



CLM

Climate Version  
of the "COSMO-Modell"



# The COSMO-Model System

## Recent Developments and Future Plans

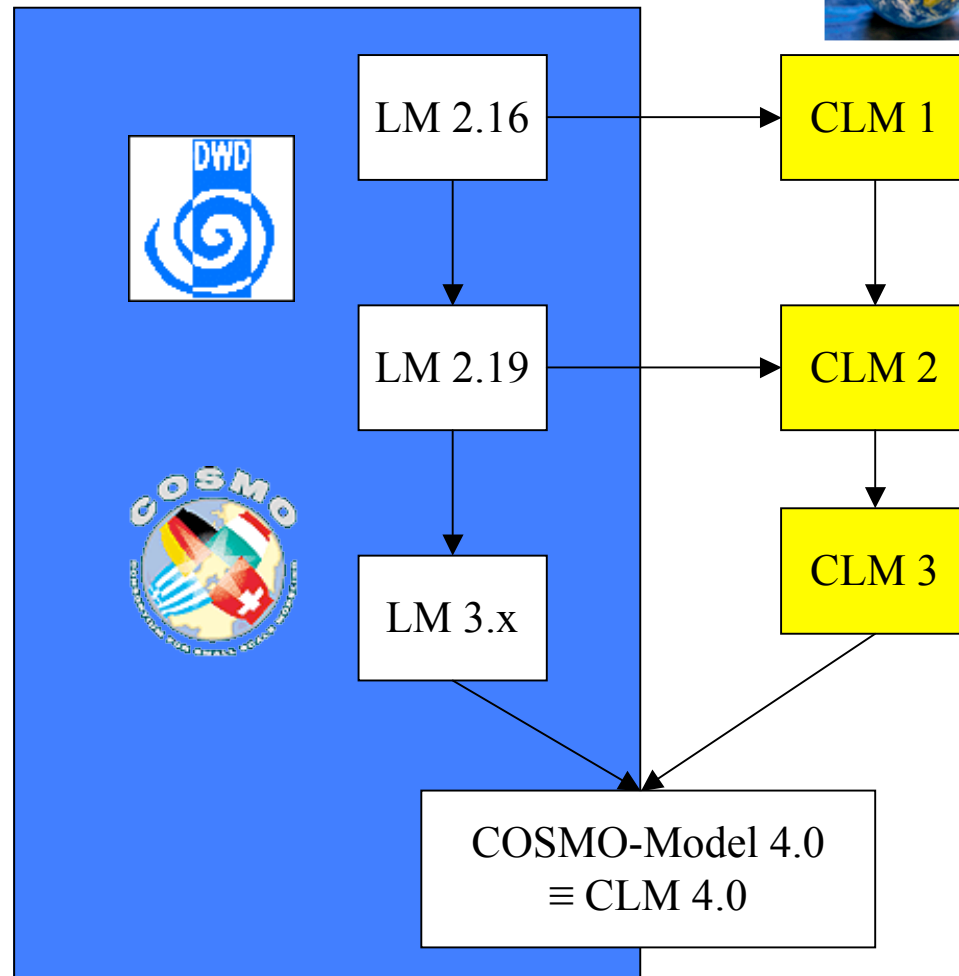
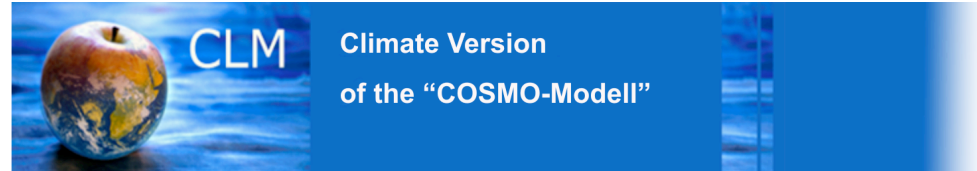
Ulrich Schättler (FE 13)  
Deutscher Wetterdienst





# The COSMO-Model in the last years





2002: First CLM Version based on LM Version 2.16

06.2003: LM Modifications incorporated into CLM 2

12.2005: More LM Modifications and local CLM developments

07.2007: Joined all modifications and local developments into a single source code; Renaming of the Model into COSMO-Model



# From 4.0 to 4.8



- Version 4.1
  - Bug fixes and adaptations for reproducibility (Runge-Kutta, Data Assimilation, Semi-Lagrange Advection)
  - Calculation of Supercell Detection Indices (Baldauf)
  - Changes in the gust parameterization (now using wind speed in 10 meters; Schulz)
  - Bright band detection in radar data (Stephan)
- Version 4.3
  - Changed interpolation onto diagnostic levels (2m temperature; now without an exponential canopy profile, but with a diagnostic Prandtl layer interpolation; Raschendorfer)





# From 4.0 to 4.8 (II)



- Version 4.4

- Changes in the Tiedtke convection scheme related to the treatment of convective cloud condensate as a mixed water-ice phase and of detrained convective cloud condensate (Mironov)
- Optimizations in the advection part of the Runge-Kutta dynamics (Baldauf)
- Optimizations for vectorization in several routines and modules (Schättler, NEC)

```
(src_turbdiff, src_lheat_nudge,  
src_lheating, src_leapfrog,  
numeric_utilities, fast_waves,  
cal_conv_ind)
```





# From 4.0 to 4.8 (III)



- Version 4.5
  - Reading of observations from NetCDF files (Schraff)
  - Optimizations for vectorization (Schättler, NEC)
  - Introduction of the subgrid scale orography scheme (Schulz)
  - New (alternative) reference atmosphere based on a different temperature profile than the existing one.
  - Optimizations / Modifications for the Runge-Kutta scheme
- Version 4.8
  - Consolidation of new features
  - Diagnostics: Provide old computations of 2m temperature and gusts (by setting corresponding namelist switches)





