Satellite Altimetry

Robert Cheney

Summary

Since altimetry data are not really old enough to use the term data archaeology, Mr. Cheney referred to the stewardship of these data. He noted that it is very important to document the basis for an altimetry data set as the algorithms and corrections used to arrive at the Geophysical Data Record (GDR) have been improving and are continuing to improve the precision of sea level data derived from altimetry.

He noted that the GEOSAT Exact Repeat Mission (ERM) data set has recently been reprocessed by his organization in the National Ocean Service of NOAA and made available to the scientific community on CD/ROM disks by the National Oceanographic Data Center of the U.S. (NODC). The new data set contains a satellite orbit more precise by an order of magnitude together with an improved water vapor correction. A new, comprehensive GDR Handbook has also been prepared.

Cross over differences have been used on the classified portion of GEOSAT in lieu of the actual orbits. These data are being used to analyze sea level differences. The cross over data are also available from NODC on CD/ROM disks. The original data for GEOSAT are stored on about 5,000 low density tapes. Since these tapes will eventually deteriorate, there is a question of whether these data should be preserved, perhaps on optical disks. Precision of the GDRs has been improved, but there may be additional factors discovered as new altimetry missions are launched.

Mr. Cheney then proceeded to show examples of how the data are processed and interpreted. He showed examples of time series analyses in the Atlantic in which he and Bruce Douglas looked at sea level variability in 2° by 1° cells.The analyses and reanalyses used to derive the best precision were described. The use of historical tide gauge records to improve the GDR were shown. This again raises the question of preservation of original records so that better quality output can be derived upon reanalysis. What has been learned from this work may be applied to TOPEX/Poseidon which will test whether further improvements can be achieved.

Finally, Mr. Cheney illustrated the potential of altimetric data to measure changes in global sea level. Although a longer time series will be needed techniques developed using GEOSAT data have already revealed possible errors in the ionospheric correction so that they are now investigating improvements that can

be made in the ionospheric model. Since TOPEX will measure the ionosphere this should not be a problem for data from that mission. Other possible improvements to the data were discussed. Raw ERS 1 altimetry are now being received and GDRs are processed by NOAA. Cross over differences from these data are being used to map sea level data in the same reference plane as the GEOSAT data, so that the time series can be extended in a way that is scientifically valid.

High Resolution Modeling of the Global Thermohaline Circulation

Albert Semtner

Abstract

Historical data have a variety of uses in ocean modeling. Surface data often help take the place of poorly known surface fluxes. Subsurface data are used to constrain models in a variety of ways, usually classified as diagnostic, robust-diagnostic, and free-thermocline. We designate a new method of forcing only the upper water column in water-mass production regions as 'convective forcing'. To the extent that data are not used in forcing or constraining a model, they may play a vital role in the initialization and/or validation of that model.

The judicious use of data in our high-resolution global ocean model enables the determination of the thermohaline circulation to an accuracy that would presently be impossible with a purely prognostic integration. A global 'conveyor-belt' circulation emerges that consists of relatively high-speed western boundary undercurrents, portions of the Antarctic Circumpolar Current, and equatorial deep jets in the Pacific. These are connected by returning near-surface flow through Indonesia and intermediate flow through the Drake Passage. Recent integrations in both the free-thermocline and the convective-forcing modes indicate that the deep circulations inferred by the two methods are nearly identical, giving added confidence in the overall results.

There are continuing needs for high-quality historical data. Specific needs are for high-resolution local datasets in model verification, high-quality datasets for convective forcing, and large-scale density fields for initialization of poorly sampled southern ocean regions.