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Clim. Past, 5, 217-227, 2009
www.clim-past.net/5/217/2009/

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Two-dimensional reconstruction of past sea level (1950–2003) from tide gauge data and an Ocean General Circulation Model

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Abstract. A two-dimensional reconstruction of past sea level is proposed at yearly interval over the period 1950–2003 using tide gauge records from 99 selected sites and 44-year long (1960–2003) 2° × 2° sea level grids from the OPA/NEMO ocean general circulation model with data assimilation. We focus on the regional variability and do not attempt to compute the global mean trend. An Empirical Orthogonal Function decomposition of the reconstructed sea level grids over 1950–2003 displays leading modes that reflect two main components: (1) a long-term (multi-decadal), regionally variable signal and (2) an interannual, regionally variable signal dominated by the signature of El Niño-Southern Oscillation. Tests show that spatial trend patterns of the 54-year long reconstructed sea level significantly depend on the temporal length of the two-dimensional sea level signal used for the reconstruction (i.e., the length of the gridded OPA/NEMO sea level time series). On the other hand, interannual variability is well reconstructed, even when only ~10-years of model grids are used. The robustness of the results is assessed, leaving out successively each of the 99 tide gauges used for the reconstruction and comparing observed and reconstructed time series at the non considered tide gauge site. The reconstruction performs well at most tide gauges, especially at interannual frequency.

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Citation: Llovel, W., Cazenave, A., Rogel, P., Lombard, A., and Nguyen, M. B.: Two-dimensional reconstruction of past sea level (1950–2003) from tide gauge data and an Ocean General Circulation Model, *Clim. Past*, 5, 217-227, 2009. ▣ [Bibtex](#) ▣ [EndNote](#) ▣ [Reference Manager](#)



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