# For (nearly) all Versions

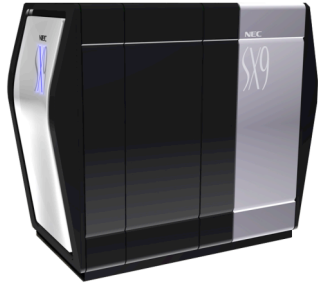


- Bug fixes, technical and / or editorial changes
- Changes of Namelist switches
  - We try to document these changes in the change log file of each version (`misc.global` + additional htm-file)
- Changes in the results
  - If the results are affected by the changes, these are also documented



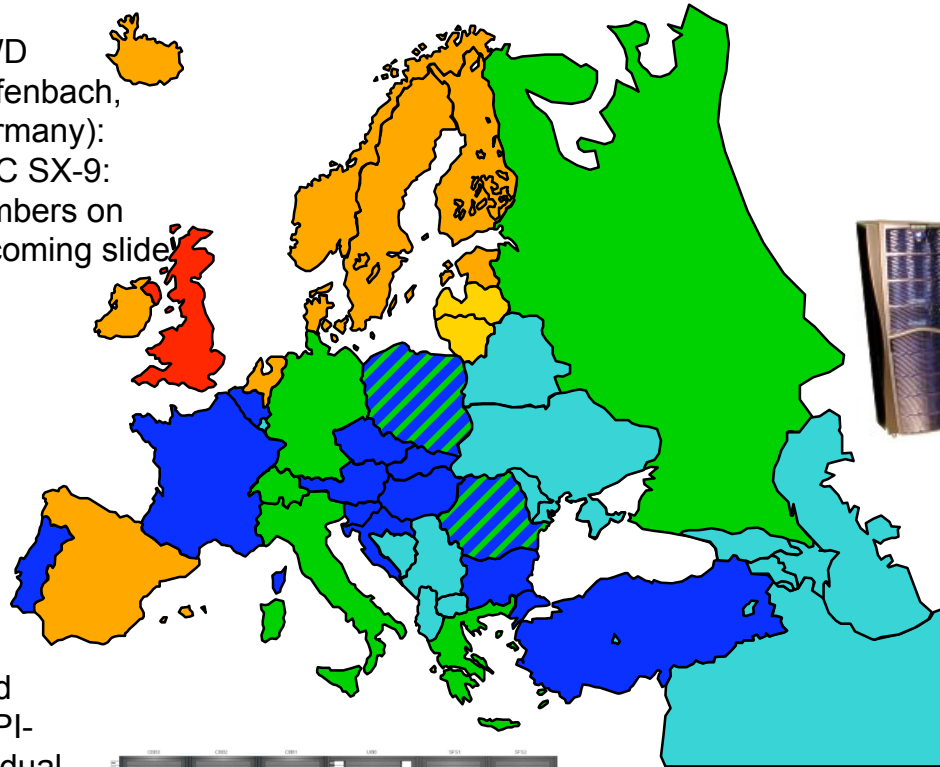


# COSMO-Model(s)



DWD  
(Offenbach,  
Germany):  
NEC SX-9:  
numbers on  
upcoming slide

Roshydromet (Moscow, Russia),  
NMA (Bucharest, Romania):  
Still in planning / procurement phase



IMGW (Warsawa, Poland):  
SGI Origin 3800:  
uses 88 of 100 nodes



MeteoSwiss:  
Cray XT4: COSMO-7 and  
COSMO-2 use 800+4 MPI-  
Tasks on 402 out of 448 dual  
core AMD nodes



ARPA-SIM (Bologna, Italy):  
IBM pwr5: up to 160 of 512  
nodes at CINECA



USAM (Rome, Italy):  
HP Linux Cluster  
XEON biproc quadcore  
System in preparation

COSMO-LEPS (at ECMWF):  
running on ECMWF pwr5 as  
member-state time-critical  
application



ARPA-SIM (Bologna, Italy):  
Linux-Intel x86-64 Cluster for  
testing (uses 56 of 120 cores)

HNMS (Athens, Greece):  
IBM pwr4: 120 of 256 nodes





# Further COSMO-Model Development





# Current Developments



- Many current developments have already been presented yesterday and today.
- Some of them are (nearly) ready to be taken to the official version:
  - COSMO\_ART (work in progress; Version 4.9 available soon)
  - Two-moment microphysical parameterization scheme
  - COSMO coupling (prototype exists; will be taken over to official version this spring)





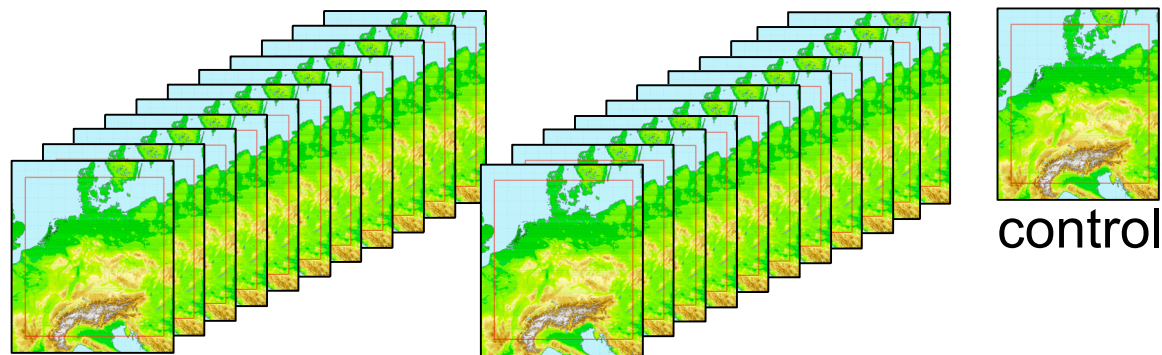
# Current Developments



- Many current developments have already been presented yesterday and today.
- Some need further development and testing:
  - Improved third order vertical advection scheme: further tests necessary
  - Implementation of the ECMWF IFS convection scheme
  - Implementation of a thermodynamic sea ice module



