

HYBRIDISABLE DISCONTINUOUS GALERKIN SKILL FOR OCEAN MODELLING

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Abstract:

Oceanographic processes are highly variable and cover a wide range of scales. Therefore, ocean models must be able to capture all the different features spanned over different time and spatial scales simultaneously. Most of the existing methods in ocean modelling can achieve this with a Finite Difference (FD) approach, requiring a high computational cost which might be a limiting factor.

Our main goal is to assess the skills of an alternative method to produce a reliable and fast solution to ocean models. In particular, the Hybridisable Discontinuous Galerkin method (HDG), based on the Finite Element method (FE), is a computationally efficient method with conservative properties that can work with unstructured meshes; these properties are fundamental for modelling the fluid equations in the ocean (Giacomini et al., 2021).

Our interest is focused on the formation and evolution of mesoscale eddies south of the Canary Islands, formed by baroclinic instabilities in the African upwelling front and the island effect (Sangrà et al., 2009). Current ocean models are too coarse to capture in detail the physical processes involved in this context, so our approach with an adapted mesh would provide a solution with a significant increase in the spatial resolution in the required zones compared to classical FD methods.

Key words: Ocean modelling, Finite elements, Hybridisable Discontinuous Galerkin, Shallow Water, Mesoscale eddies

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