Geophysical Research Abstracts
Vol. 13, EGU2011-7474, 2011
EGU General Assembly 2011

Internal inertial wave characteristic paths in a sphere and in a spherical shell

Anna Rabitti (1) and Leo R. M. Maas (1,2)

(1) NIOZ Netherlands Institute for Sea Research, PO Box 59, 1790 AB Texel, The Netherlands , (2) Institute for Marine and Atmospheric research Utrecht (IMAU) Utrecht University, The Netherlands

Internal wave motions are considered responsible for a substantial part of the dynamics and mixing, both in geophysical and astrophysical context, where the supporting media (Ocean, Earth or stellar atmospheres) are stratified fluids (in density and/or in angular momentum), naturally constrained to spherical or spherical shell shaped domains.
It is known that the internal wave field behaviour in a homogeneous fluid is ruled by a hyperbolic equation, that becomes partially elliptic in the stratified case, and since the system must meet some boundary conditions, the problem is ill-posed mathematically.
Having in mind mainly Oceanographic applications, we try to shed some light on this fundamental but disregarded problem, with a study of the internal wave characteristic paths in the domains of interest.
Differently from previous works, separation of variables is not used as an ansatz, and therefore full three dimensional effects are taken into account in our simple model, allowing focusing of the orbits and subsequent development of singularities in the wave field.
Even when built in the inviscid limit, some of the results obtained with our simple algorithm are still applicable to the real Ocean dynamics, where perfect axisymmetric modes are hardly justifiable due to the presence of quite strong meridional boundaries (continents). Since in the 2D case a perfect correspondence between characteristics and energy paths exists, we can argue that even in the 3D case the study of the characteristics, at least, will not be misleading, and the existence of prohibited areas inside the domain (as found in the sphere), attractive planes (found in the shell), and coherent feature formation will strongly influence the whole dynamics of the fluid.