- COSMO-DE EPS
  - Convection resolving EPS based on COSMO-DE under development at DWD
  - Perturbations for initial and boundary conditions and model setup
  - Pre-operational use is aimed for later this year / beginning of next year



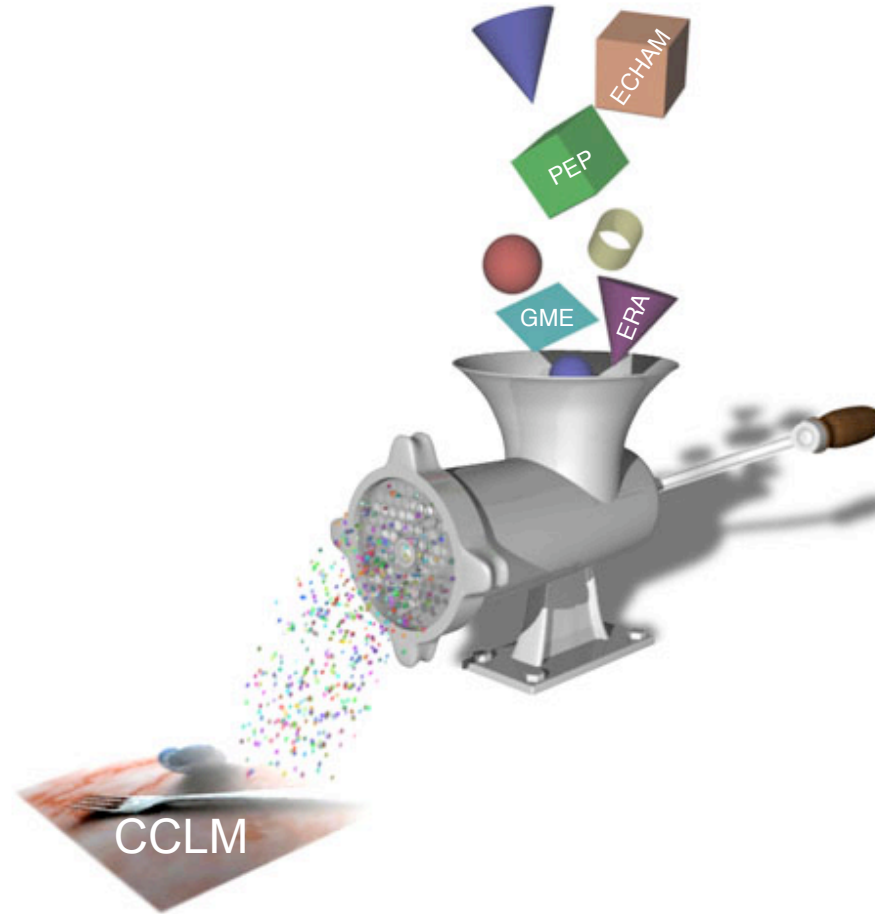


Thank you  
very much  
for your  
attention

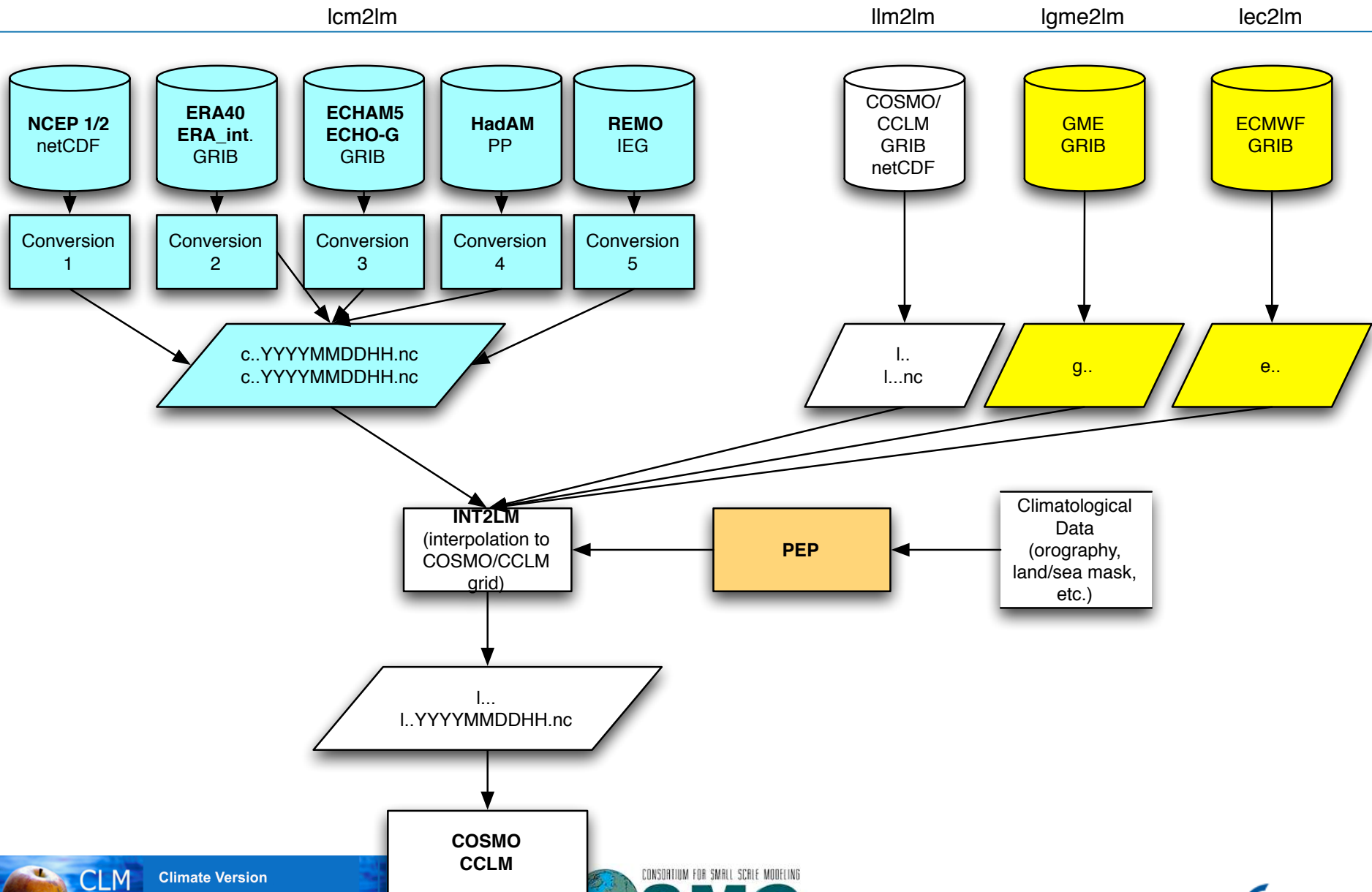


Thank you for your Attention





# The Unified Preprocessor INT2LM and PEP

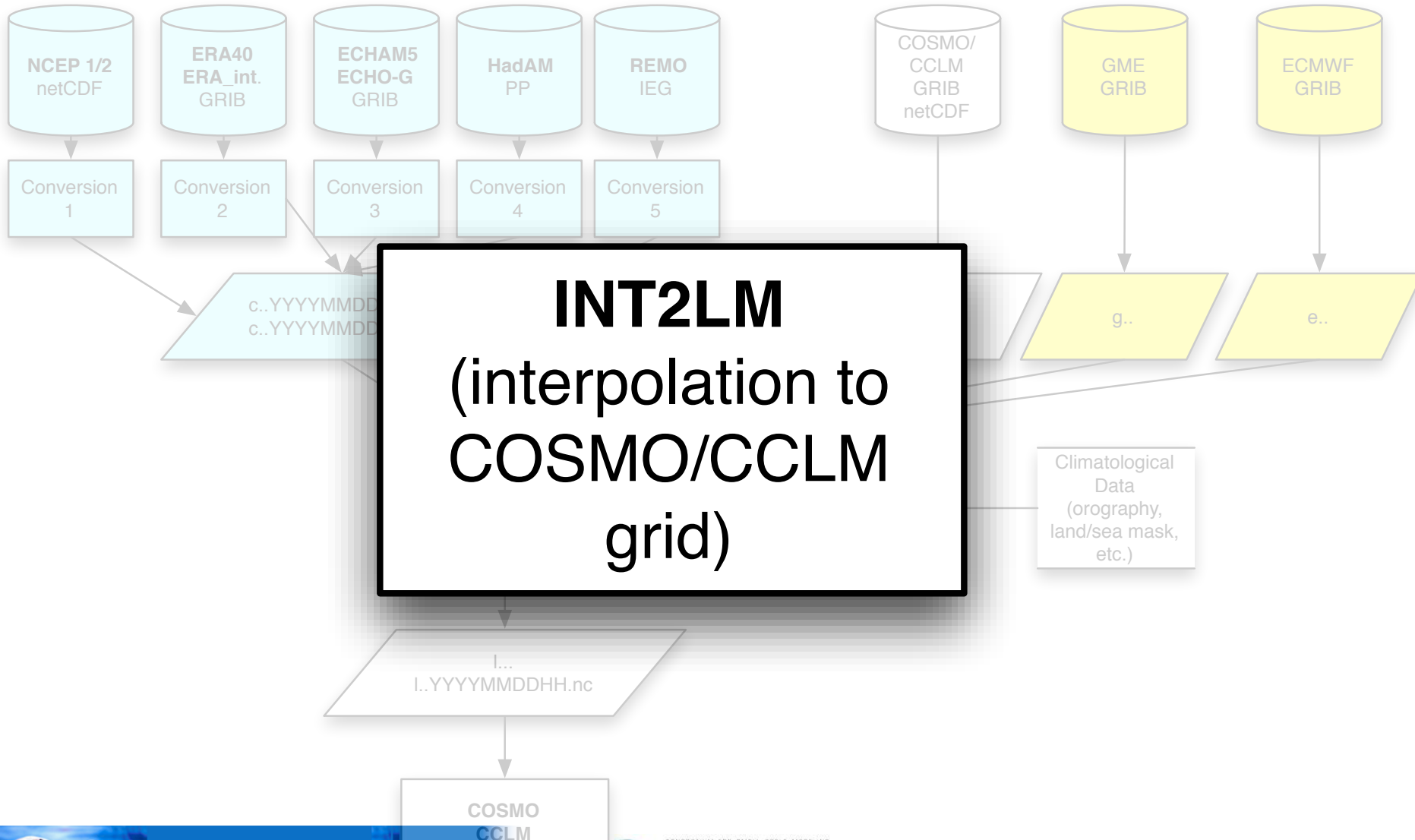


lcm2lm

llm2lm

lgme2lm

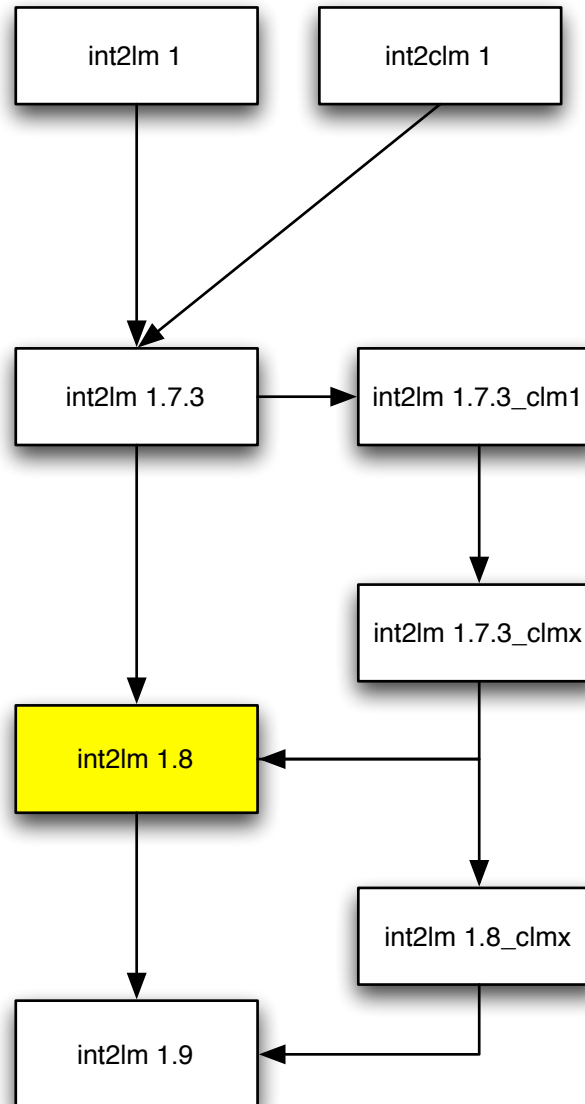
lec2lm



# Development Streams

Standard Version Stream  
Maintained at DWD

Development Stream  
CLM Community



