Coral Sea circulation and tides from radar altimetry, tidal models and in-situ data. by

Craig Steinberg*, Derek Burrage*, Luciano Mason+, and Lance Bode+.

*** Australian Institute of Marine Science**
PMB No 3, Townsville MC, Qld, 4810 (077) 789 211
+ James Cook University

Significant improvements in the accuracy and precision of radar altimetry sensing of sea surface height have been attained during the first two years of operation of the TOPEX/POSEIDON (TP) mission. Since the TP orbits have been determined with high accuracy, the most significant remaining source of time-varying error in mapping low-frequency sea level variations lies in tide model corrections. These corrections are used to remove tidal aliases from the altimetric heights prior to spatial and temporal smoothing, and least squares adjustment to determine the time-varying and mean (geoid plus steady ocean circulation) sea-level components. Using an alternative approach, the TP altimetry data itself can be used to determine the tides globally at scales of 10s to 100s km. However, tides determined in this way obviously can not be used as an independent correction for the altimetric heights.

Tidal predictions using a range of recently developed tidal models for locations in the Coral Sea are being compared in order to select an optimal tidal model for use in the region. These models fall naturally into 3 classes; those based on numerical hydrodynamic models, inverse dynamical models, which also assimilate sea level data, and those derived from altimetry data (TP, GEOSAT etc). An independent check on the performance of these models is afforded by long-term sea-level data acquired from offshore reefs and islands.

Selected results from the model inter-comparisons along with *in-situ* data will be discussed and examples of the use of independent tidal models to correct the altimetry data will be shown. The resulting sub-tidal frequency fluctuating sea level fields will then be presented and interpreted with respect to known features of the Coral Sea circulation.

AUSTRALIAN WEATHER

Harvey Stern

Victorian Regional Office, Bureau of Meteorology, Australia.

Abstract

The island continent of Australia features a wide range of climatic zones, from the tropical regions in the north, the arid expanses of the interior, to the temperate regions of the south. With the exception of the eastern uplands, the generally low relief of Australia causes little obstruction to the large-scale atmospheric systems which control the climate.

In the winter half of the year, the anticyclones pass from west to east across the continent. Northern Australia is then influenced by mild and dry southeast trade winds, and southern Australia experiences cool and moist westerly winds. The westerlies and frontal systems associated with depressions over the Southern Ocean cause rainy periods over southern Australia during the winter. Periodic northwest cloudbands appear when upper troughs "shear off" from the westerlies into the sub-tropics. Cold outbreaks occur in southern Australia, with snowfalls down to low levels, when cold sub-Antarctic origin air is directed northwards by intense depressions.

In the summer half of the year, the anticyclones follow a more southerly track across the southern fringes of Australia resulting in mostly settled weather over the temperate zones. However, heatwaves occur when the eastward progression of these anticyclones is blocked and winds turn northerly and persist for some time. It is when these northerly winds strengthen after an extended dry spell, that the bushfire prone areas suffer their worst outbreaks. Northern Australia comes under the influence of summer disturbances associated with the southward intrusion of moist monsoonal air, resulting in the rainy season. Southward dips of the monsoonal low pressure trough sometimes spawn tropical depressions and cyclonic storms and, in turn, may lead to wet episodes of many weeks duration.

Median annual ***rainfall*** varies from 4000 mm along the north Queensland coast and the Snowy Mountains to only 100 mm in the vicinity of Lake Eyre. The more densely populated coastal regions mostly receive between 750 mm and 1250 mm annually. Inter-annual rainfall variability is high over much of the inland, and in eastern and northern Australia this variability has been linked to the El Nino Southern Oscillation (ENSO) phenomenon.

Average maximum ***temperatures*** exceed 35 C over a vast area of the interior during summer, and exceed 40 C in the northwest, but average 20 C to 25 C along the southern coast and in the alpine region. Sharp temperature gradients along the coast are due to the penetration inland of sea breezes. Australia's highest recorded temperature is 53 C at Cloncurry in north Queensland. In winter, maximum temperatures grade from 25 C to 30 C in the north to about 15 C in the south, except in the alpine region where 5 C. Frost can cause serious damage to agriculture, and although most of the country has a frost-free period in excess of 250 days, this is reduced to less than 150 days in some of the agricultural regions of the southeast. Australia's lowest temperature ever recorded is minus 23 C at Charlotte Pass, a "hollow" in the NSW alps.

Thunderstorm frequency ranges from over 60 days per year in the far north, to about 40 days per year along the eastern ranges, with most of the remainder experiencing thunderstorms on less than 20 days annually. These storms are occasionally associated with damaging ***large hail***, particularly during summer in the temperate and sub-tropical regions while associated ***tornados*** and ***waterspouts***, while less common than in the United States, are sometimes responsible for severe damage.

The nation experiences numerous interesting weather phenomena, with local names characteristic of the feature, for example - Perth's ***Fremantle Doctor*** (welcome sea breeze during a heatwave), ***Darwin's Hector*** (a cumulonimbus cloud, that develops almost every summer day over nearby Bathurst Island), the Gulf of Carpentaria's ***Morning Glory*** (a beautiful roll cloud), Sydney's ***Southerly Buster*** (a vigorous squall, which brings relief in the form of a cool change after a heatwave), Melbourne's ***Eddy*** (a not-so-welcome phenomenon, which traps pollution) and Adelaide's ***Gully Wind.***