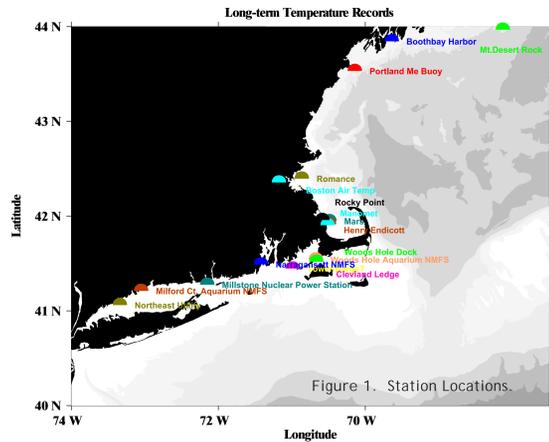


Long-Term Temperature Records From New England's Coastal Waters

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Abstract:

Water temperature has been collected on a near-daily basis for over a decade at almost a dozen locations along the New England coast by various state, federal, and commercial institutions. These records have now been archived in a common ORACLE database and are available on the web. The NMFS labs have made a significant contribution to this set with time series from Woods Hole, MA beginning in the 1960's, Milford, CT in the 1970's, and Narragansett, RI in the 1980's. However, there are several other non-NMFS sites maintained by the Northeast Utilities power plants and the states of Rhode Island, Massachusetts and Maine. The Division of Marine Resources in Boothbay Harbor, for example, now has nearly a century of data.

The interannual variability of temperature anomalies (after removing seasonal cycles) is fairly coherent throughout the New England region. There are some indications of warming trends that are most evident during the winter months.

Questions:

Now that these data-sets are merged, how should we analyze the collective set? What does it say about long-term variability of our coastal waters? Can we track the transport of Canadian source water as it enters into and out of the Gulf of Maine and how important is the influx of remote sources relative to the local runoff and surface heating?

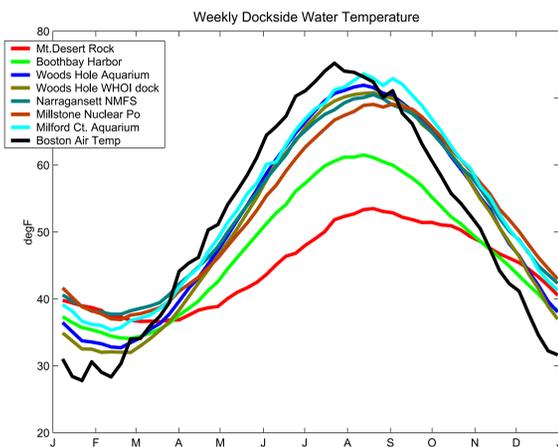


Figure 2a. Seasonal cycle of temperature for various dockside locations.

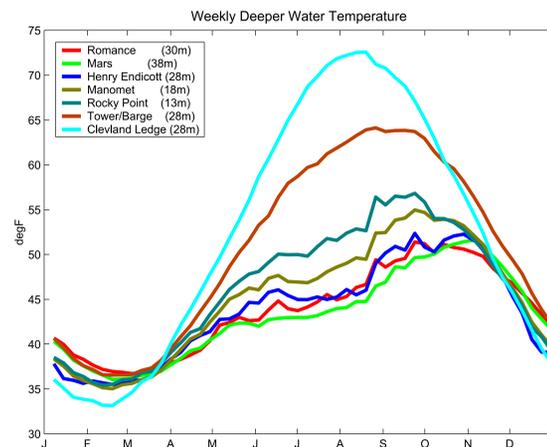


Figure 2b. Seasonal cycle of temperature for deeper than dockside locations.

Preliminary Results/Conclusion:

After removing the seasonal cycles (Figure 2), the annual anomalies (Figure 3) are fairly coherent from the sites tested thus far. Sites at Woods Hole, MA, Boothbay Harbor, ME, and the Millstone Nuclear Power Station in Waterford, CT all recorded warm years in 1984, 1991, and 1995, and cold seasons in 1987/1988, 1993, and 1996.

Wolff & Incze and Landers have both noted a significant warming for their respective records especially for the winter months. After plotting the anomalous seasonal cycles for each decade, the change is evident (Figure 4). The warming occurs in the winter months so that if one removes the long-term seasonal cycles at the particular sites there are strong positive anomalies in recent decade(s). This warming appears partially correlated to a similar index of local air temperature anomalies. Based on the Boothbay Harbor series with the long-term seasonal cycle removed (Figure 4a), this process has evidently been occurring throughout this century.

