Title

Effects of hydrologic event history on the suspended-sediment behavior of a central California river

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MULTI-PROXY CHARACTERIZATION OF ABRUPTLY DEPOSITED SEDIMENTARY PACKAGES AT PETALUMA MARSH, SONOMA COUNTY, CALIFORNIA

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Petaluma Marsh, at ~20 km^2, is the largest remaining extant salt marsh in San Pablo Bay, California. The marsh lies within the Petaluma River watershed which drains approximately 380 km^2 of land in southern Sonoma county and portions of the northeastern Marin county. The marsh formation and continued development is connected to the fluvial system as well as sea level. Sediment cores retrieved from the marsh therefore have the potential to reveal long-term trends in climate change, as well as, extreme weather events.

We present preliminary data from several cores retrieved from Petaluma Marsh. The cores were collected approximately 700 m due south of the Petaluma River. Tule tidal slough is approximately 100 m away from the core site. The dominant vegetation at the site is pickleweed (*Sarcocornia pacifica*) with dodder (*Cuscutasalina* sp.) and gum plant (*Grindelia stricta*) at higher elevations.

To date, sedimentary and biological proxy analysis has focused primarily on core 1a. This core shows classic sedimentary facies changes reflecting the progression of marsh formation from mud flat to incipient marsh to fully developed peat marsh. However, on two occasions fully developed marsh peat is abruptly overlain by thick packages of inorganic muds. The abrupt change in stratigraphy suggests a dynamic sedimentary event affected the marsh. In this poster we present preliminary multi-proxy data selected to characterize these sedimentary packages and shed light on their cause. Our current working hypothesis is that these packages are the result of intense flooding events most likely caused by an Atmospheric River event.

EFFECTS OF HYDROLOGIC EVENT HISTORY ON THE SUSPENDED-SEDIMENT BEHAVIOR OF A CENTRAL CALIFORNIA RIVER

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Suspended-sediment yields of many developed watersheds have decreased with time, and increased urbanization and hydrologic modifications are often identified as contributing mechanisms. Examination of a river system that had not experienced these alterations during the period of record, yet displayed high variability in suspended-sediment behavior and decreasing trends in sediment yield provided an opportunity to evaluate the effects of hydrologic event history. The objectives of this study were to identify the time-dependent behavior of suspended-sediment concentrations at the terminus of the Salinas River, California, since the initiation of monitoring in the late 1960's, and determine the hydrologic factors that influenced this behavior. The Salinas River is a seasonally active river of moderate size that may be particularly susceptible to the effects of hydrologic event history on suspended sediment behavior due to the high variability of discharge in this system, which is largely driven by ENSO-influenced storm events. We found that suspended sediment yield from the Salinas had decreased, despite little change in the proportion of urbanized land area and no major dam emplacement during the period of record. Hydrologic factors, including hydrograph slope, change in daily discharge and elapsed time since the last high discharge event were found to have significant positive effects on discharge corrected suspended sediment concentrations. The positive effect of hydrograph slope on suspended sediment concentration implied that fine suspended sediment in the lower Salinas displayed a generally positive hysteretic behavior, which was supported by the prevalence of positive hysteresis in events with sufficient data density for analysis. Identification of the preferential mobilization of sediment on the rising limb of the hydrograph as the major mechanism for the overall hysteretic pattern is forensically supported by the annual occurrence of in-channel suspended sediment deposition by early season, channel terminating flows and the flushing function of major hydrologic events found in this study. While hydrologic characteristics were not responsible for temporal changes in suspended sediment behavior, future changes in ENSO cycling would alter the periodization of larger, channel sediment flushing events, in turn affecting suspended sediment residence time in the channelized system.

RESOLVING VARVE AND RADIOCARBON CHRONOLOGY DIFFERENCES IN THE SANTA BARBARA BASIN SEDIMENTARY RECORD, CALIFORNIA

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Santa Barbara Basin (SBB) is well known for producing high quality paleoclimate reconstructions, but the validity of correlations between the basin and other regions rests upon age model accuracy. Yet, the two independent and well-established chronologies based on varve counting and foraminifera-based radiocarbon dating does not consistently agree during the last two millennia. Here the validity of age model assumption that the regional reservoir age of surface waters was invariably 641 ± 119 years through time is tested. This high-resolution ^{14}C study of SBB sediments compares 49 mixed planktonic foraminiferal carbonate and 20 terrestrial organic carbon ^{14}C dates to the varve chronology, in order to extend the high-resolution paleoclimate chronology of the basin back ~2000 years. Evidence indicates that regional reservoir ages do not remain constant through time with ΔR, (i.e. regional reservoir age minus variations in the global mixed-layer ocean reservoir age) fluctuating between 80 and 350 years. Second, there is a consistent ($R^2 = 0.96$) undercounting of laminae couplets (traditionally presumed to represent varves) between AD 150 and ~AD 1700 based on a new varying ΔR ^{14}Cchronology. Previous investigations of SBB varves have focused on the competing roles of biogenic sediment delivery and bottom water oxygen concentrations on the generation of laminae couplets. Due to the Mediterranean climate of the SBB region, loss of varves may occur when low riverine input and infrequent winter storm activity fail to supply siliciclastic layers during La Niña years and negative Pacific Decadal Oscillations. Here we test the assumption that laminae couplets are annual independently of previous studies. We compare two 20th century chronologies generated from the major siliciclastic element concentrations generated by scanning XRF analysis of box core SPR0201-04BC. The first chronology assumes annual precipitation delivery controls laminae couplets and the second assuming laminae couplets are controlled by interannual variability. Although differences between the chronologies are small, they demonstrate how age model assumptions can influence the interpretation of paleoclimatic reconstructions.

THE RETURN OF ATMOSPHERIC RIVERS: TRANSITIONING FROM THE MEDIEVAL CLIMATE ANOMALY TO THE LITTLE ICE AGE IN SOUTHERN CALIFORNIA

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