# INT2LM 1.7.3

## Merged INT2LM - INT2CLM

Input on Gaussian Grid	x
Southern Hemisphere	x
Pole crossing	x
Date Line crossing	x
Cressman	x
360 days/year	x
Lakes (fraction)	x
Deep Soil Temperature Clim.	x
Artificial soil water profile	x
Orographic filtering	x
pp filtering	x
GRIB, netCDF I/O format	x
Parallelized	x

## Treatment of qr, qs, qg:

- There are developments going on to introduce prognostic variables for rain and snow into the global model GME of DWD. The INT2LM has been extended, to interpolate also these variables from the GME. Up to now, qr and qs could only be interpolated from the COSMO-Model itself. This feature is switched on by `lprog_qrqs=.TRUE.` and `lgme2lm=.TRUE.`.

## External parameters for the subgrid scale orography (sso) scheme:

- Additional external parameters are read, if the subgrid scale orography scheme should be used for the coarser applications of the COSMO-Model. The reading of the additional parameters can be controlled by the new Namelist variable (in group /CONTRL/) `Isso`

## External parameters for the topographical corrections in the radiation scheme:

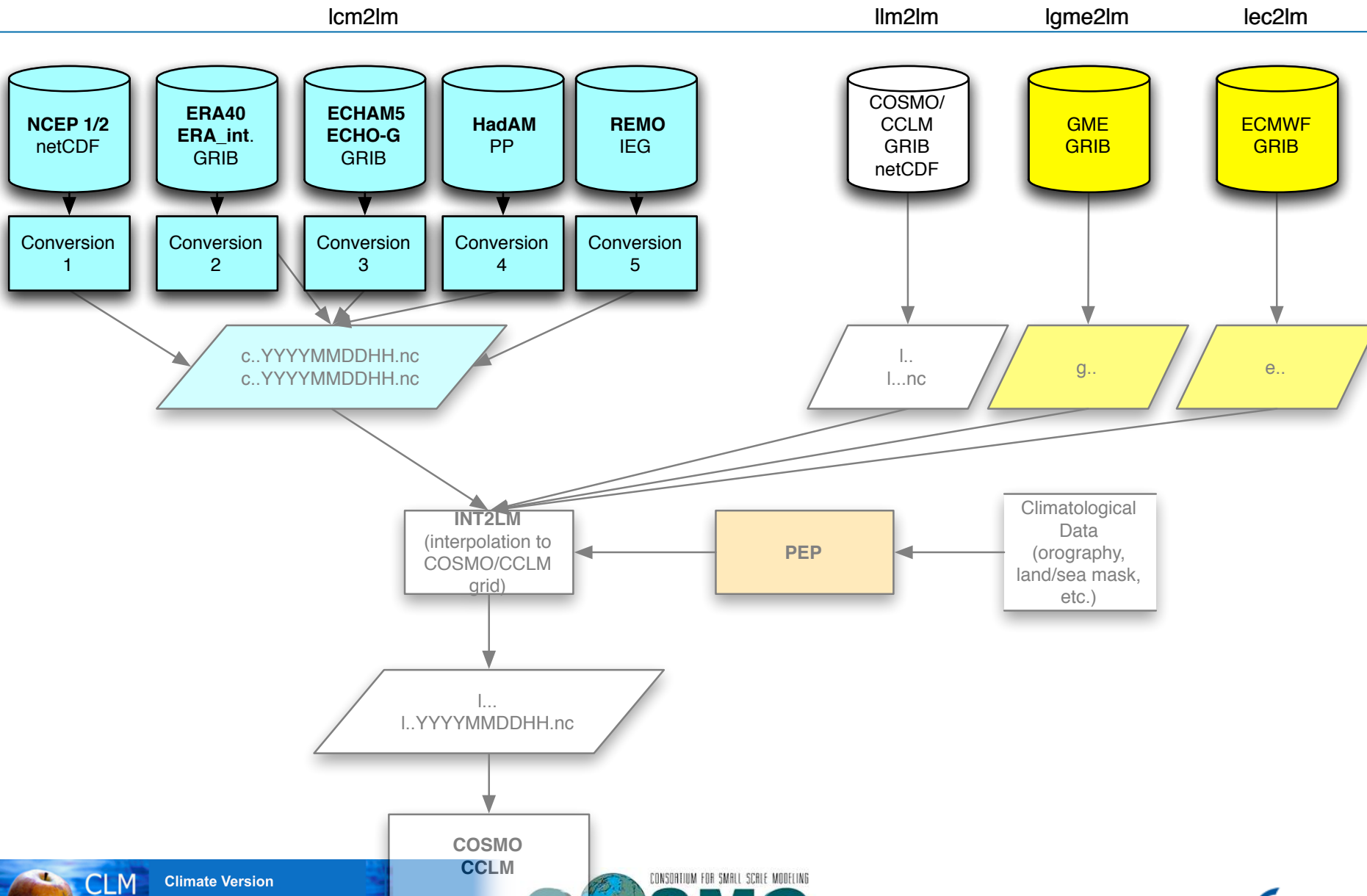
- Additional external parameters are read, if the corrections in the radiation scheme should be computed in the COSMO-Model. The reading of the additional parameters can be controlled by the new Namelist variable (in group /CONTRL/) `lradtopo`

