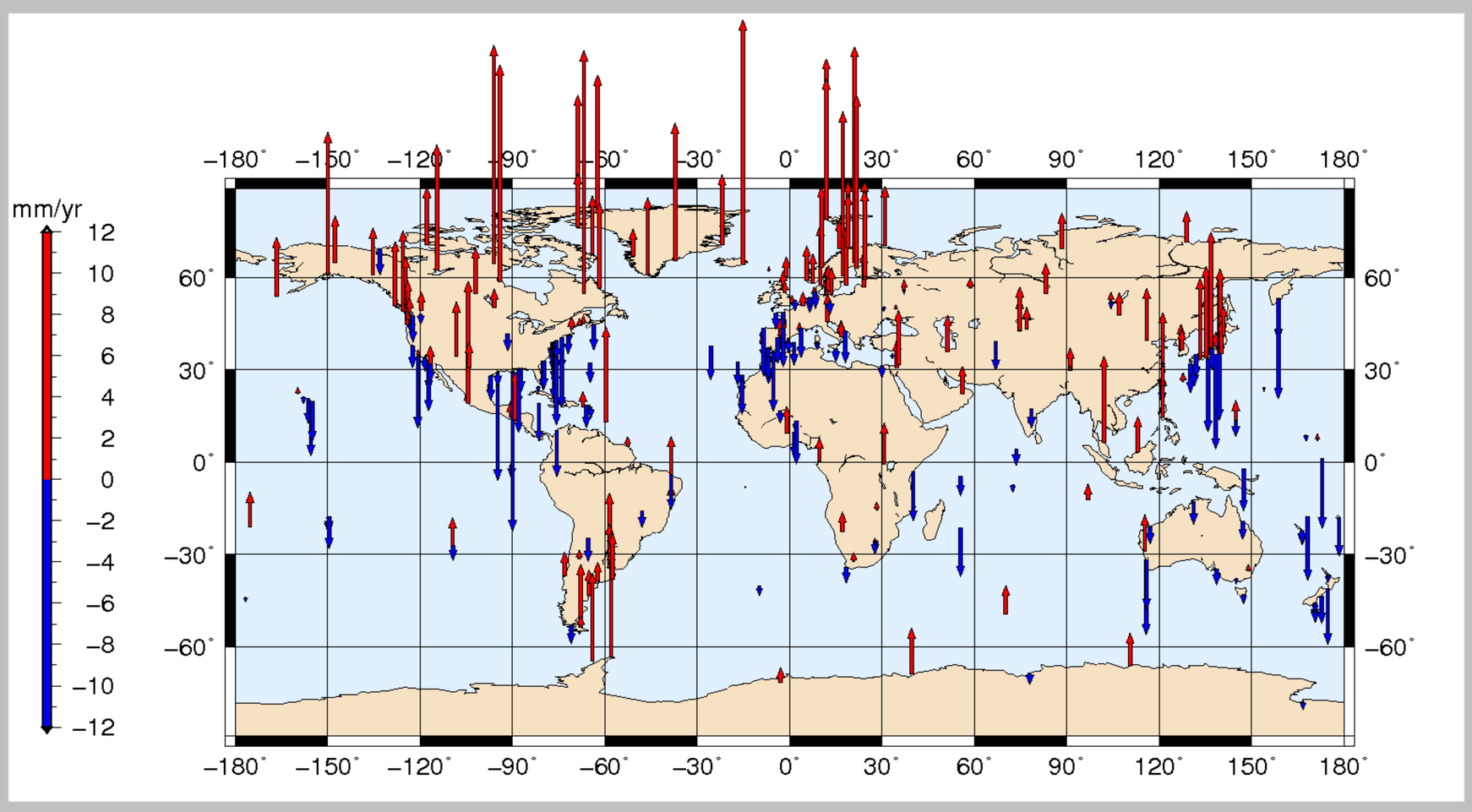
The University of La Rochelle TIGA Analysis Center Consortium (ULR) has computed a global vertical velocity field from a state-of-the-art global GPS solution providing estimates of the long-term vertical land motion (VLM) at co-located tide gauges (GPS@TG).

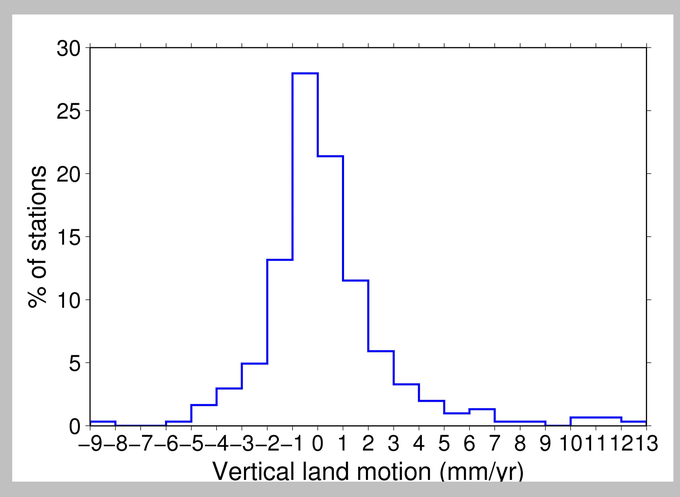
Sea level data from a global network of tide gauges is usually used to calibrate the altimeter drift of satellite missions (e.g., Topex/Poseidon, Jason). Satellite altimetry provides a comprehensive view of the global/regional absolute sea level like no other technique. The altimeter errors are the weakness of this technique, having a direct impact on the estimates of sea level changes.

