2012 Project Summary

SODA: Exploring Centennial Changes in Ocean Circulation

PIs: James Carton[1] and Benjamin Giese[2]
U.S. Collaborators: Gennady Chepurin[1], Semyon Grodsky[1], H. Siedel[2], Gilbert Compo[3]
[1]University of Maryland, College Park, MD
[2]Texas A&M University, College Station, TX
[3]University of Colorado/Cooperative Institute for Research in Environmental Sciences, Boulder, CO

The objective of this collaborative project between University of Maryland and Texas A&M University is to explore the potential of data assimilation to allow reconstruction of ocean climate variability throughout the 20th century. One theme of this work has been to carry out data assimilation reanalysis experiments relying primarily on surface forcing generated by the atmospheric 20CRv2. The potential of long reconstructions is evident in a number of the papers collected in the Special AMOC Volume of *Deep-Sea Research* (*Carton and Häkkinen, 2011*). A second has been to explore the usefulness of ensemble Kalman Filter methods.

Recent Results

(1) Exploration of past climate variability. *Giese et al. (2010)* examines one El Nino event early in the 20th century and its potential climate (and human health) impact. *Carton et al. (2011a)* examines variability of water properties during the latter half of the 20th century in the Nordic Seas and adjacent seas. This historical analysis reveals considerable decadal variability in temperature, salinity, and density, which has implications for a wide variety of processes, including the rates of water sinking.

(2) Examination of historical data sets and observing system simulation experiments (OSSEs) to determine what variability could have been detected by the historical observing system. It has become evident that the bias known to be present in the historical XBT data set has been changing in time. *Giese et al. (2011)* explores the impact of the XBT (and MBT) bias on ocean reanalyses. The historical observing system has changed dramatically in the course of the 20th century, expanding geographically and in depth. *Carton et al. (2011b)* uses a series of OSSEs to investigate the extent to which a climate event as extreme as the 1997/8 El Nino could have been observed if it had occurred earlier in the 20th century. The results are quite encouraging, but additional studies will be needed to explore the detectability of weaker variability, and variability whose focus is at higher latitudes. Finally, a study by *Santorelli et al. (2011)*, which was part of his dissertation research, examined some of the problems connected with surface heat flux estimation.

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