Overview of COSMO WG6 activities

Reference Version and Implementation

Massimo Milelli and WG6 colleagues

Offenbach, 36th EWGLAM and 21st SRNWP meeting - Thursday, October 2nd 2014

Outline

- PP POMPA Summary
- GRIB2 Standards
- NWP Test Suite
- Technical Test Suite
- Web Management
- Science Plan

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Performance **O**n **M**assively **P**arallel **A**rchitectures

4 +1 years project (09.2010 – 09.2015)

- **Goal:** *Prepare the COSMO model code for these future high performance computing (HPC) architectures*

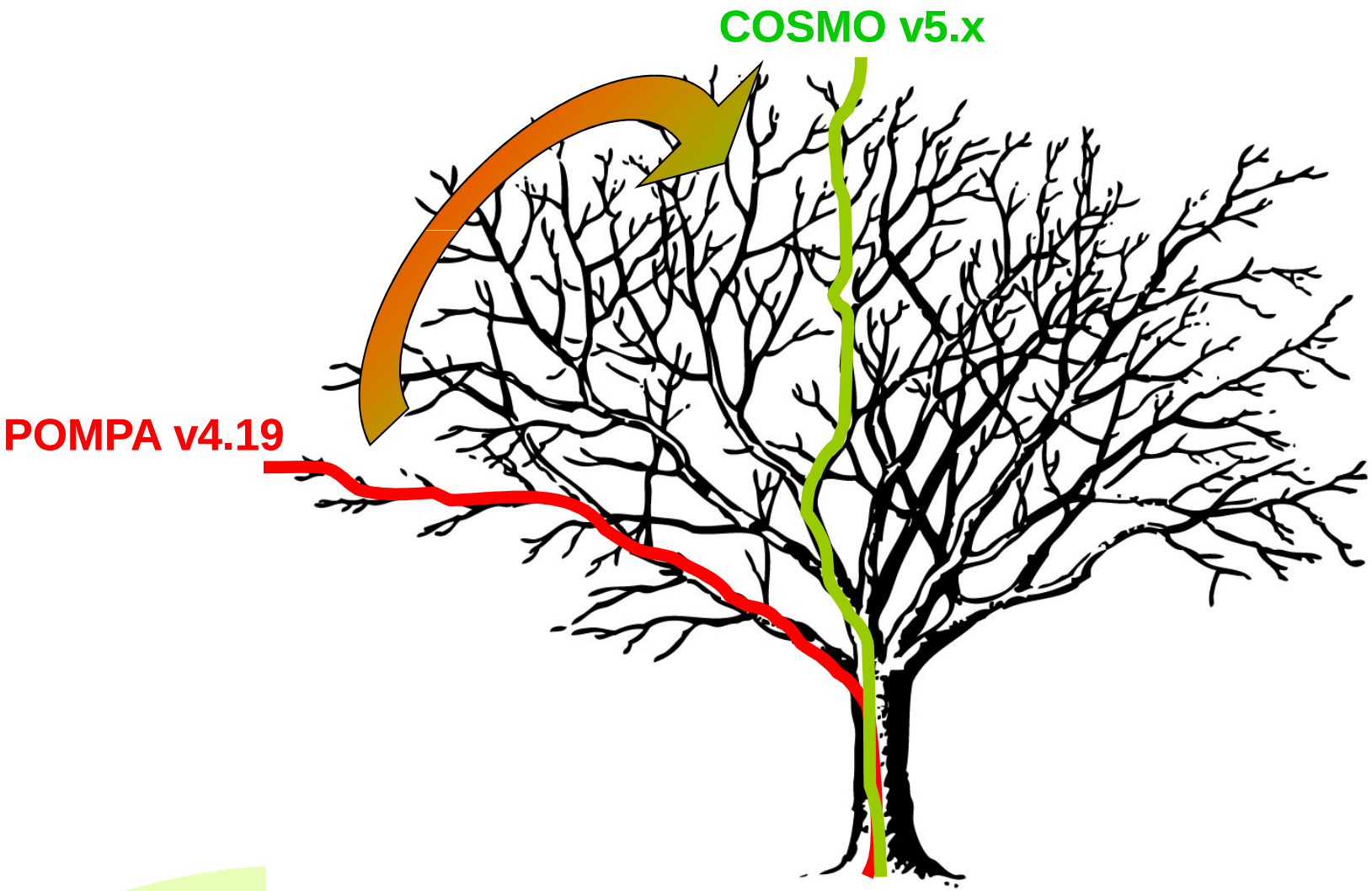
- **Complete rewrite of dynamical core using stencil library:**
  - Single source code for GPU and CPU
  - Modern software engineering
  - Speedup of ~2x for CPU and ~5x for GPU

