Submitted to the International Union of Geodesy and Geophysics (IUGG) by Professor Alex Soloviev of the Nova Southeastern University Oceanographic Center and accepted for oral presentation at XXIV IUGG General Assembly scheduled for July 2-13, 2007 in Perugia, Italy

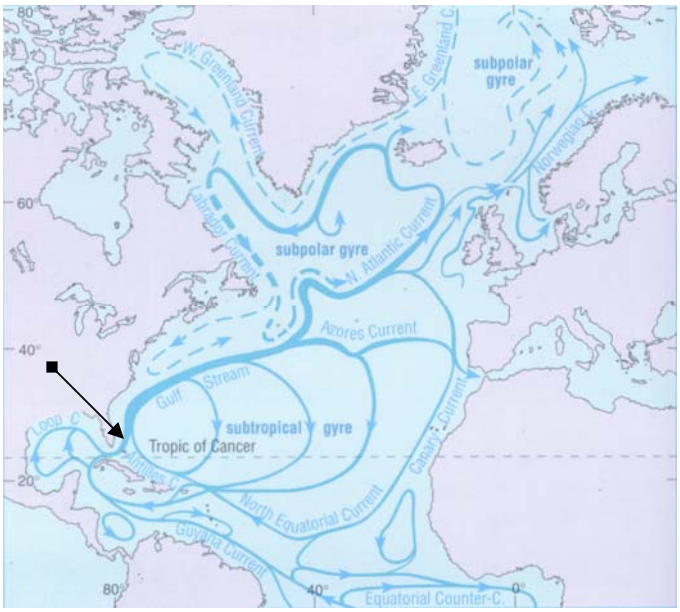
Title

Energetic Internal Oscillations in the Straits of Florida Preceding Formation of Strong Hurricanes in the Tropical Atlantic Region

Abstract

In this paper we report some intriguing results of the analysis of a seven-year observational data set obtained by a coastal ocean observatory established in 1999 on the Dania Beach, Florida shelf. The energetic internal oscillations with 10 hr period previously reported at this location appear to precede the formation of strong hurricanes in the tropical Atlantic region (including the Caribbean Sea and the Gulf of Mexico) with lead time from one week to one month. This phenomenon is presumably related to the fact that flow dynamics in the Straits of Florida reflect the state of the whole North Atlantic subtropical gyre and contain useful information about the conditions favorable for the hurricane formation and intensification such as the presence of warm pools in the tropical Atlantic region.

The overheating of the tropical ocean preceding the formation of intense hurricanes increases pressure gradients in the western boundary current system and the Straits of Florida "resonate" at an internal seiching period. The cause of the energetic 10 hr internal oscillation in the Straits of Florida has been attributed to the baroclinic cross-stream seiching. A natural period of the baroclinic (internal) seiching developing between Florida and Bahamas is approximately 10 hrs at the Dania Beach, Florida latitude. The location of the coastal observatory in the vicinity of the Gulf Stream front ensures the best conditions for detecting cross-stream seiching due to significant cross-stream current velocity and temperature gradients. When combined with other observational tools, such observations may be able to improve midterm hurricane forecasting capabilities.



This illustration represents a schematic representation of the connectivity of the Straits of Florida with the tropical Atlantic region via the North Atlantic subtropical gyre. Location of the coastal observatory in the Straits of Florida is indicated by the black arrow. Due to dependence of the Earth rotation effects on latitude, the subtropical gyre takes an asymmetric shape including a strong and narrow western boundary current passing through the Gulf of Mexico as the Loop Current and then through the Straits of Florida as the Florida Current. The overheating of the tropical ocean preceding the formation of intense hurricanes increases the sea level anomaly and "pressure" in the western boundary current system and the Straits of Florida "resonate" at an internal seiching period.

March 2, 2006