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Hybridisable Discontinuous Galerkin applications for oceanographical Shallow Water Equations

I. Hernández García*+, A. Oliver Serra† and F. Machín Jiménez+

+ Departamento de Física, Oceanografía Física y Geofísica Aplicada (OFyGA)
Universidad de Las Palmas de Gran Canaria
Campus de Tafira, 35017, Las Palmas, Spain.
{ines.hernandez,francisco.machin}@ulpgc.es

† Instituto Universitario de Sistemas Inteligentes y Aplicaciones Numéricas en Ingeniería (SIANI),
Universidad de Las Palmas de Gran Canaria,
Campus de Tafira, 35017, Las Palmas, Spain.
albert.oliver@ulpgc.es

ABSTRACT

Ocean dynamics show a wide range of scales and high variability, and it is fundamental for ocean models to be able to capture these interactions. The Navier Stokes equations involve the conservation of momentum, mass, and field variables such as temperature and salinity. The Shallow Water Equations (SWE) are obtained by integrating the Navies-Stokes equations in depth when the vertical scale is much smaller than the horizontal scale. (Kämpf, 2009, Foucart et al., 2018)

The Finite Difference method (FD) is the most used numerical method for these problems; in this talk, we explore the Hybridisable Discontinuous Galerkin (HDG) as a viable alternative for oceanographic modelling. HDG stems from Discontinuous Galerkin (DG), a widely used method for fluid dynamic equations that allows using unstructured meshes (in comparison with FD). On top of that, HDG is naturally conservative and reduces the computational cost compared to classical DG methods, maintaining DG appealing stability and convergence properties. (Betteridge 2020, Huerta 2020).

In this talk, several problems in an oceanographic context will be solved using the HDG method.

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