Conferencias Magistrales

Los buques oceanográficos de la UNAM y su papel en las investigaciones marinas en México

Ingvar Emilsson
Coordinación de Plataformas Oceanográficas, UNAM

Los buques oceanográficos de la UNAM, EL PUMA y JUSTO SIERRA, fueron adquiridos al inicio de la década de los ochenta como medio indispensable para la investigación de la Zona Económica Exclusiva, recién establecida por México, permitiendo así el uso adecuado del potencial humano e institucional que se había creado mediante los esfuerzos realizados en los años setenta para crear una verdadera infraestructura en las ciencias del mar a nivel nacional.

El B/O EL PUMA tiene su base en Mazatlán, Sin. y cubre las áreas oceánicas frente al litoral Pacífico mientras su gemelo B/O JUSTO SIERRA opera en el Golfo de México y el Caribe con su base situada en Tuxpan, Ver.

Desde su entrada en servicio, anualmente cada buque ha operado cerca de 150 días en 10 campañas y ha navegado una distancia equivalente a un perímetro del globo terráqueo, en promedio. En estas unidades multidisciplinarias, cómodas y eficientes, han trabajado más de 10 mil personas, entre investigadores, asistentes técnicos y estudiantes, nacionales y extranjeros.

La entrada en el escenario de estas unidades representó un verdadero parte-aguas en el desarrollo oceanográfico nacional y los trabajos efectuados mediante su apoyo han avanzado de manera muy significativa el conocimiento de los mares de México y áreas oceánicas aledañas en todas sus facetas, biológicas, químicas, físicas y geológicas.

A general review of MT studies of continental dynamics

Martyn Unsworth
University of Alberta

Plate tectonics has provided a unifying explanation for many diverse geological processes, ranging from the locations of earthquakes and volcanoes to the distribution of mineral deposits. Since plate tectonics was first widely accepted in the 1960's, geophysical imaging has played a major role in understanding the processes that occur at plate boundaries. Seismic studies are the most widely used and have defined the geometry of many plate boundaries at depth, both by imaging variations in seismic wave velocity and the spatial and temporal distribution of earthquake hypocentres. Magnetotelluric (MT) studies use low-frequency radio waves to image subsurface resistivity structure and provide complementary information to that obtained from seismic studies. The resistivity of crustal and upper mantle rocks is controlled by minor constituents with a low resistivity, such as aqueous fluids, partial melt, graphite and sulphide minerals. In this presentation, I will summarize what magnetotelluric exploration has contributed to the study of continental dynamics.

Rift valleys and mid ocean ridges are the locations where two plates diverge. MT studies of these regions have delineated the distribution of partial melt and hydrothermal circulation at depth, and shown that these features are not generally symmetric at depth.

Where plates converge, the style of deformation depends on whether the plates are composed of continental or oceanic crust. If at least one of the plates is composed of oceanic crust, then a subduction zone will develop with a fluid saturated plate descending into the mantle. MT studies of several subduction zones (Cascadia, Central America, and South America) have shown where fluids are released from the subducting plate from depth of a few kilometres to more than 100 km. These fluids have a profound impact on the composition and rheology of the overlying crust and mantle. When both plates are composed of continental crust, then buoyancy prevents subduction occurring and a zone of thickened continental crust can develop (e.g. Tibetan Plateau and Anatolian-Iranian Plateau). MT studies of these continent-continent collisions have defined regions in the crust with an elevated fluid that are weaker than the surrounding crust and may act as channels of crustal flow.

At strike-slip boundaries, one plate moves past the other and a zone of relatively narrow deformation can develop. These boundaries are important because of the destructive earthquakes that can occur on them. MT studies of a number of strike slip faults have revealed that zones of elevated fluid content can occur, both in the brittle upper crust, and also in the ductile lower crust. This includes studies of the San Andreas Fault, the North Anatolian Fault and the Alpine Fault in New Zealand. The fluid content appears to show some relation with the type of seismic behaviour exhibited by the fault. However it is not clear if the fluids control the seismic behaviour, or whether the deformation produces zones of high fluid content.

This area of research has advanced significantly in recent years as data collection allows larger grids of stations to be collected, and improved software allows 3D inversions to become more widely used. Combined seismic / MT inversion is a developing field that is also improving the ability of MT data to reliably image crust and upper mantle structure in regions of active deformation.

The heliosphere at solar minimum: what are we learning from STEREO?

Angelos Vourlidas
Naval Research Laboratory

The SECCHI telescopes aboard the STEREO mission have been providing continuous imaging of the corona and inner heliosphere since 2007. The observations have already provided important clues about the magnetic nature of CMEs. However, the extended solar minimum allows us an opportunity to observe the quiescent solar wind as well. I review the status of solar wind analysis based on the SECCHI observations and what have we learned from this analysis.