- **Porting of rest of code using compiler directives:**
  - Physics (Speedup ~4x for GPU)
  - Assimilation (no speedup)

Single precision

- In official version 5.1
- Runtime & memory consumption decreases significantly (~ 60% of double precision)
- Tested for COSMO-E

- **But…**
  - Some parts do not work yet (e.g. assimilation) or have not been tested (e.g. sea-ice)
  - Developer behaviour has to change
  - Developers currently do not run single precision

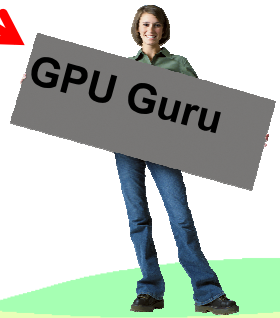

COSMO v5.x
POMPA v4.19

Know-how Transfer

- Stencil workshop
- OpenACC tutorial
- Documentation:
  - Presentations
  - Publications
  - Newsletters

Coordination of new versions

New development



Project extension

- **POMPA project extension proposed until 09.2015**
- **Main reasons**
  - Integration into 5.X will require further work with code responsible, SCA, and working group chairs
  - Further GPU porting work required/requested (physical parameterizations, LHN)
  - Work to keep C++ version of dycore synchronized
  - Support, training and documentation
  - Assimilation does not work in single precision
  - Open tasks (hybrid OpenMP/MPI, new halo-update, …)
  - Ongoing related activities (e.g. PASC GridTools project)

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COSMO GRIB2 Policy

- Field short name (set of **common definitions**)
- Center specific table values (set of **common values**)
- Model name (the name of each model is uniquely defined by the **n-tuple** (center, subcenter, product category, generating process identifier)
- COSMO standard keys and local use section (a **default local use section**, with localSectionNumber = 250, and containing all COSMO standard keys, is defined for each center)
- **GRIB API set of definition files** is maintained, which is compatible with all COSMO software

