EDITORIAL

TOPEX/POSEIDON: 5 years of progress

Observe, understand, predict: words that ring like a mantra in many areas of science. Oceanography is no exception, and researchers have constantly refined their methods and equipment over the years to achieve these three objectives. Early observers soon realised the major role played by the oceans in regulating the Earth's environment, and recognised the need to understand them better. But until fairly recently, the data were confined to patchy measurements from ships, buoys, or the shore. The advent of earth observation satellites in the 1970s changed all that, providing us with vast quantities of data. At the same time, ever more powerful computers gave us the tools to make sense of these data and describe the ocean more precisely. As a result, *observation* and *understanding* advanced considerably in the 1970s and 1980s. The 1990s brought new observation techniques and more powerful computers and modelling tools, paving the way for the final phase: *prediction* and the real beginnings of operational oceanography. In the next millennium, we will see operational systems observing the oceans on a global scale. The Global Ocean Data Assimilation Experiment program (GODAE) will be a pioneer, with satellite altimetry playing a key role.

Think back to 1985, when the U.S. and French space agencies, NASA and CNES, prime movers behind the TOPEX and POSEIDON projects, joined forces to develop a high-precision altimetry mission. The decision was driven mainly by the agencies' desire to promote and optimise satellite-based ocean observation, after the successful SEASAT and GEOSAT missions. The science and engineering teams pooled their skills to meet the challenge, leading to the launch of the TOPEX/POSEIDON satellite on 10 August 1992. The system has since provided unprecedented performance, its success a tribute to exemplary cooperation between the NASA and CNES teams.

Since the launch nearly six years ago, TOPEX/POSEIDON has closely monitored the oceans and recorded the slightest variations in sea level. The millions of measurements make up the largest set of altimeter data ever compiled. Over 400 teams worldwide have used the data to achieve significant results and further our understanding of the complex mechanisms regulating the ocean. The mission's success is also due to the rapid availability of well documented, continuously updated and upgraded data, easily accessed on CD-ROM, and to the efficiency of the AVISO and PO-DAAC distribution centers.

The principal investigators (PIs) and co-investigators (Co-Is) assigned to the project by NASA and CNES to provide scientific input at every stage of the mission's development and operation have also been instrumental in its success. Meetings of the TOPEX/POSEIDON Science Working Team (SWT) have provided regular opportunities for PIs, Co-Is and engineering teams to engage in constructive debate and move the project forward, leading to the development of new processing algorithms, better validation and quality control, and higher performance. Ten years after the first SWT was formed, and after four years analysing data returned by the mission, NASA and CNES decided to continue the project and called for new proposals for the TOPEX/POSEIDON Extended Mission. The SWT was initially made up of 38 PIs (see TOPEX/POSEIDON Science Investigation Plan, 1991) who focused on preparing for the mission, validating and operating the system, and outreach. The extended program will see 60 PIs building on the previous SWT's results and preparing future missions.

This special issue of the AVISO newsletter, marking five years of TOPEX/POSEIDON operations, contains contributions from each member of the new SWT. It provides an overview of the applications of satellite altimetry, covering areas as diverse as ocean circulation from the mesoscale to seasonal and interannual signals, ocean wave dynamics, the long-term trend in sea level, tropical dynamics, the dynamics of western and eastern boundary currents, regional studies of inland seas and lakes, tidal measurements, the response to atmospheric forcing, data assimilation in ocean models, pre-operational applications in oceanography and marine meteorology, studies of the marine geoid, and geodynamics. Many studies in this newsletter also address quality control and improved system features, like correction models, orbit determination, reference systems and drift monitoring.

A key application of TOPEX/POSEIDON data is as input to predictive models for assisting observation and monitoring of the 1997-98 El Niño Southern Oscillation (ENSO). Interim Geophysical Data Records, now available in just two days, are also providing new scope for pre-operational applications. In response to the need for continuous ocean monitoring and data acquisition over periods spanning four to ten years and more, NASA and CNES have given the go-ahead for the Jason-1 program. This will take over from TOPEX/POSEIDON from the turn of the century. Latest estimates of the TOPEX/POSEIDON satellite's lifetime suggest it will continue operating up to the year 2000, and even beyond, ensuring a smooth transition between the missions. High-precision satellite altimetry is set to become a vital component of future operational ocean observing systems, which will rely on high-resolution ocean models forced by readily available in situ and satellite data.

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