THE INFLUENCE OF RIVER DISCHARGE, COASTAL WATER LEVELS, AND CLIMATE ON EXTREME SALINITY EVENTS IN THE LOUISIANA COASTAL MARSHES

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Water levels and salinity in Louisiana estuaries are controlled by a balance between the freshwater input from runoff and precipitation, and the salt water mixing into the estuaries at the coast through the coastal boundary layer. The coastal boundary is in turn influenced by exchange with the deeper shelf and Gulf of Mexico waters, as well as the freshwater plume from the Mississippi River. This present study is concerned with the recently observed extremes in coastal salinities and how they relate to these forcing functions.

The deviations from the long-term (1960-2000) monthly mean for each of the variables (using data from various state and federal sources) was computed. Analysis of the deviations indicates that 1999-2000 has been the lowest estuarine freshwater input year in the last 40 years, and that the duration of high salinity levels has been about four times longer than what would normally be expected. The coastal water levels have been lower than normal since late 1999, the Mississippi River discharge has been extremely low, and the Palmer Drought Severity Index (PDSI) has indicted extreme to severe drought conditions in the northern Gulf of Mexico estuarine areas for about the past 18 months.

The deviation data are also being used to develop a spatial-temporal classification matrix. This matrix is being used to look at the coherence among the salinity deviations and the forcing functions in the northern gulf as well as identifying time periods during which similar conditions may have occurred. Stepwise linear regression is being used to model the salinity deviations at several stations along the Louisiana coast. Preliminary analysis indicates that the deviation in Mississippi River flow explains about 40 percent, the PDSI, and the coastal water levels less than 10 percent of the observed salinity deviations on a monthly basis. Similar results were obtained for seasonally averaged data. The model also shows that the effect of the Mississippi River discharge decreases, and the effect of precipitation increases from the coast inland. The model is being refined to look at the effect of lags of the forcing functions on the salinity.