- New reference atmosphere (Zängl)
- Improved interpolation in and adaptation of the boundary layer (MeteoSwiss)
- lake depth (Rockel)
- 12 monthly vegetation (Lüthi)

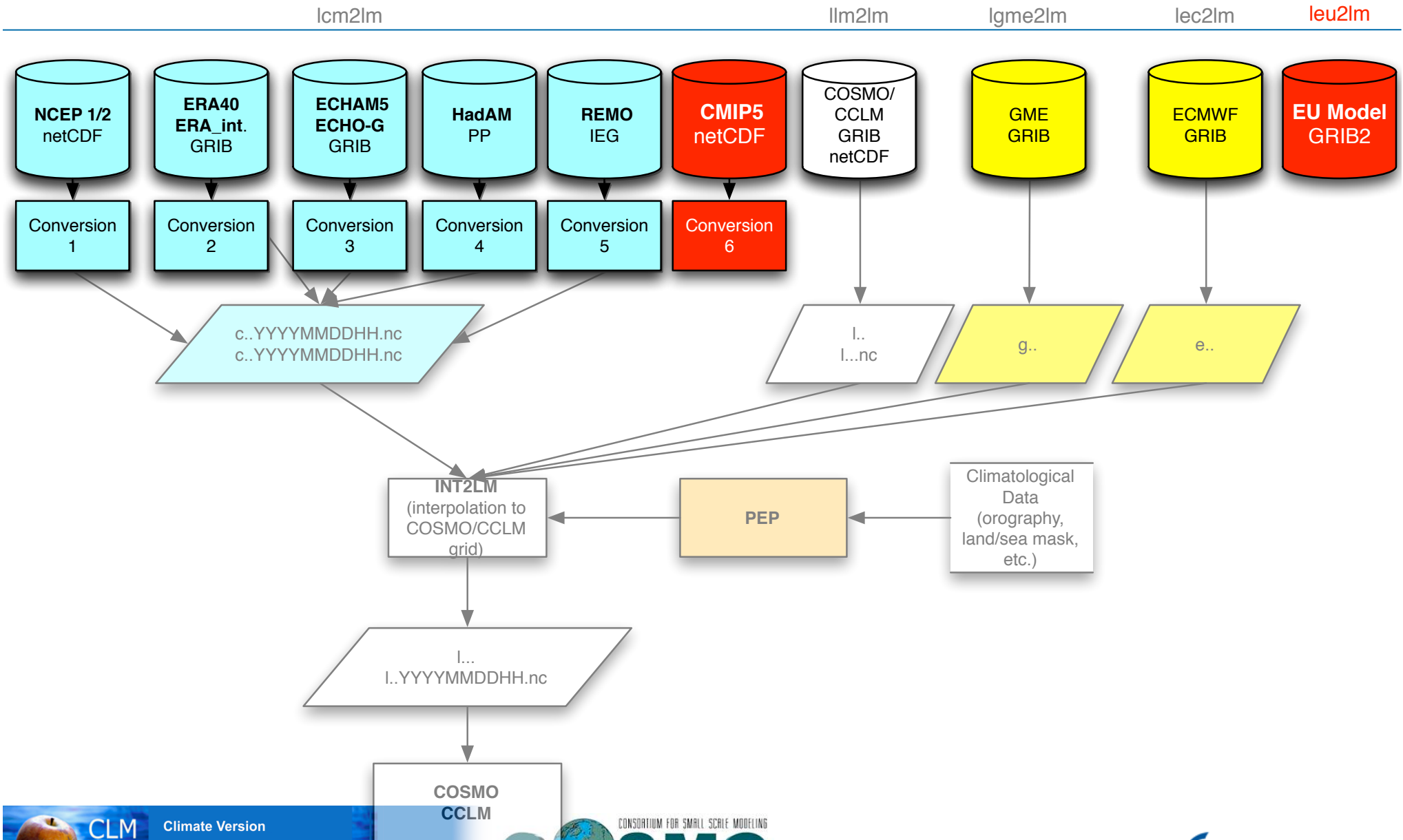
On longer term

- Enhancement to read NWP data from all European global and regional models (e.g. IFS, UM global, ARPEGE, UM local, HIRLAM, ALADIN)

