# Coupling instrumental and proxy records of recent sea-level change

**Roland Gehrels**
*roland.gehrels@plymouth.ac.uk*

**School of Geography, University of Plymouth, Drake Circus, Plymouth PL4 8AA, UK**

**1** **Long instrumental records of sea-level change are scarce and very few date back to pre-industrial times. Geological records of sea-level change, on the other hand, are often imprecise and lack sufficient temporal resolution in recent centuries. To bridge the gap between the geological and observational records of sea-level change, this poster presents high-resolution proxy sea-level reconstructions from recent salt-marsh sediments that offer useful supplements to the small database of long-tide gauge records.**

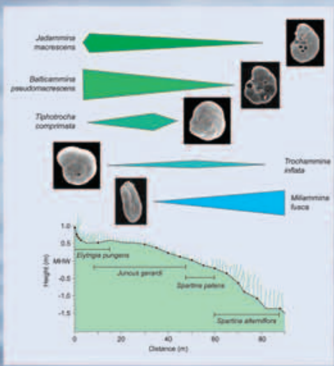



**Figure 1**
Vertical zonation of foraminifera in salt marshes in the northeastern USA and Atlantic Canada. This zonation pattern allows reconstruction of tidal heights from fossil foraminifera preserved in salt-marsh sediments using transfer functions.

**2** **Reconstructions of sea-level change derived from salt-marsh sediments use microfossils (commonly foraminifera or diatoms) in cores to constrain the former position of sea level. This is achieved by surveying the height at which populations of modern counterparts are found in the modern environment (Figure 1) and by assigning this height to the fossil populations using transfer functions. The height of the fossil assemblages is surveyed to the same (tidal) datum as the modern populations which allows the difference between modern and former sea level to be calculated. Dating methods that are used to assign an age to the former sea-level positions include radiometric techniques (AMS$^{14}$C, $^{210}$Pb, $^{137}$Cs, $^{241}$Am) and specific stratigraphic markers (e.g. pollen, tephra, Pb concentrations, Pb isotopic ratios) (Figure 2).**

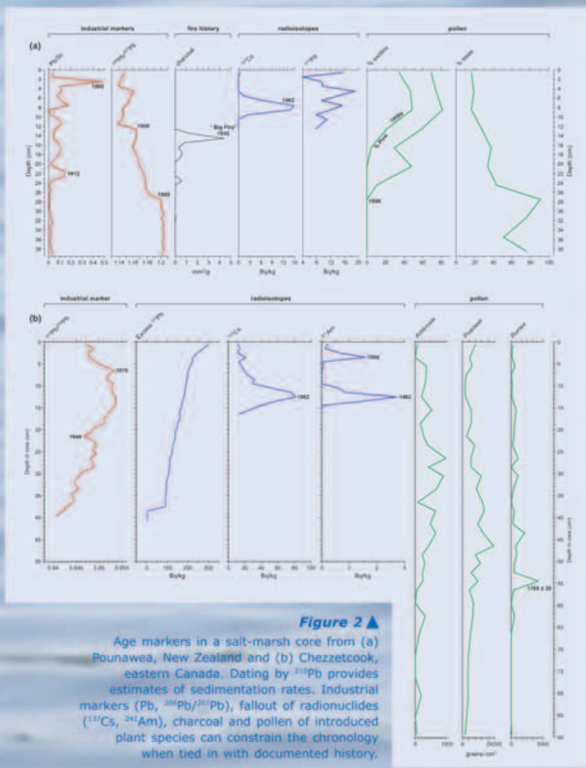
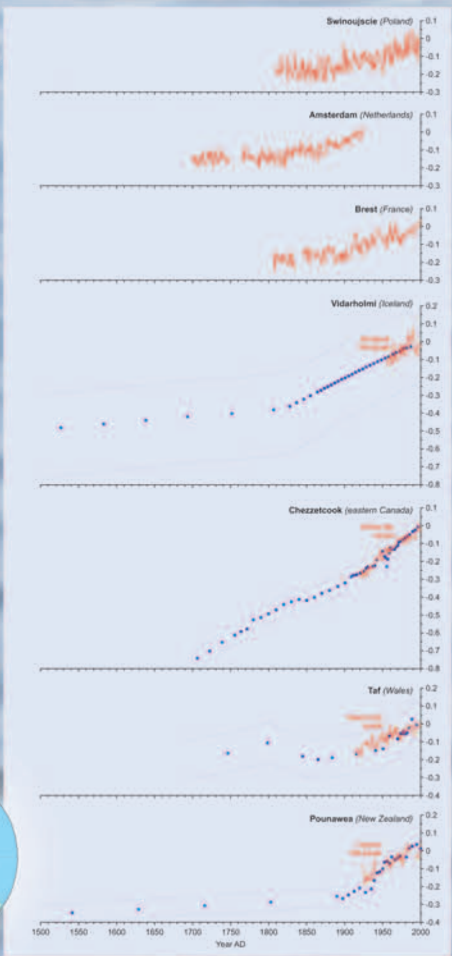



**Figure 2**
Age markers in a salt-marsh core from (a) Pounawea, New Zealand and (b) Chezzetcook, eastern Canada. Dating by $^{210}$Pb provides estimates of sedimentation rates. Industrial markers (Pb, $^{206}$Pb/$^{207}$Pb), fallout of radionuclides ($^{137}$Cs, $^{241}$Am), charcoal and pollen of introduced plant species can constrain the chronology when tied in with documented history.

**Figure 3**
Three long European instrumental sea-level records (from PSMSL database) and four proxy relative sea-level reconstructions. The records exhibit varying rates of isostatic vertical motion, but all document a marked increase in the rate of sea-level rise between 1840 and 1920. The reconstructions compare well with nearby tide-gauge records. (Vidarholmi record from Gehrels *et al.*, 2006, The Holocene 16 (7), in press. Chezzetook record from Gehrels *et al.*, 2005, Quat. Sci. Rev. 24, 2083-2100. Other proxy records in prep.).




**3** **Records presented in this poster were obtained from salt marshes in Iceland, Atlantic Canada, the British Isles, and New Zealand (Figure 3). In each location the proxy record for the 20th century can be directly compared with tide-gauge records to validate the method of reconstruction. The salt-marsh records generally provide one sea-level data point for every 5 or 10 years, depending on vertical accretion rates and sampling resolution. Short-term (multi-) annual variability is not resolved. The vertical precision of sea-level reconstructions ranges from ±5 to ±20 cm and depends on site characteristics, especially tidal range. The dating precision of sediments deposited during the 19th century is ±10 years, improving to ±5 years or better in the 20th century.**

**4** **The emerging picture is that the recent acceleration of sea-level rise is global in character and started between the middle 19th and the early 20th century (Figure 3), coincident with global temperature rise. Differences in the timing of the onset of rapid sea-level rise across the North Atlantic Ocean may reflect spatial non-uniformity of steric sea-level change. It is concluded that proxy records from salt-marsh sediments are of great value for documenting the spatial and temporal patterns of sea-level rise in the past 200 years and, ultimately, for determining the causes of this rise.**

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The following people have contributed data to this poster: Peter Appleby, Stuart Black, Rob Clough, Jason Kirby, Wil Marshall, Scott Mooney, Simon Newman, Rewi Newnham, Tracy Shimmield, Kate Southall

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