Moored Observations of Salinity Variability in Florida Bay and South Florida Coastal Waters on Daily to Interannual Time Scales

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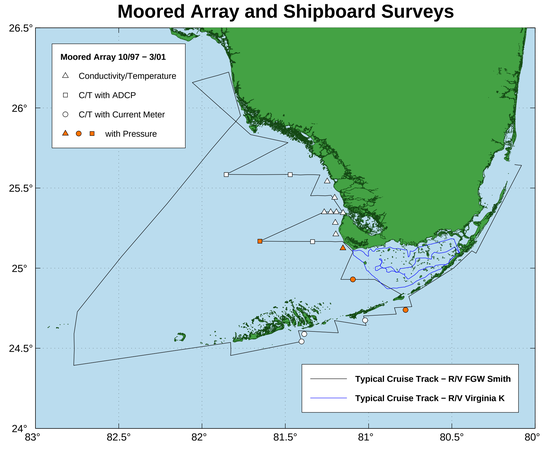
In support of the South Florida Ecosystem Restoration, Prediction, and Modeling Program (SFERPM), a multi-year physical oceanographic study of the connectivity between Florida Bay and the surrounding waters of the Gulf of Mexico, the Southwest Florida shelf, and the Atlantic Ocean is underway. The field survey includes a moored array equipped with current meters, bottom pressure sensors and conductivity/temperature sensors, satellite-tracked surface drifters, and bimonthly interdisciplinary shipboard surveys with continuous underway thermosalinograph observations of surface salinity, temperature, and fluorescence. The moored conductivity/temperature array consists of 21 sensors positioned from the Florida Keys reef tract, though western Florida Bay and around Cape Sable, extending northward off the mouths of the Shark, Broad, and Lostmans Rivers, to Indian Key just south of Marco Island, Florida.

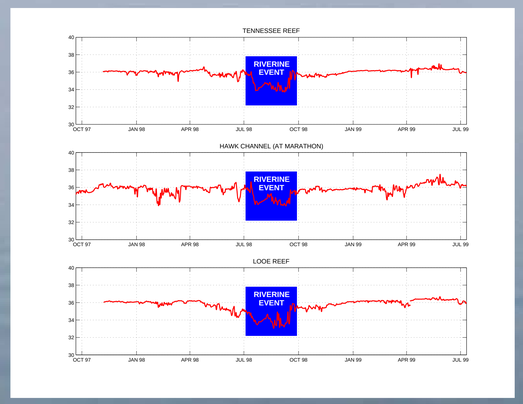
The moored array pictured below was maintained from October 1997 through March 2001. Following this period, the array was modified, relocating instrumentation from several offshore sites (shown below) to new locations within Florida Bay. These new locations vary seasonally and are aimed at studying the inner basin dynamics of Florida Bay. Additional moorings with real-time capabilities are under construction for deployment in the Keys passages at Long Key and 7-Mile Bridge. These stations will help quantify salt and other fluxes between the Bay and the reef tract. Further improvements to the real-time sensor suite at Looe Key will also be completed this year. Shipboard surveys continue and have been expanded as of summer 2002 to include monthly surveys of Biscayne Bay and bimonthly surveys of the Dry Tortugas. These modifications, to both the array and to the shipboard surveys, have increased our coverage over South Florida coastal waters and have improved our ability to study the interaction between the unique marine environments of the region.

Moored Array and Shipboard Surveys

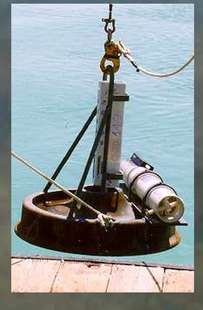


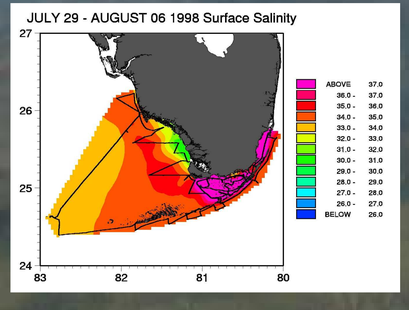
Sponsored by the NOAA / South Florida Ecosystem Restoration, Prediction, and Modeling Program.

