

3<sup>rd</sup> International Conference on

# Oceanography

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## G-PAMD- The geometric-mechanical origin of planetary angular momentum dynamics and application to the intrinsic drift of oceanic monopolar vortices

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A comprehensive expose will be presented covering the both intimate and elucidative interweavement of (differential) geometry and planetary fluid mechanics. It will be made explicit how coordinate-free representations of dynamics and representations with respect to chosen suitable coordinate systems are complementary, and how coordinate free representations are helpful to identify the role of geometrical objects in geophysical fluid dynamics (GFD). This will be presented both from the point of view of Eulerian fluid dynamics and from the point of view of a Lagrangian variational formulation. A slight generalization of Noether's theorem then shows how the mathematical Lie group of rotations manifests itself in the mechanics of a fluid shell covering a rotating planet in the guise of global planetary angular momentum dynamics. The underlying approximate spherical symmetry of the geopotential will be thoroughly discussed. As an illustration, the application of the theory to the dynamics underlying trajectories of oceanic monopolar vortices, including their intrinsic westward drift, on a rotating sphere, will be outlined.

### Biography

Ramses van der Toorn (MSc in Applied Physics from Delft University of Technology) completed his PhD (*cum laude*, Utrecht University, 1997), on research in geophysical fluid dynamics, carried out at the Netherlands Institute for Sea Research. He has published and has been active (including teaching, and serving conference committees as well as the CMC international industrial standardization coalition) in semiconductor device physics and compact transistor modeling (from Philips Research Laboratories, and developing and hosting the world wide industrial standard *Mextram* from Delft University of Technology). In parallel he has continued publishing scientific work in geophysical fluid dynamics. He currently holds an Assistant Professor position, with a focus on research of applications of mathematics in geophysical fluid dynamics, at the Delft Institute of Applied Mathematics.

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