Session: C4 Poster: TH196B

CLIVAR-SPAIN contributions: Response of coastal environments to current sea-level rise

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Under the current climatic scenario of global warming and accelerating sea-level rise the study of natural and recently regenerated coastal wetlands over time in response to tidal inundation can potentially provide us with key information of future trends of coastal evolution. Salt marshes in the northern coast of Spain are restricted to the inner parts of the small estuaries that interrupt the continuous cliffs that characterize this coastal area. Marsh reclamation for agricultural and disease-eradication purposes was initiated in the 17th century and was particularly intense since the second half of the 19th century. During the 1950s these reclaimed areas were abandoned due to rural migration to the cities, and the lack of dyke maintenance provoked the entrance of tidal, estuarine water and allowed their natural regeneration. Reconstructions of the recent sea-level changes from natural salt marsh geological records offer a great potential to extend the global instrumental data set obtained from tide gauges. A foraminifera-based transfer function has been developed based on a modern dataset of samples and species obtained from different salt marshes in northern Spain. The relationship between observed and foraminifera-predicted elevation indicated that precise reconstructions of former sea levels are possible (error ranges from 0.11 to 0.19 m). The foraminifera-based reconstructions were placed into a temporal framework using 137Cs, Pb concentrations, and 210Pb-derived sediment accumulation rates. This transfer function was then applied to different cores from different marshes along this coast showing a relative sea-level rise rate of 2.0 mm yr-1 for the 20th century. This figure is in general agreement with the nearest instrumental records. When comparing the relative sea-level rate for the last century to the average rate for the Holocene, modern rate is 3-6 times higher than in the last 7000 years, which can be related to the anthropogenic impact of global change. On the other hand, short sediment cores taken from recently regenerated salt marshes in the same coastal area interpreted on the basis of microfaunal and geochemical determinations and historical data have shown increasing amounts of sand and foraminifera and very high sedimentation rates (average 16 mm yr-1) during the regeneration process (1950s and 1960s), while the already regenerated environments show much lower sedimentation rates (average 2.5 mm yr-1), abundant agglutinated foraminiferal assemblages and enrichment of Pb and Zn due to industrialization. This rapid regeneration process (less than 10 years) is of great interest for environmental management of modern coastal areas, particularly where extensive reclaimed land is still present and could be easily restored to tidal wetlands under the current scenario of accelerating sea-level rise, as these environments accrete sediment very fast to reach equilibrium with the tidal frame. Acknowledgements: Research funded by TANYA (MICINN, CGL2009-08840), K-Egokitzen II (Etortek 2010) and Harea-Coastal Geology Research Group (80IT365-10, GV) contracts. Ane GarcÌa-Artola received a Basque Government doctoral grant (BFI08.180) and Dr. Eduardo Leorri a Ralph E. Powe Junior Faculty Enhancement Award. KEYWORDS: Clivar-Spain, Climate variability and change, Southwestern Europe, Coastal environments, Sea-level rise