What is going on in dynamics in HIRLAM

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P.L. on dinamics

HIRLAM-B

Overview

- Optimal nesting strategy
- Elimination of the extension zone from the grid-point representation
- Taking advantage of Boyd's biperiodization
- Change of vertical coordinate
- Other developments
  - Semi-analytical
  - Physics-dynamics interface

Optimal nesting strategy

- ECMWF →16 km resolution, 3h interval
  - HARMONIE→targetted at ~2.5 km
  - Do we need an intermediate resolution model?
  - Do we gain something with more frequent LBC's?
  - -→ see next presentation by Jana and Javier

Elimination of the extension zone in the grid-point computations

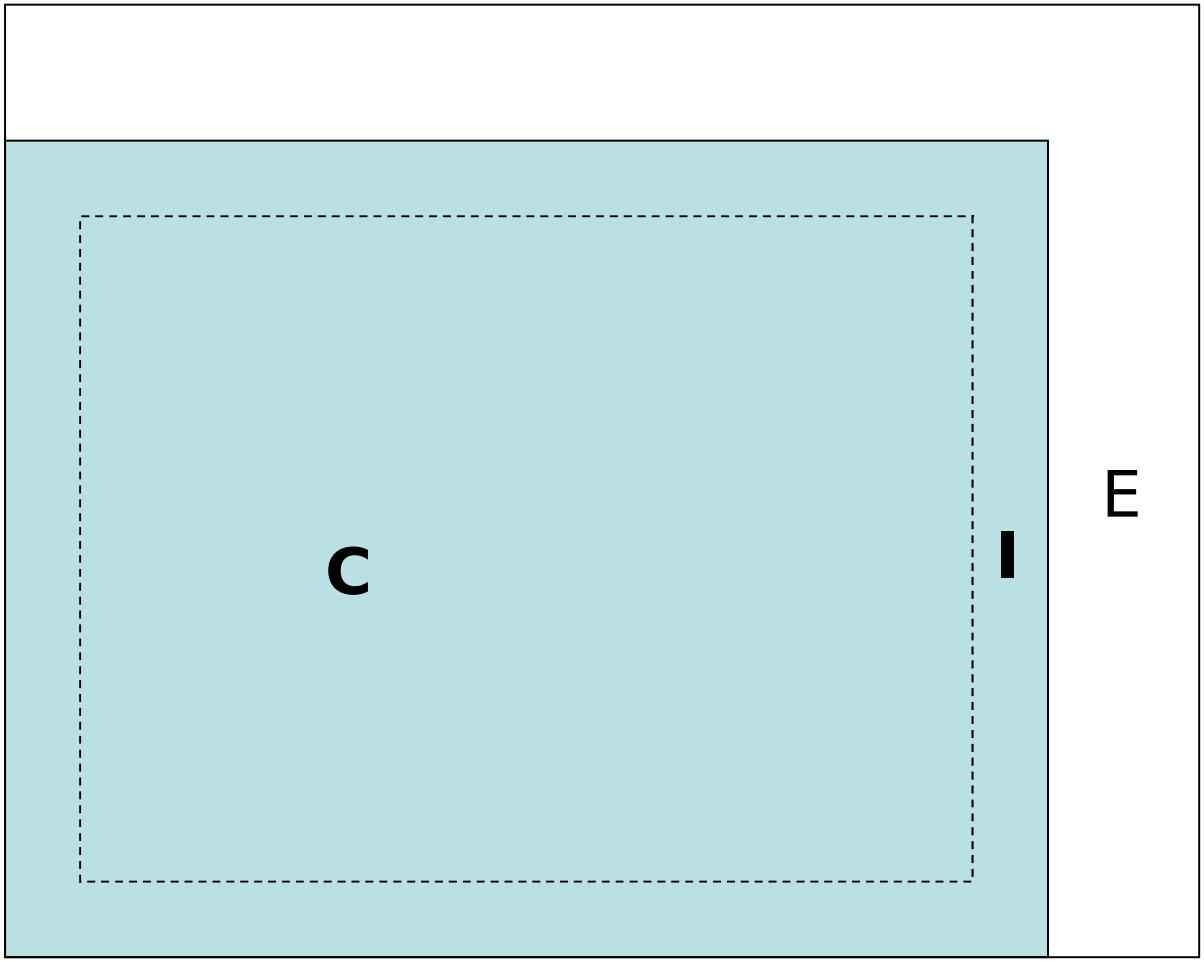
- In the present situation
  - Some grid-points from the extension zone are assigned to processors, others are not
  - Some computations are carried on including the extension zone (GPNORM, for example). In others they are excluded (CPG, partly in CALL_SL).
  - Biperiodization is applied to all fields before writing.

Advantages of the new setup

- Only points in the C+I area “exist” in grid-point space
- No need to biperiodize before writing a grid-point field
- Fields in grid-point format can be coded in GRIB
- Periodization for the spectral transforms do not involve interprocessor communications

Future connection with Boyd'd periodization

- Values of fields in the extension zone and in part of the **I** zone come from the host model (presentation by Steven Caluwaerts)
  - They can be kept from the beginning in spectral space
- Values coming from the LAM model go to **zero** smoothly on the boundaries.
  - Biperiodization is a simple padding with zeroes



Computations are carried on in C+I, Davies relaxation is Applied in I, Boyd's values are applied in E

Change of the vertical coordinate to a height-based hybrid one

- Use of a time-independent coordinate eliminates the X-term.
- Only derivatives are used in the vertical (no integrals) which simplifies the *constraints* to arrive at a single Helmholtz equation
- The coordinate is still a hybrid coordinate. The data flow is maintained.

Change of vertical coord (cont)

- Slab model using a vertical hybrid coordinate based on height

Figure 3: Vertical velocity (ms^{-1}) at $t^* = 120$ with $N = 0.02\,s^{-1}$, $U = 8\,ms^{-1}$, $H_0 = 1\,m$, $a = 16\,km$, $\Delta X = 3.2\,km$ and $H_T\,\Delta Z = 100\,m$. The results are shown for a domain of 14 km height and 384 km width centered at the mountain.

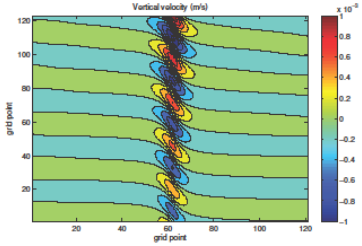
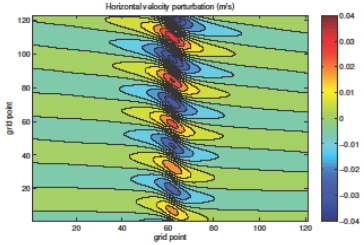


Figure 4: Horizontal velocity perturbation (ms^{-1}) at $t^* = 120$ with $N = 0.02\,s^{-1}$, $U = 8\,ms^{-1}$, $H_0 = 1\,m$, $a = 16\,km$, $\Delta X = 3.2\,km$ and $H_T\,\Delta Z = 100\,m$. The results are shown for a domain of 14 km height and 384 km width centered at the mountain.



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Use of ECMWF physics allowed in the LAM version

- Switches LECMWF and LELAM made compatible
- Surface fields are interpolated by “gl” to use the ECMWF soil scheme
- In the HIRLAM setup, set PHYSICS=ecphy and SURFACE=htessls
- Physics parameters depending on resolution computed from EDELX instead of NSMAX

Other projects

- Second-order accurate interface with the physics
- Semi-analytical time-stepping scheme
- Running the physics and the dynamics at different resolutions