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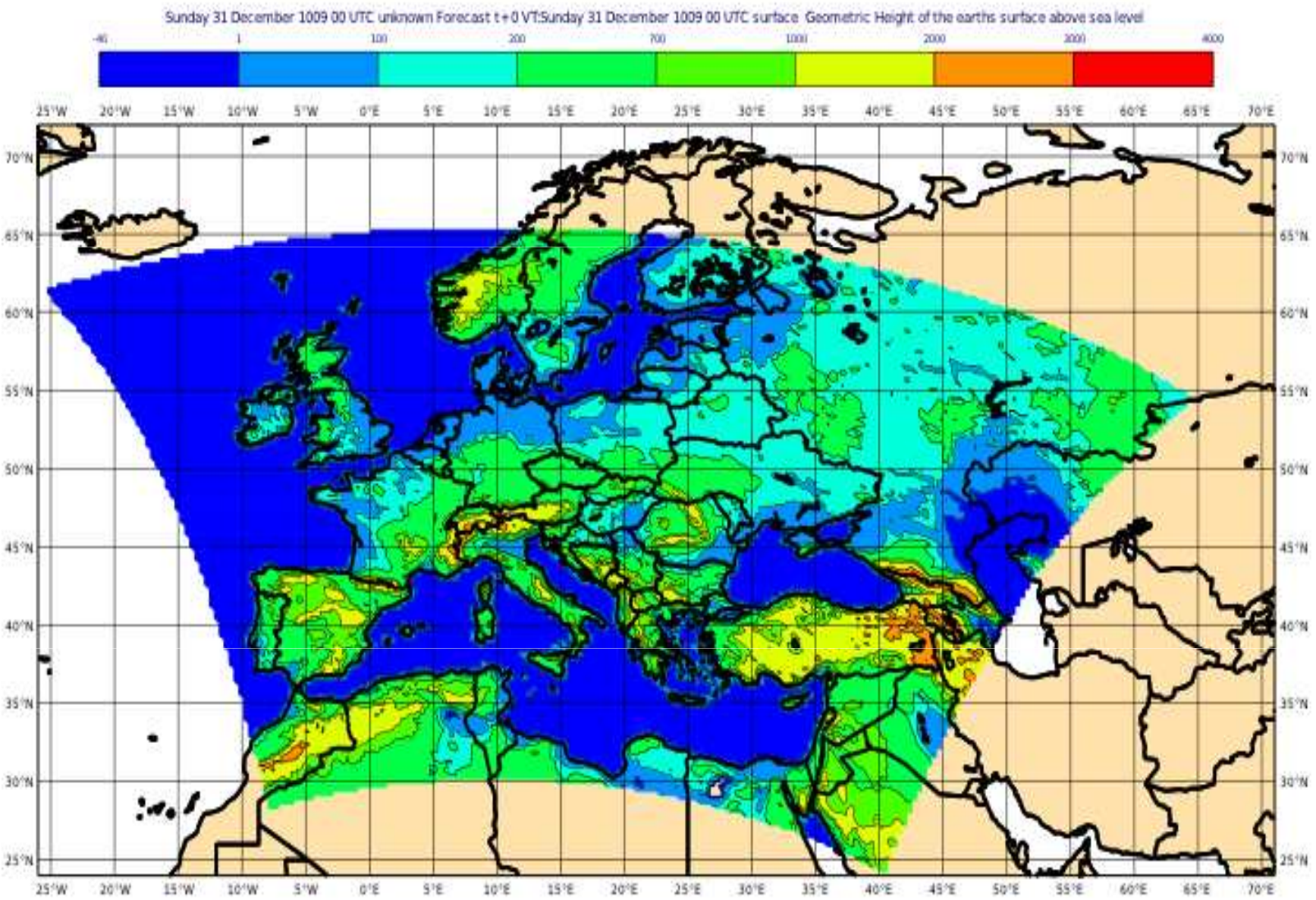
Goal

- Build up a software environment to perform carefully-controlled and rigorous testing calculation of verification statistics for any COSMO model test–version
- Offer necessary information on the model forecasting performance
- Provide the COSMO community with standards against which the impacts of new developments in the model should be evaluated
- Benchmark to monitor the progress of mesoscale forecast improvement (periodic testing as COSMO evolves)

- Installed @ ECMWF
- Runs without data assimilation cycle
- 2 months/y in January and July
- Coupled with VERSUS (COSMO official verification software)
- Grid2point verification
- Standard set of variables:
  - 2mTD, MSLP, 2mT, WS
  - TCC
  - 6h/12h/24h precipitation
  - T, WS, RH profiles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Developed @ MeteoSwiss, it is a light and easy to use python tool to check a newly developed COSMO model version:

- The code is running and gives “correct” results with various configurations (e.g. only dynamics, dynamics + physics, members configurations ...)
- Same results compared to a reference simulation (within a given error range)
- The code gives bit identical results with different processor configurations (8x8 tasks have to give the same results as 7x9+1 tasks)
- Restart functionality is working, and gives bit identical results
- Additional user defined verification could be specified

