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A p-adaptive approach for high order numerical weather prediction

Giovanni Tumolo (1,2), Luca Bonaventura (3), and Graziano Giuliani (4)

(1) The Abdus Salam ICTP, Trieste, Italy (gtumolo@ictp.it), (2) OGS, Trieste, Italy, (3) Politecnico di Milano, Italy (luca.bonaventura@polimi.it), (4) The Abdus Salam ICTP, Trieste, Italy (ggiulian@ictp.it)

An adaptive discretization approach for model equations typical of numerical weather prediction is presented, that combines a novel two-time-level semi-Lagrangian semi-implicit technique with a discontinuous finite element spatial discretization, with variable and adaptive element degree p.
The resulting numerical formulation has full second-order accuracy in time, can employ polynomial bases of arbitrarily high degree in space, is
unconditionally stable and permits the number of degrees of freedom employed for representing the solution in each element to be effectively adjusted at runtime to the local structure of the solution itself, in order to balance accuracy and computational cost. Both the main advantages for numerical weather prediction applications of such an adaptivity approach and the main challenges for its effective parallel implementation will be shown and discussed.