Remote Riverine Outflow Affects Salinities in the Florida Keys



Larger scale ocean transport mechanisms have been seen to affect the moored salinity records. As seen above, low salinities from June 1998 through September 1998 at our Florida Keys moorings, including sites at Tennessee Reef, Hawk Channel, and Looe Reef, suggest the presence of remote riverine discharge. During this time period, satellite data verify that the Gulf of Mexico Loop Current was in a prolonged state of partial development. This "young" Loop Current may be responsible for driving southward flow towards the Tortugas and onto the Southwest Florida Shelf, possibly entraining Mississippi River Water from the northern Gulf, around the Tortugas, and into the Florida Keys. Salinity surveys from the same time period (below) show that this low salinity signal, seen at all three Keys moorings, was not due to a local freshwater event originating in South Florida.





All salinity time series plots presented here have been processed with a 40 hour low-pass filter, unless otherwise noted. Further questions regarding this salinity data set may be directed to:

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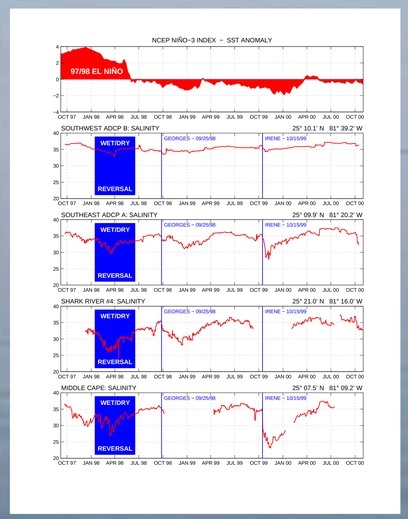
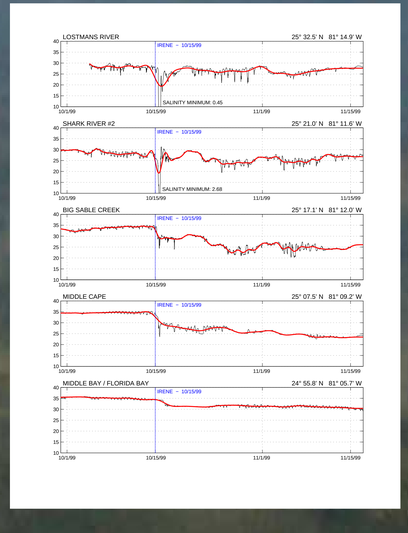
El Niño Produces Wet Season / Dry Season Reversal



Though the bulk of the array was deployed late in 1997, the effects of the 97/98 El Niño on the climate patterns of South Florida can be seen throughout the salinity time series. From November 1997 through March 1998, regional rainfall was roughly three times normal, consistent with El Niño conditions. As a result, a wet season / dry season reversal is evident in 1998 with salinity minima at our moorings in March and April (traditionally the most saline period of the year due to dryer, winter weather) and maxima prevalent in late summer (contradictory to typical wet season conditions).

Storm Events Introduce Freshwater to Southwest Florida and Florida Bay



Mooring sites throughout the array recorded the effects of local weather events between 1997 and 2001, including heavy precipitation due to passing cold fronts and hurricane activity in the region. Georges, Mitch, Harvey and other tropical systems passed over the array. By far, the most dramatic influence of a tropical cyclone on the time series appeared in October 1999, when Hurricane Irene dumped massive amounts of freshwater over South Florida. A significant quantity of this precipitation was eventually discharged through the rivers of the Everglades, north of Cape Sable. This flushing caused extreme salinity minima in the days following Irene at our Lostmans River, Broad Creek, and Shark River mooring locations. This low salinity water mass migrated southeastward into Florida Bay, which had already seen an influx of freshwater through the Taylor Slough. As a result, salinities in Florida Bay remained low for four to five months, indicative of the relatively long residence time following such extreme events.