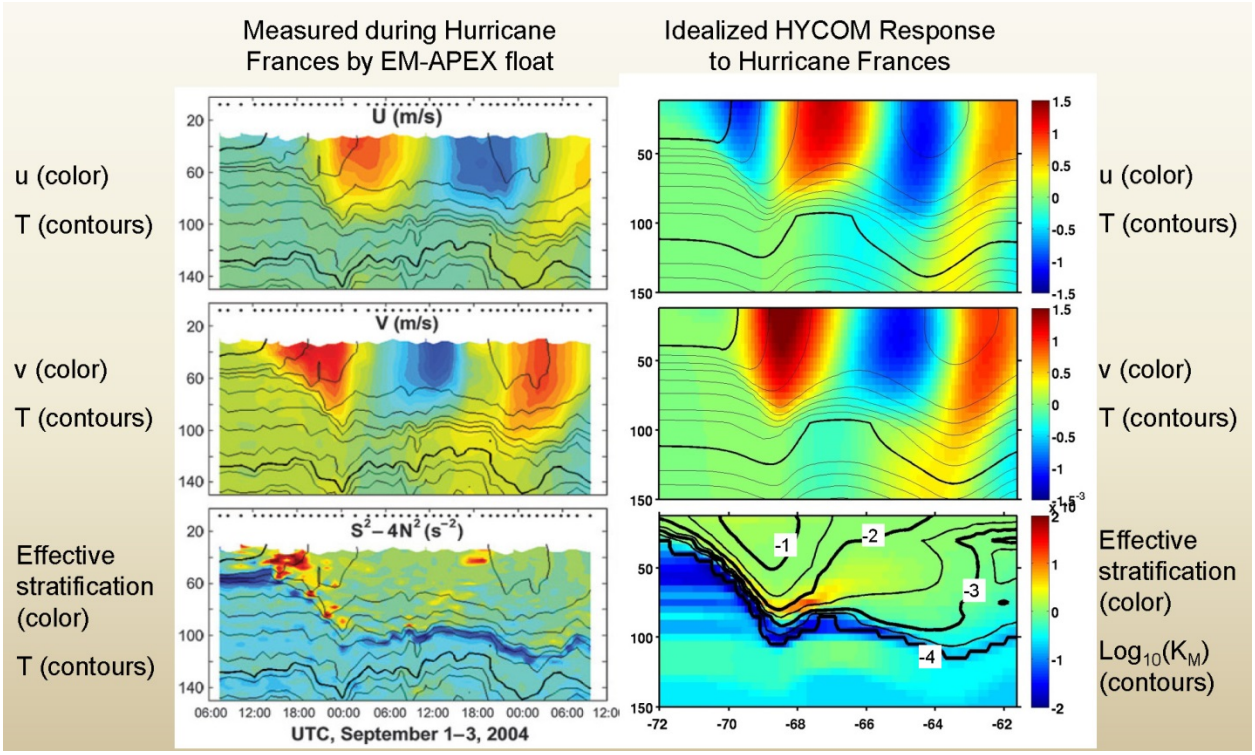
Ocean Model Evaluation and Improvement in Support of the Next-Generation HWRF Regional Tropical Cyclone Prediction System

George Halliwell and hurricane modelers from AOML/HRD and NCEP/EMC

This project combines the capabilities of PhOD ocean modelers and coupled Tropical Cyclone (TC) modelers to improve coupled forecasts as part of the Hurricane Forecast Improvement Project (HFIP). Accurate intensity forecasts require that the coupled model accurately predict the cooling rate of sea surface temperature (SST) in response to storm forcing, which in turn requires the ocean model to accurately predict mixed layer deepening and entrainment cooling. There are three primary components to this work. In the first component, a one-dimensional version of the HYbrid Coordinate Ocean Model (HYCOM) was coupled to the multiple-nest experimental Hurricane Weather Forecast Model (HWRF). A set of idealized experiments was run with this configuration to isolate the impact of initial ocean heat content, storm translation speed, and storm size on predicted intensity. In the second component, idealized ocean model response experiments run with HYCOM are being compared to observations. The figure illustrates a depth-time series of several fields during the passage of Hurricane Frances (2004), demonstrating that the ocean model can potentially perform well in an idealized setting when provided with accurate atmospheric forcing and quasi-optimal choices of numerical algorithms and sub-grid scale turbulence closure schemes. In the third component, G. Halliwell is collaborating with NCEP/EMC as co-lead of the HFIP Ocean Model Impact Tiger Team to evaluate ocean model performance and document the impact of ocean coupling on intensity forecasts produced by the HYCOM-HWRF coupled prediction system.



Depth-time plots of several upper ocean fields during the passage of Hurricane Frances (2004). Panels at left show fields measured at two radii of maximum winds to the right of the storm track by EM-APEX profiling floats (From Sanford et al., 2011, J. Phys. Oceanogr.).Panels at right illustrate ocean fields from an idealized ocean response experiment to forcing by the same storm.