Annales Geophysicae

ISSN: 0992-7689 (printed version)
ISSN: 1432-0576 (electronic version)

Abstract Volume 12 Issue 9 (1994) pp 868-886

The oceanic tides in the South Atlantic Ocean

M. L. Genco, F. Lyard, C. Le Provost

Equipe de Modélisation des Ecoulements Océaniques et des Marées, Laboratoire des Ecoulements Géophysiques et Industriels (I.M.G.), BP 53X, 38 041 Grenoble, France, URA 1503, CNRS

Received: 30 July 1993/Accepted: 17 January 1994

Abstract. The finite element ocean tide model of Le Provost and Vincent (1986) has been applied to the simulation of the M_2 and K_1 components over the South Atlantic Ocean. The discretisation of the domain, of the order of 200 km over the deep ocean, is refined down to 15 km along the coasts, such refinement enables wave propagation and damping over the continental shelves to be correctly solved. The marine boundary conditions, from Dakar to Natal, through the Drake passage and from South Africa to Antarctica, are deduced from in situ data and from Schwiderski's solution and then optimised following a procedure previously developed by the authors. The solutions presented are in very good agreement with in situ data: the root mean square deviations from a standard subset of 13 pelagic stations are 1.4 cm for M_2 and 0.45 cm for K_1, which is significantly better overall than solutions published to date in the literature. Zooms of the M_2 solution are presented for the Falkland Archipelago, the Weddell Sea and the Patagonian Shelf. The first zoom allows detailing of the tidal structure around the Falklands and its interpretation in terms of a stationary trapped Kelvin wave system. The second zoom, over the Weddell Sea, reveals for the first time what must be the tidal signal under the permanent ice shelf and gives a solution over that sea which is generally in agreement with observations. The third zoom is over the complex Patagonian Shelf. This zoom illustrates the ability of the model to simulate the tides, even over this area, with a surprising level of realism, following purely hydrodynamic modelling procedures, within a global ocean tide model. Maps of maximum associated tidal currents are also given, as a first illustration of a by-product of these simulations.