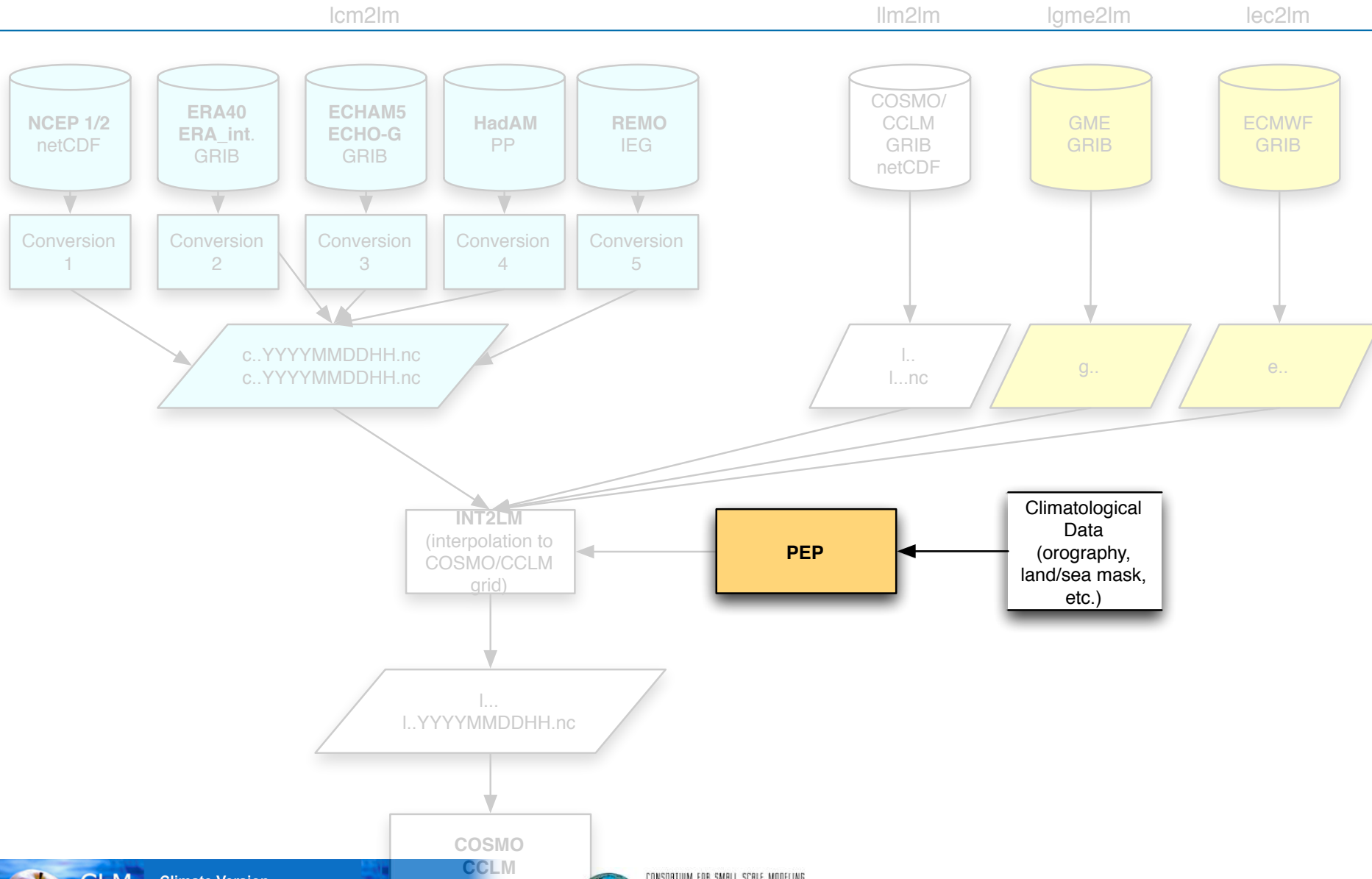
# Present Coarse Model Inputs



# Additional Coarse Model Inputs

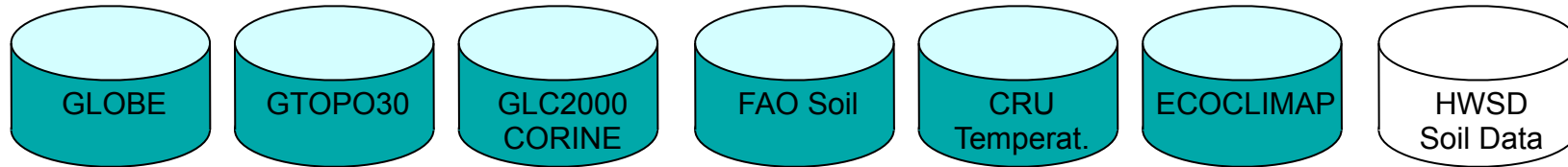


# PEP



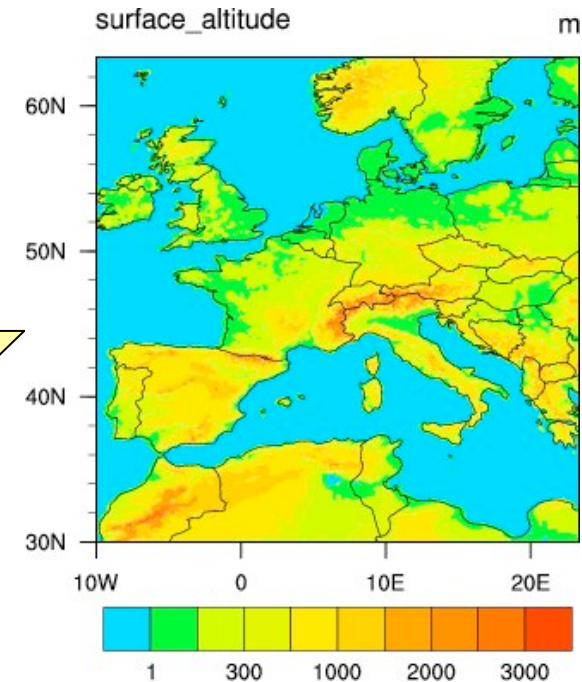
# PEP Structure

INPUT (Geographical projection, NetCDF format)



