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Combining altimetry and tide gauges to derive past sea level change

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Sea level change prior to 1993 is described by time varying amplitudes of spatial EOFs, in analogy to Church & White and many others. The amplitudes, denoted principle components (PC) are estimating by historic tide gauge records. We complement the suite of studies inspired by Church and White study with alternative methods. In a first step gaps in 178 records of sea level change are filled using the pattern recognition capabilities of artificial neural networks. Afterwards satellite altimetry is used to extrapolate local sea level change to global fields. In contrast to prior studies we do not try to reconstruct sea level at tide gauges. Instead we estimate the PCs from the tide gauge observations directly.

We derive a global mean sea level change since 1900 of 1.77 $\pm$ 0.19 mm/year. Local trends are essentially positive with the highest values found in the western tropical Pacific. Regions with negative trends are spotty with a minimum value of about -2 mm/year south of the Aleutian Islands. Uncertainties can be estimated using a Monte Carlo method. The acceleration found for the global mean is +0.0042$\pm$0.0046 mm/year**2. Local values range from -0.1 mm/year**2 in the central Indian Ocean to +0.1 mm/year**2 in the western tropical Pacific and east of Japan. These extremes are associated with patterns of sea level change that differ significantly from the first half of the analysed period (i.e. 1900 to 1950) to the second half (1950 to 2000). We take this as an indication of long period oceanic processes that ar superimposed to the general sea level.