

Development of a Global Hydrographic Climatology with High Quality Arctic Data

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<http://psc.apl.washington.edu/Climatology.html>

LONG-TERM GOAL

The goal of this project is to develop a global ocean climatology that contains a high quality representation of the arctic seas for use in PIPS (and other) model development. Our product is called the Polar science center Hydrographic Climatology, or PHC.

OBJECTIVES

Our objective is to assist in the development of PIPS 3.0, the next generation Navy operational polar model. Specifically, we propose to develop a gridded oceanic data set that will be uniquely suited to this model. It will consist of global temperature and salinity fields using new Russian and Western arctic data that can be used for model initialization, restoring, and validation.

APPROACH

Our approach is to merge two data sets: (1) The Arctic Ocean Atlas (AOA) produced by the Environmental Working Group (EWG, 1997, 1998) in which formerly classified Russian and Western data have been gridded into fields for the Arctic Ocean and Nordic Seas, and (2) the World Ocean Atlas, 1998 version (WOA98; *Antonov et al.*, 1998; *Boyer et al.*, 1998) produced by the National Oceanographic Data Center (NODC) under the leadership of S. Levitus, which includes data from many sources into a global product. NODC does not have access to the original Russian data that are included in the AOA, and thus the Arctic Ocean fields in WOA98 are not as reliable. We merged AOA and WOA98 temperature and salinity fields using optimal interpolation. The AOA data were assigned lower error in the Arctic regions than the WOA data. The opposite was true in the Nordic Seas, as we found that the WOA reproduced the strong exchanges of Atlantic and Arctic waters more accurately than the AOA. Our result is a global product that includes a state-of-the-art representation of the Arctic Ocean. It provides the first comprehensive view of waters as they move from the North Pacific, through Bering Strait into the Arctic Ocean, and then out the Canadian and Eurasian straits into the Northwest and Northeast Atlantic Ocean. The product is interpolated onto the exact same grid as the WOA98 product and in the exact same format, making it easy for current WOA users to use our new PHC product. M. Steele is responsible for guiding the research; W. Ermold is the programmer who runs the merging and graphics analysis software.

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WORK COMPLETED

The first version of PHC merged the Environmental Working Group (*EWG*, 1997, 1998) and WOA94 (*Levitus and Boyer*, 1994) climatologies. In the past year, we have completed transition of this product to PIPS modelers, who are using it for model initialization, climate restoring, and validation. Several dozen other modeling centers are also using this product.

Early in 2000 a new WOA98 data set was publicly released. It contains more data and uses an improved interpolation algorithm relative to the 1994 version. During this past year we thus updated the PHC using this new product. We also improved the PHC interpolation algorithm. The new PHC is now publicly available. We are also updating the PHC web site (<http://psc.apl.washington.edu/Climatology.html>) to reflect these changes.

We have a paper in press at the Journal of Climate (*Steele et al.*, 2000) that describes the new version of PHC. In addition, we have presented this material at several national and international meetings and workshops.

RESULTS

We are using the PHC actively in our research. For example, we are using it as "ground truth" in the Arctic Ocean Model Intercomparison Project (AOMIP), an international cooperative project funded currently by the International Arctic Research Center. We are comparing model output from a variety of centers (including the Naval Postgraduate School) and determining where the models agree and where they disagree with the observations as represented in part by the PHC.

IMPACT/APPLICATION

The use of a good climatology should reduce the magnitude of the artificial "climate restoring" term needed in PIPS. This seems to be the case, but we need to investigate further. The ultimate goal is to eliminate this term completely, which will involve solving the outstanding mystery in the entire community as to why most models need this term to accurately simulate a PHC-like mean state.

TRANSITIONS

PIPS modelers have been using the first version of our PHC that included the WOA94. We will be assisting soon with the transition to the newer PHC that includes WOA98.

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PUBLICATIONS

Steele, M., R. Morley, and W. Ermold, PHC: A global ocean hydrography with a high quality Arctic Ocean, *J. Climate*, in press, 2000.