Interpolation

Rotated coordinates  
NetCDF data format



Example: dx : 1667° x 0.1667°

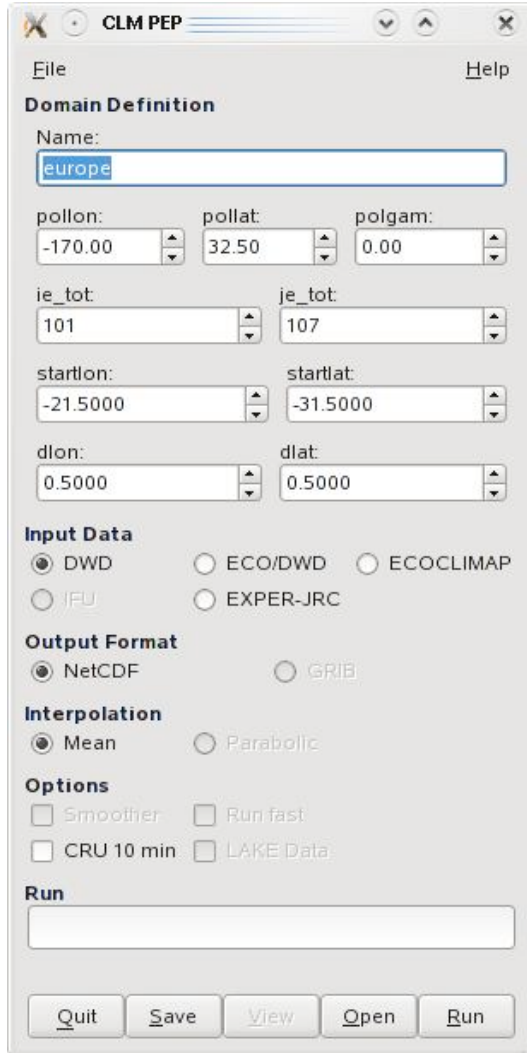
# Preprocessor PEP Version 0.74

Provision of time invariant boundary data:  
Topography, vegetation, soils and others

- Option DWD (operational):
- Option ECO/DWD (experimental)
  - monthly resolution of the vegetation parameters + FAO/DWD Soil
- Option ECOCLIMAP(experimental)
  - Monthly resolution + FAO/STASGO Soil
- Option EXPER-JRC (experimental)
  - Soil data from JRC
- Option HWSD + LAKE (in development)
  - Soil from Harmonized Soil Database
  - Lake database

# Preprocessor PEP Version 0.74

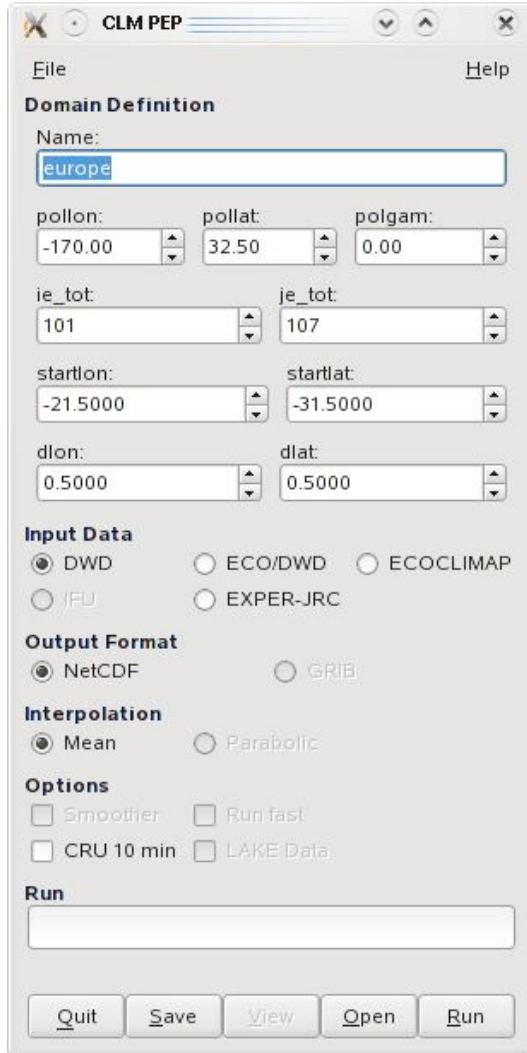
## GUI Version



The screenshot shows the CLM PEP GUI window. The title bar reads "CLM PEP". The menu bar includes "File" and "Help". The "Domain Definition" section contains a "Name:" field with "europe" entered. Below this are several spinners: "pollon:" (-170.00), "pollat:" (32.50), "polgam:" (0.00), "ie\_tot:" (101), "je\_tot:" (107), "startlon:" (-21.5000), "startlat:" (-31.5000), "dlon:" (0.5000), and "dlat:" (0.5000). The "Input Data" section has radio buttons for "DWD" (selected), "ECO/DWD", "ECOCLIMAP", "IFU", and "EXPER-JRC". The "Output Format" section has radio buttons for "NetCDF" (selected) and "GRIB". The "Interpolation" section has radio buttons for "Mean" (selected) and "Parabolic". The "Options" section has checkboxes for "Smoother", "Run fast", "CRU 10 min", and "LAKE Data". At the bottom, there is a "Run" field and buttons for "Quit", "Save", "View", "Open", and "Run".

# Preprocessor PEP Version 0.74

## GUI Version



CLM PEP

File Help

**Domain Definition**

Name:

pollon:  pollat:  polgam:

ie\_tot:  je\_tot:

startlon:  startlat:

dlon:  dlat:

**Input Data**

DWD  ECO/DWD  ECOCLIMAP  
 IFU  EXPER-JRC

**Output Format**

NetCDF  GRIB

**Interpolation**

Mean  Parabolic

**Options**

Smoother  Run fast  
 CRU 10 min  LAKE Data

**Run**

Quit Save View Open Run

## WEB PEP

Fill out the form to create an external data set

pollon	<input type="text"/>	<a href="#">?</a>
pollat	<input type="text"/>	<a href="#">?</a>
polgam	<input type="text" value="0"/>	<a href="#">?</a>
ie_tot	<input type="text"/>	<a href="#">?</a>
je_tot	<input type="text"/>	<a href="#">?</a>
startlon	<input type="text"/>	<a href="#">?</a>
startlat	<input type="text"/>	<a href="#">?</a>
dlon	<input type="text"/>	<a href="#">?</a>
dlat	<input type="text"/>	<a href="#">?</a>
Input data set	<input type="text" value="DWD"/>	<a href="#">?</a>
Output format	<input type="text" value="NetCDF"/>	<a href="#">?</a>
Options	<input type="checkbox"/> CRU 10min	<a href="#">?</a>
email address	<input type="text"/>	<a href="#">?</a>

PEP Version 0.74 18.02.2009

go raibh maith agat !

thank you !

kiitos !

спасибо !

Danke !

dziękuję !

merci !

mulțumesc !

gracias !

grazie !

ευχαριστώ !

شكراً