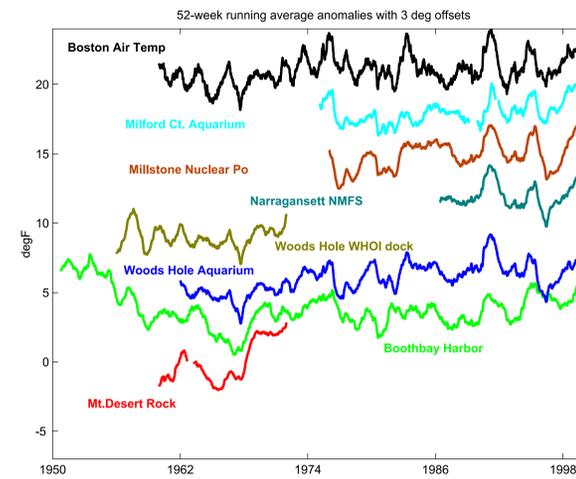


Figure 3a. Annual anomalies from the last half century with seasonal cycle removed. (A 52-week running average has been applied to the anomalies plotted to depict major events on an annual time scale.) Note coherence of interannual events between sites. Note BBHR record goes back to 1905.

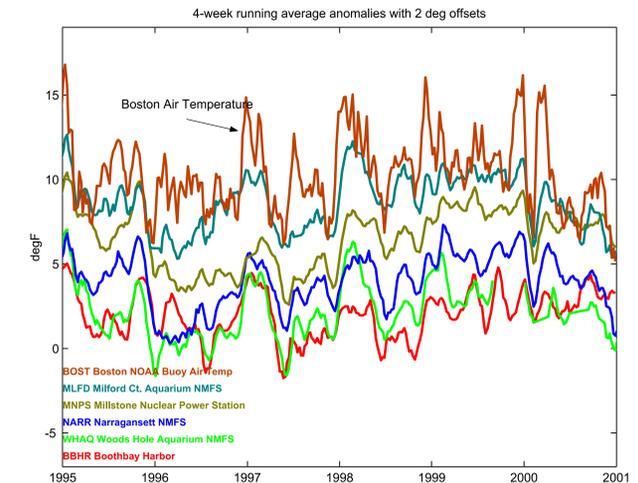


Figure 3b. Four-week running averages of the weekly anomalies for several sites over the past several years depicting the coherence of events on a monthly time scale.

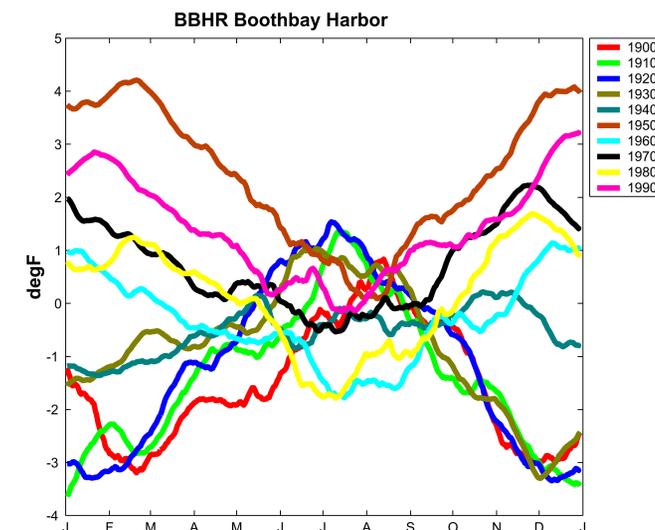


Figure 4a. Decadal-mean seasonal cycles from Boothbay Harbor with the century-mean seasonal cycle removed.

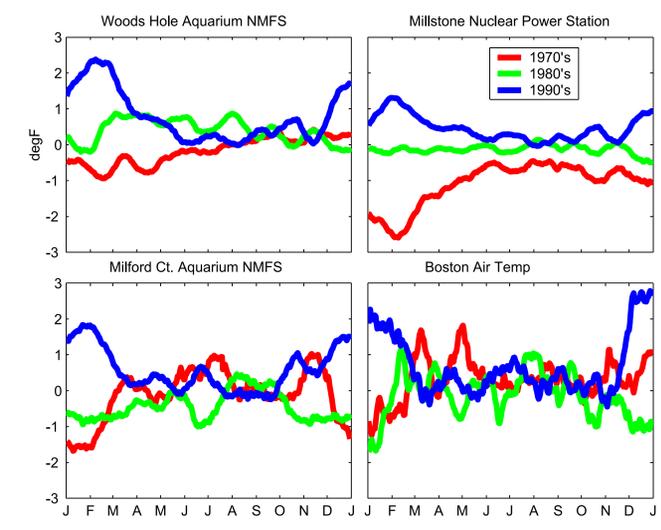


Figure 4b. Decadal-mean seasonal cycles with the record-mean seasonal cycle removed. The lower right panel indicates that air temperature is a possible source of the warming water temperatures.