COSMO GPU: The C++ Dynamical Core

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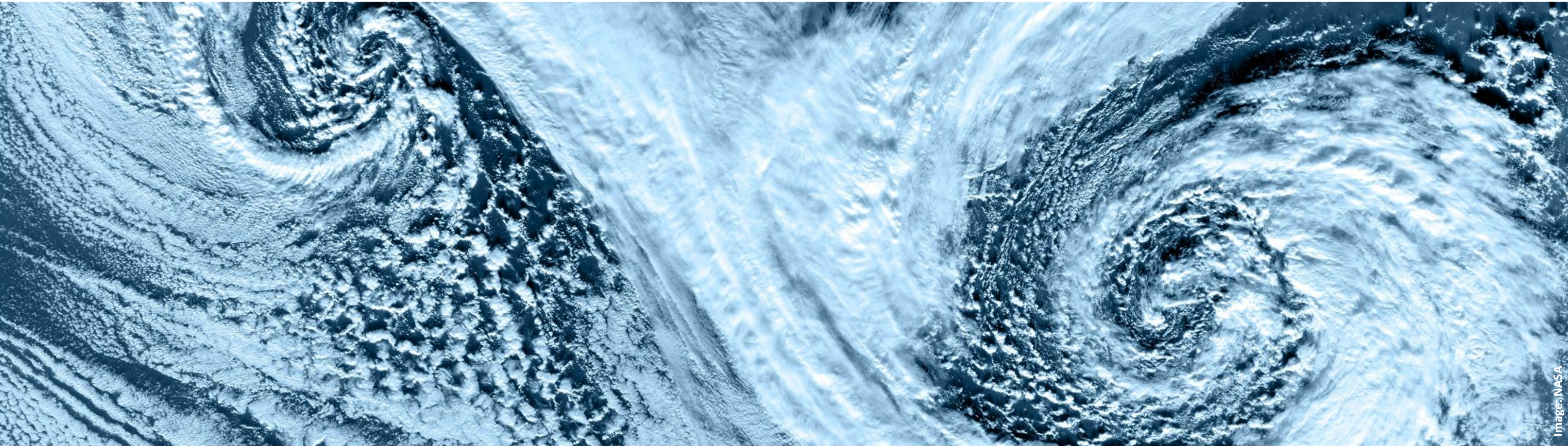
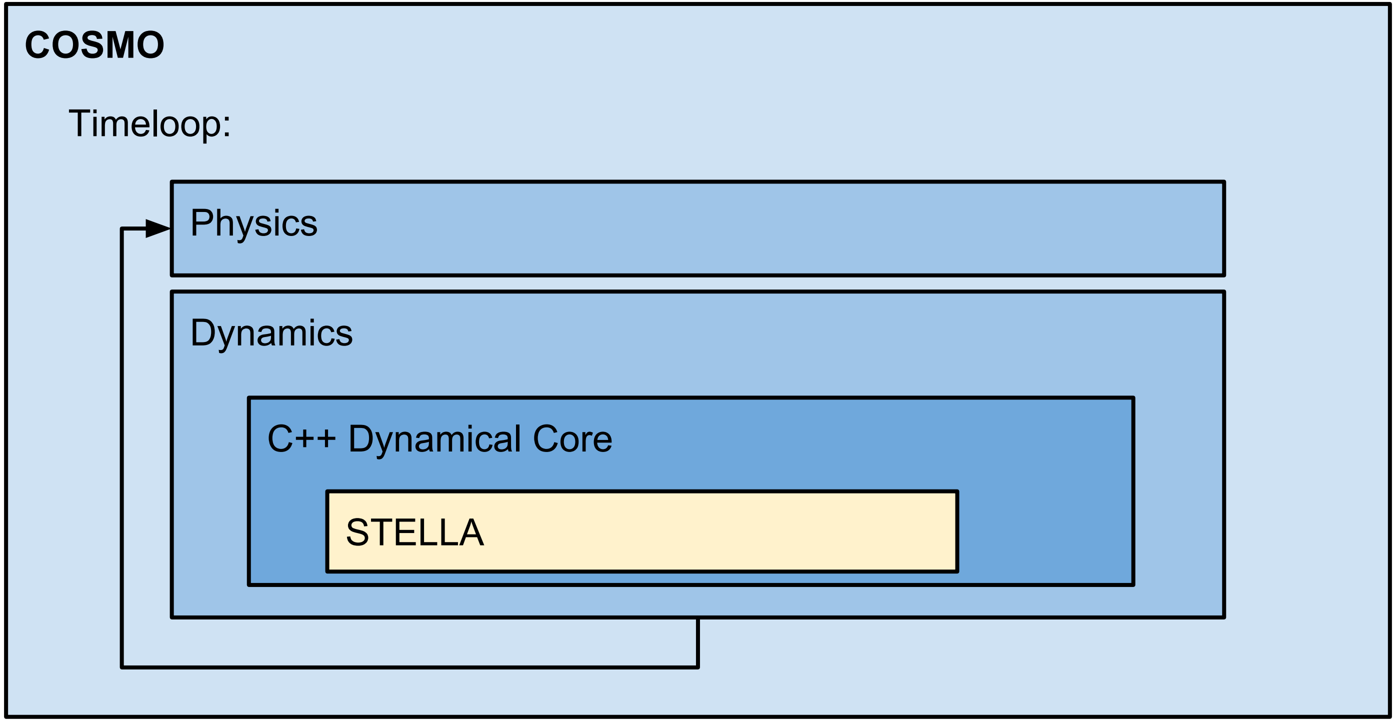


Image: NASA

Who

- Maintainer for the C++ Dynamical Core
- MSc ETH Computer Science
- Replaced Andrea Arteaga
- Primarily work at MeteoSwiss
- User [pspoerri] on Github

What is the C++ Dynamical Core?



