AN UNSTRUCTURED IMPLICIT APPROACH FOR NUMERICAL WEATHER PREDICTION

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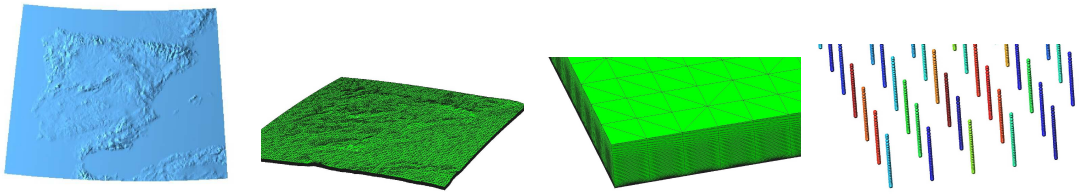
ABSTRACT

The aim of this paper is twofold. First, it is difficult for a newcomer in the Numerical Weather Prediction (NWP) community to find similarities with Computational Fluid Dynamics (CFD) techniques as far as the numerical methods of the dynamical cores in NWP are concerned. Different variables than the CFD traditional conservative one are used and seemingly different discretization techniques have been developed, whereas the same Euler equations are being solved in both cases. So the first aim is to compare and contrast the main numerical elements used in both communities. The second aim consists in validating a CFD solver adapted to NWP to a set of traditional NWP benchmarks. It is shown that it produces accurate and low diffusive results. An implicit time integration has been persued to allow for flexible and efficient unstructured techniques that mimic the one used in finite differences. The implicit solver provides a framework to embed those techniques, such as implicit horizontal integration/ linelet preconditioner, time splitting / Low Mach number preconditioner. The obvious advantage of this approach is that it allows in almost one solver to cover the NWP and CFD ranges of applications. Furthermore, he solver has been designed to run on fully three dimensional unstructured grids for geometric flexibility and adaptivity.

Keywords: Numerical Weather Prediction, Computational Fluid Dynamics, compressible implicit edge-based HLLC solver, density current, gravity waves, linelets

REFERENCES

[1] R. Aubry and M. Vázquez and G. Houzeaux and J.M. Cela and S. Marras, An unstructured approach to Numerical Weather prediction, *AIAA Paper* (2010)



(a) The Iberian peninsule surface mesh (b) Semistructured volume mesh (c) Zoom of the semistructured mesh (d) Zoom of the linelets build on the semistructured mesh

Figure 1: Data assimilation with orography and linelets build automatically.