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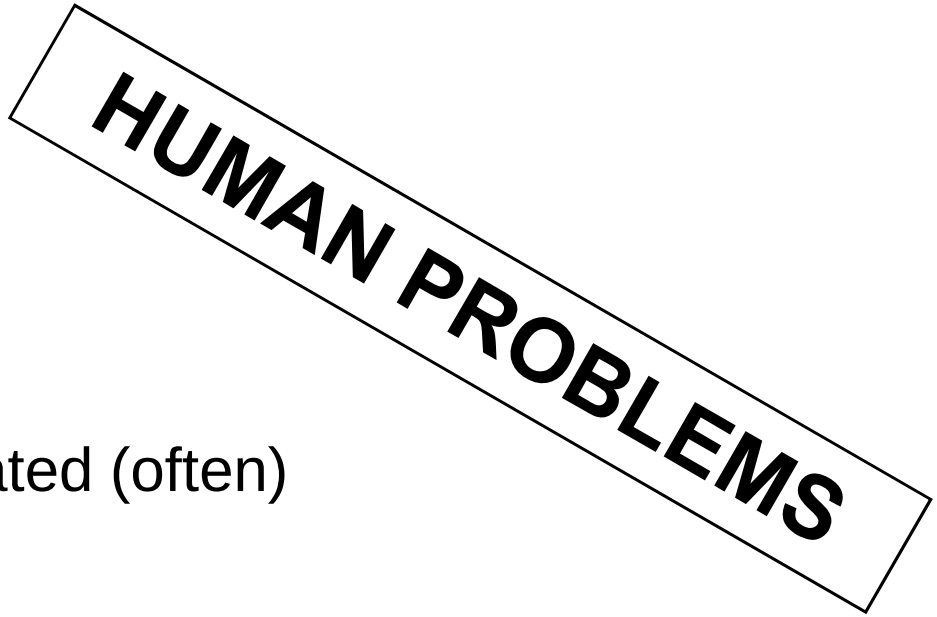
What's bad ?

- The web and mail server is quite old
- It is behind HNMS' firewall (mirroring is complicated…)

TECHNICAL PROBLEMS

What's bad ?



- The static contents are not updated (often)
- Some tool is not used (forum)
- Sometimes files are uploaded randomly (the more the users, the larger the chaos)
- Only one person is fully aware of the WHATs and HOWs of the site

Solutions ?

We have to decide what we really need:

- If the web is intended simply as “we exist”, we could survive more or less as we are now
- If we wish to have some more features, and give more support also to external users, something has to be done
- What about a software repository, a bug-tracker, a namelist generator,... ?

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Short-term actions (2015-2017)

1. Consolidation of the results of POMPA and further developments
2. Consolidation of the GPU-version of COSMO and testing this and also other emerging architectures (as Intel XeonPhi)
3. Organization of regular training courses for COSMO researchers on new architectures and programming languages/paradigms like DSEL
4. Automation of current procedures

Long-term actions (2017-2020)

1. Transfer of new programming paradigms (DSEL, C++) to ICON model
2. Code administration and maintenance

Continuous actions (2015-2020)

1. Increase of cooperation with the numerical aspects groups
2. Various management issues (RCS, web tools, Coding Standards…)
3. Participation in European Projects

Reviewers' comments

- General agreement with the proposed strategy/roadmap
- Some concern about code porting and merging with existing model
- Some remarks about FTEs planning
- Suggestion to include participation in European projects (such as H2020)

Thank you for your attention

And many many thanks to:

Oliver Fuhrer (MeteoSwiss)
Ulrich Schättler (DWD)
Xavier Lapillonne (ETHZ)
Andrea Montani (ARPA-SIMC)
Amalia Iriza (NMA)
Jean-Marie Bettems (MeteoSwiss)
Theodore Andreadis (HNMS)