Why

Piz Escha/Kesch: 2x12 node machine with 16 GPUs/node

- COSMO-E 120h forecast: 1 node per member
- COSMO-1 33h forecast: 9 nodes

⇨ **COSMO GPU version required!**

Daily builds of COSMO_GPU are available on Piz Kesch and Piz Daint
/project/c01/install/${machine}/cosmo5/cosmo_gpu_${precision}

Projects

COSMO-POMPA

- Maintain C++ Dycore: Performance, Bugs
- Serialization in Fortran
- Build system, testing architecture

STELLA

- Small contributions

Serialbox (Fortran serialization)

- C++/Python interface

COSMO-PRERELEASE (COSMO 5.x dev trunk by DWD)

- Bringing back changes from MeteoSwiss

Status

Dynamical Core version 5.0 is now supported.

- Used pre operationally at MeteoSwiss
- Features (currently) restricted to Namelist used by OWM

Integration COSMO 5.3+ Features

- Work in progress

Dycore Standalone

- Work in progress

Questions?

Contact me if you need $FEATURE in the C++ Dynamics (lcpp_dycore)

Email: pascal.spoerri@env.ethz.ch

Backup Slides

Testing and Verification

- Unit testing
  - Use Pure Fortran COSMO to compute reference data
  - Unit test the Dycore against against the reference data
- Verification
  - Verify COSMO YUPRTEST with Dycore Enabled/Disabled
  - Use serialization and unit testing to locate the problem

Serialization

Comments get expanded by script

```
!$ser savepoint CoriolisUnittest.Apply-in LargeTimeStep=ntstep
!$ser data u_nnow=u(:,:,:,nnow) v_nnow=v(:,:,:,nnow)
!$ser data u_tens=utens v_tens=vtens

DO k = 1 , ke
 ....
ENDIF

!$ser savepoint CoriolisUnittest.Apply-out LargeTimeStep=ntstep
!$ser data u_tens=utens v_tens=vtens
```

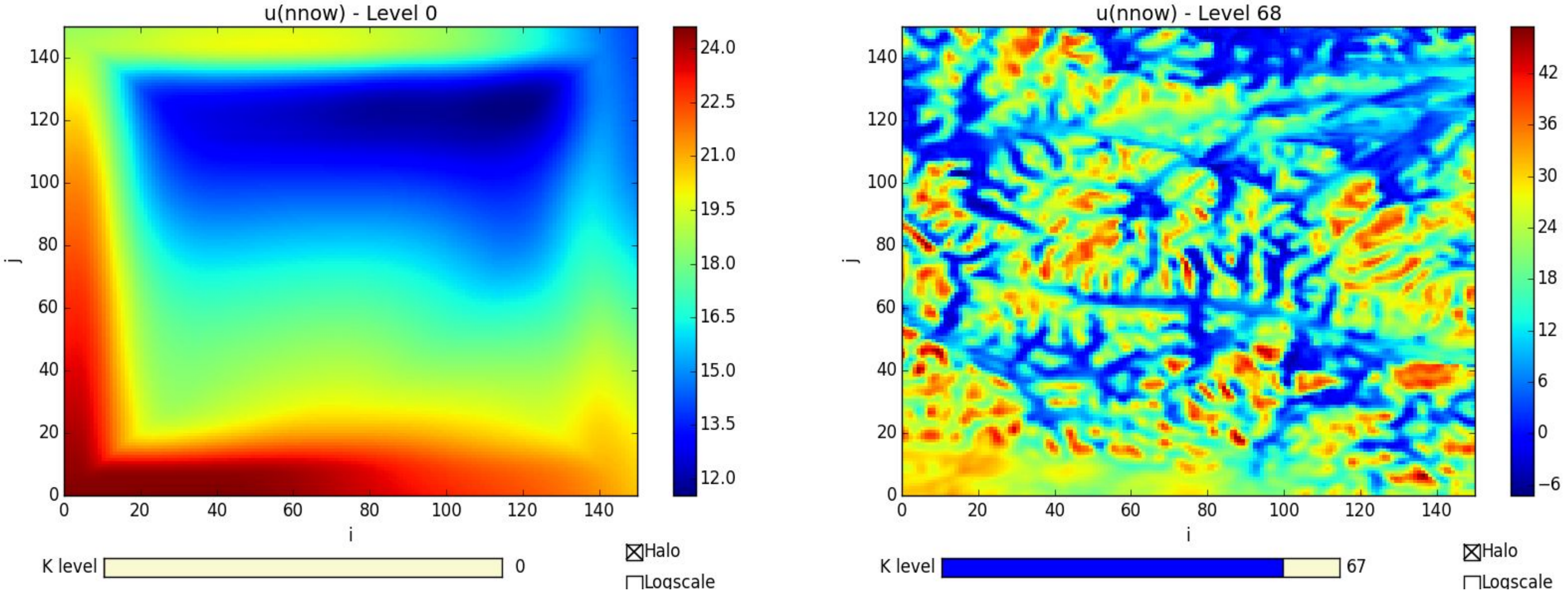
Python Serializer

- Python bindings to serializer
  - Write/read serialized data
  - Export fields to Numpy
  - Visualize 3D Fields
- Sample

```
from serialization_framework import *
ser = Serializer("/path/to/data", "Fields")
u_nnow = ser['CoriolisUnittest.Apply-in']['LargeTimeStep'][5]['u_nnow']
Visualizer(u_nnow, 'u(nnow)')
```

Python Visualizer

Explore data interactively



Automation

- Nightly builds
- Nightly tests