Sea level trend estimates from tide gauges are contaminated by the VLM, and so is the altimeter drift calibration from that dataset. The uncorrected mean VLM of the set of tide gauges used is propagated directly into a bias of the altimeter drift estimate. For instance, among all the VLM processes, the predominant is originated by the global-scale ongoing GIA effect. At global scale, the GIA effect is not a zero-mean VLM process, and even less within the altimetry latitude limits (± 66º).

What may be the level of VLM contamination in the altimeter drift estimates from an uncorrected global set of the tide gauges?

We answer this question with precise VLM estimates from a global set of GPS@TG stations.

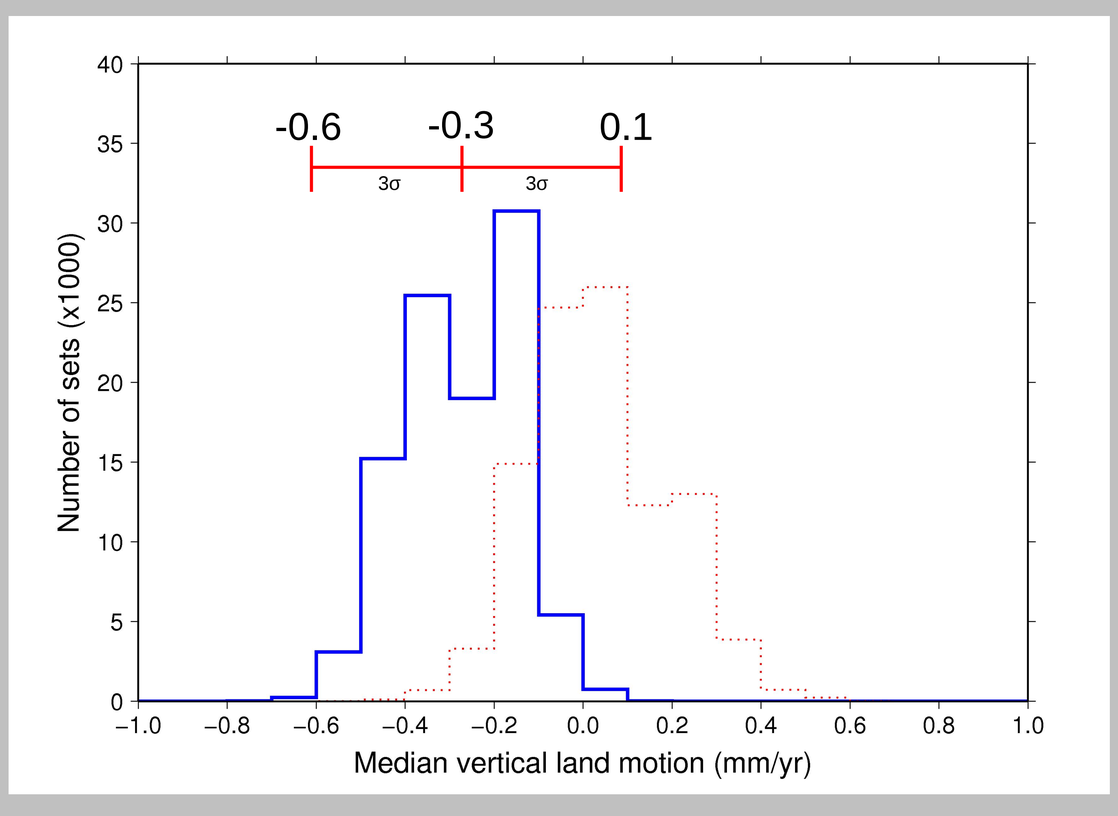




The ULR vertical velocity field: 326 vertical velocities from time series with more than 3 years of data without discontinuities.

178 velocities of GPS@TG stations between ±66º latitude.

VLM histogram of 100.000 random sets of 108 GPS@TG stations between ±66º latitude (red doted line for stations between ±90º latitude).



CONCLUSIONS:

1) VLM may bias the altimeter drift estimates up to 0.6 mm/yr depending on the tide gauge selection.

2) The bias of the altimeter drift calibration is driven by non-zero mean VLM processes and the latitude limits of satellite altimetry observations.

3) In the absence of accurate VLM corrections, the altimeter drift estimates would be less biased if the TG set used had a mean VLM closer to zero, even if they are affected by large positive signals (e.g., GIA at high latitudes).

REFERENCES:

Mitchum, G.T. An Improved Calibration of Satellite Altimetric Heights Using Tide Gauge Sea Levels with Adjustment for Land Motion. Mar. Geod. 23, 145-166, 2000.