

# COSMO Priority Project C2I Transition of COSMO to ICON-LAM



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# ...with contributions from many

COSMO and ICON colleagues

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# **ICON-LAM – Goals**

- Unified modelling system for global and regional scale
- Focus of national and international collaborations on this modelling system (e.g., COSMO, CLM, ART, universities)
- Better efficiency in model development (content and software infrastructure)
- → Improvements in model physics (e.g., surface tiles)
- ➔ Better forecast quality
- ➔ Higher efficiency in terms of HPC resources



# ICON-D2 – Setup



- → Grid: R19B7 (2.08 km), 65 layers with model top at 22 km
- → Grid covers an area similar to COSMO-D2





# **Motivation COSMO Priority Project C2I**

- COSMO Priority Projects are specific research tasks over a period of 3 to 4 years
- ➔ Focus of DWD developments on ICON instead of the COSMO model
- ➔ COSMO strategy foresees a transition phase to ICON-LAM
- PP C2I is restricted to deterministic modelling systems. Ensemble applications are covered by COSMO Priority Project APSU
- Goal of the COSMO Priority Project C2I is to ensure a smooth transition from the COSMO model to ICON-LAM



- National meteorological services of the COSMO member states: MCH (Switzerland), COMET (Italy), HNMS (Greece), IMGW (Poland), NMA (Romania), RHM (Russia), IMS (Israel)
- Other major COSMO members:
   ARPAE (Italy), ARPA Piemonte (Italy), CIRA (Italy)
- Academic communities:
   CLM Community, ART
- National meteorological services (licensees):
   INMET (Brasil)









- → 15-19 October 2018, Langen, Germany
- Financial support from COSMO license money is already approved for two participants per institution!

#### Preliminary agenda includes:

- Remapping of initial and boundary data (from global ICON or IFS)
- Conduction of ICON simulations for individually chosen limited-area domains
- Visualization of the results
- First, these tasks are performed on DWD's HPC system. The next step is to perform those simulations on the individual participants' HPC system (if remote access is possible)



# Preliminary Agenda is Available!









#### C2I Workshop on Setup & Experiments

#### Monday, October 15, 2018

09:00	Registration
09:30 - 10:30	Introduction (D. Rieger)
	Overview the plans, tasks and goals of the C2I workshop. Introduction to ICON grid files, external parameter files and remapping of initial and boundary data.
10:30 - 11:00	Installation
	Installation of dwd-icontools and the ICON code at DWD's HPC system.
10:30 - 11:00	Break
11:00 - 12:30	Remapping of Initial & Boundary Conditions
	Usage of dwd-icontools to remap initial and boundary data from ICON or IFS to the individual target grid.





- Support mailing list is ready icon.support@dwd.de
- ➔ Official start in October?
- Externally accessible Git repository at DWD: git.dwd.de
- ➔ Currently, Terms of Reference are being prepared
- The ToR include a specific development workflow



# **Development Workflow**





Figure 1: Illustration of the workflow. The colors indicate the responsibilities of the different source code administrators and developers for branches and the merging of branches: ICON-NWP Gatekeeper, COSMO Source Code Administrator, CLM-Community Source Code Administrator, and Developers. Any merge of branches that are not connected by arrows is <u>not</u> allowed.





Institution	Installation	Idealized Cases	Real Cases
ARPA-P/CIRA			
NMA			
IMS			
RHM			
IMGW			
HNMS			





# ICON-CLM (Climate Limited Area Mode) Development Status

**Trang Van Pham, Christian Steger** 

Climate and Environment Service Deutscher Wetterdienst



C2I Meeting, COSMO GM 2018

# **ICON-CLM** first test results



ICON-CLM Run EU-R2B6 -- 1979-1991

Difference ICON-CLM - EOBS (t 2m)

Computing system: Cray/DWD Contact: T.V.Pham

#### COSMO-CLM

Run CON069 -- 1981-2000 Computing system: blizzard Contact: K.Keuler Difference CCLM-EOBS (T\_2M)





CI2 Meeting, COSMO GM

Instituto Nacional de Meteorologia - Brasil

 $\frac{\partial p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y}(a(y,s)p(x,t,y,s)) + \frac{\partial^2 \partial^2}{\partial x \partial x}(b^2(y,s)p(x,t,y,s)) + \frac{\partial^2 \partial^2}{\partial x \partial x \partial x}(b^2(y,s)p(x,t,y,s)) + \frac{\partial^2 \partial^2}{\partial x}(b^2(y,s)p(x,t,y,s)) + \frac{\partial^2 \partial^2}{\partial$ 

# · ICON and ICONTOOLS compiled with versions of gcc (6.2.1) and openmpi (2.0.2).

 All exercises done successfully (case\_idealized, case\_lam and case\_realdata).

 $\frac{\partial}{\partial u}\left(a(y,s)p(s(t,y,s))\right) = \frac{1}{a}\frac{\partial}{\partial u^2}(b^2(y,s)p(s,t,y,s))$ 

 $\frac{\partial p(x,t,y,s)}{\partial x} = \frac{\partial}{\partial y} (a(y,s)a(x,t,y,s)) + \frac{1}{2} \frac{\partial}{\partial y} (b(y,s)a(y,s)) + \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) + \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s))$ 

 $\frac{\partial p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} \left( \sigma(y, t) p(y,t,y,s) \right) + \frac{\sigma p(x,t,y,s)}{2 dy^2} \left( \frac{\partial^2 (y,s) p(x,t,y,s)}{\partial s} \right) + \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s) p(x,t,y,s)) + \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s) p(x,$ 

 $\frac{\partial p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} \{a(y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) \frac{\partial^2 p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} \{a(y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) \frac{\partial^2 p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} \{a(y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) \frac{\partial^2 p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} \{a(y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s)) \frac{\partial^2 p(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} \{a(y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial}{\partial y} \{b(x,t,y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial}{\partial y} \{b(x,t,y,s)p(x,t,y,s)\} \frac{1}{2} \frac{\partial}{\partial y} \{b(x,t,y,s)p(x,t,y,s)p(x,t,y,s)\}$ 

 $\frac{\partial_{\mathcal{P}}(x,t,y,s)}{\partial s} = -\frac{\partial}{\partial y} (a(y,s)p(x,t,y,s)) + \frac{1}{2} \frac{\partial^2}{\partial y^2} (b^2(y,s)p(x,t,y,s))$ 



$\left(\frac{y,s}{\partial y}\right) = -\frac{\partial}{\partial y}\left(a\right)$	Waiting for data and training to run ICON - Br	razil
Global parameters:	43	
subcentre:	0	
spring dynamic	s optimization (recommended)	
detailed optimization s max. number of iteration	ettings (change this if necessary): ons:2000	
beta factor: fixed lateral boundary:	0.9	
Extpar: Tile Mod	de (recommended)	
(Sub-) Domain #2:	🖲 rectangular 🔍 circular 🔍 global	100
domain name:	ICON-AS	ASIA
number of grid used:	99 Enable this checkbox when your add file is to be used with (CONL) AM and	Cry
write parent grid:	AFRICA AFRICA AFRICA	
parent grid ID:		Indian Occe
half width:	37.5	s)
rotate:		for all for
Estimated resolution:	3 288 km	IT.
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