Welcome to the

1st COSMO Developers Workshop

26./27. January 2016
Langen, Germany

Ulrich Schättler

Source Code Administrator

COSMO-Model

Why a Developers Workshop

- Gathering Ideas: Doodle Document

- Ongoing and planned developments
  - discuss technical issues (e.g. changing data structures, code abstraction)
  - identify possible areas of conflicting developments

- How to work together:
  - can we all use common tools?
  - who should review which code?
  - how to test all the developments?

Overview on Current Developments

From POMPA

- C++ Dycore
  - adapt C++ dycore to COSMO Version 5.4
  - complete serialization statements in the Fortran dynamical core
- Code refactoring of the Fortran dynamical core (outstanding)
  - change of handling of density and lateral boundary conditions in positive definite advection
  - re-computation of precipitating water species (qrs), density (rho), surface pressure (ps) and other diagnostics after the dynamical core.
  - hardcode number of saturation adjustment iterations to 3.
- Latent Heat Nudging
  - Porting to GPUs (changes required)
  - Optimization of global communication

From POMPA (II)

- Block Physics
  - adapt src_block-modules to copy fields with block index (nproma,ke,nblocks)
  - adapt src_block-modules to work with arbitrary number of tracers
  - optimization to pack multiple copies
- New boundary condition module
  - new source file src_lbc.f90 (about 2500 lines of code)
  - approximately 100 calls to lbc_masspoint, lbc_upoint, lbc_vpoint in order to apply boundary conditions (code abstraction!)
  - different BCs at several places (partly bug-fixes)
- Data Assimilation:
  - changes required for GPU port; add OpenACC statements

From POMPA (III)

- Static memory allocations: cost of memory allocation is very high on the GPU, therefore all arrays need to be allocated before the time loop
- Change of application domain in relaxation
- Code refactoring in I/O
- New communication interfaces

Data Assimilation

- Assimilation of radar-derived rain rates by a 1DVAR + nudging approach (Poli, ARPA-EMR)
- Optimizations from project OPCODE (see POMPA?)

Dynamics

- Kaas (2008)-conserving extension of the Semi-Lagrange Advection (deMorsier)
- Extension of the Bott tracer advection scheme (Uni Bonn)
- High order horizontal schemes for the Runge-Kutta dynamical (Fortran) core (Will, BTU Cottbus)
- Optimal relaxation function for lateral boundary conditions (Will)
- New implementation of 3D diffusion in terrain following coordinates (Fuhrer)
- Mahrer-discretization of horizontal pressure gradients in fast_waves; current and new version (deMorsier)
- Implicit finite-volume compressible solver (Vitagliano)
- Conservative dynamical core (PP Participants)

Atmospheric physics

- Improved cloud-radiation coupling (Blahak, Ritter)
- Soil and surface fluxes: effective slope-angle correction factor (Blahak, deMorsier, Raschendorfer)
- Stochastic boundary layer perturbations reflecting unresolved effects of variability of surface fluxes on convection initiation (Blahak, Kober)
- Shallow convection: new closure based on convective vertical velocity scale, modified entrainment, modified shallow convective cloud cover (Boeing, Blahak)
- Turbulence: Implementing and extending the restructured ICON-version of TURBDIFF (Raschendorfer, Schättler)
- Providing COSMO-SC for general application (Raschendorfer, Schättler)
- Consolidation of surface-to-atmosphere transfer ConSAT (Raschendorfer)
- Turbulence: Smagorinsky LES turbulence parameterization (Raschendorfer)

Atmospheric Physics (II)

- Turbulence: Extension of TURDIFF to the TKE-Scalar Variance configuration (Mironov, Machulskaya)
- Modified saturation adjustment
- Microphysics: Melting Snow
- Microphysics: Cirrus clouds
- Turbulence: Clean up namelist switches

Soil and Surface Physics

- Parameterization of urban effects (Wouters, Blahak)
- COSMO PT Mire parametrization (RosHydroMet)
- Comprehensive tiles approach (Machulskaya, see: COSMO-ICON Physics)
- Revision of rainfall interception (Helmert)
- Revision of transpiration and root parameterization (Vogel)
- Revision of TERRA to support HWSD data (Helmert)

WG 6:

- DFI: Better treatment of clouds / precipitation (Torrisi)
- Unified COSMO-ICON Physics
- interface for radar obs operators (Blahak)


Thank you
very much
for your
attention