

ATMOSPHERIC FLOWS: EFFICIENT AND STRUCTURE-PRESERVING HIGH-ORDER METHODS

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ABSTRACT

This minisymposium focuses on recent advances in efficient and high-order numerical methods for atmospheric applications, e.g., in dynamical cores used for numerical weather prediction or climate modeling. Typically, the governing equations are the compressible Euler equations on the sphere or related models. Topics of interest include efficient time integration methods (e.g., horizontally-explicit and vertically-implicit (HEVI) methods), structure-preserving discretizations (e.g., energy-conserving, entropy-stable, well-balanced, asymptotic-preserving methods), robustness (e.g., bounds/positivity-preserving methods and schemes able to handle under-resolved flows), subgrid scale modeling for these methods, adaptivity (of models or in space/time), and the design of efficient and scalable (open-source) software. This minisymposium is intended to bring together researchers with different backgrounds, e.g., numerical analysis of compressible flows, high-performance scientific computing, and atmospheric sciences to foster discussions and collaborations.

SPEAKERS

1. Marco Artiano (Johannes Gutenberg University Mainz, Germany): *Optimized DGSEM Rosenbrock HEVI Schemes for Atmospheric Flows.*
2. Philipp Baasch (University of Cologne, Germany): *An Entropy-Stable Discontinuous Spectral-Element Method for the Covariant Euler Equations.*
3. Michael Baldauf (Deutscher Wetterdienst, Germany): *A Discontinuous Galerkin solver as an alternative dynamical core for the weather and climate prediction model ICON.*
4. Werner Bauer (University of Surrey, UK): *Fully implicit timestepping methods for the rotating shallow water equations.*
5. Philipp Birken (Lund University, Sweden): *A direct flux reconstruction solver for numerical weather prediction*
6. Kenneth Duru (University of Texas at El Paso, USA): *On well-posed and structure preserving formulations of equations of motion for compressible atmospheric flow problems.*
7. Christopher Eldred (Sandia National Laboratories, USA): *Progress towards a high order discrete exterior calculus for geophysical fluid dynamics.*
8. Stéphane Gaudreault (Environment and Climate Change Canada): *Modernization of Atmospheric Modelling in Canadian Numerical Weather Prediction*
9. Francis Xavier Giraldo (Naval Postgraduate School, USA): *Entropy-Stable Discontinuous Galerkin Methods for Atmospheric and Ocean Modeling.*
10. Michele Girfoglio (University of Palermo, Italy): *Large Eddy Simulation of Geophysical Turbulent Flows.*
11. Molin Han (Imperial College London, UK): *Parameter-Robust Preconditioners for Compatible Discretisations of Stratified Flows in Thin Domains.*
12. Yuta Kawai (RIKEN Center for Computational Science, Japan): *Development of a High-Order Discontinuous Galerkin Atmospheric Model for Future High-Resolution Simulations: Dynamics–Physics Coupling in the DG Framework.* Joint work with Xuanzhengbo Ren, Seiya Nishizawa, Takahiro Katagiri, and Hirofumi Tomita

13. Dean Muir (Max Plank Institute for Plasma Physics, Garching, Germany): *A dual-pairing summation by parts method for transport problems on the sphere.* Joint work with Kenneth Duru
14. Giuseppe Orlando (École polytechnique Palaiseau, France): *High-order IMEX-DG schemes for Numerical Weather Prediction on non-conforming adaptive meshes.*
15. Andrés Rueda-Ramirez (Universidad Politécnica de Madrid, Spain): *Nested Schur-Complement Methods to Accelerate Atmospheric Flow Simulations using Horizontally-Explicit, Vertically-Implicit Discontinuous Galerkin Methods.*
16. Raymond Spiteri (University of Saskatchewan, Canada): *Dubious No More: Adaptive Runge–Kutta Evaluation of φ -functions for Scalable Exponential Integration in Atmospheric Models.*
17. Dougal Stewart (Monash University, Australia): *A systematic method for deriving high-order finite element discretizations of the Euler equations that conserve nonlinear invariants in arbitrary geometries.*
18. Seth Taylor (University of Saskatchewan, Canada): *High-order functional Lie group integrators for atmospheric flows.*