

Academic simulation using a 2D-3D model options

3D pseudo-academic tests ALPIA/SCANIA

Alena Trojakova

Czech Hydrometeorological Institute (CHMI)

Outline of the talk

- Introduction of pseudo-academic experiment
- Setup
- Coupling and/or possible downscaling
- Post processing
- Technical notes (namelist variables)
- Some examples

Introduction of pseudo-academic experiment

Pseudo-academic experiment allows to study the forcing induced by a complex orography (e.g. SCANIA case for Scandinavian peninsula or ALPIA for Alps) in otherwise idealized conditions where orography is the only forcing. There is no exact analytical solution to compare results with; but one can still judge the physical realism of model's simulation.

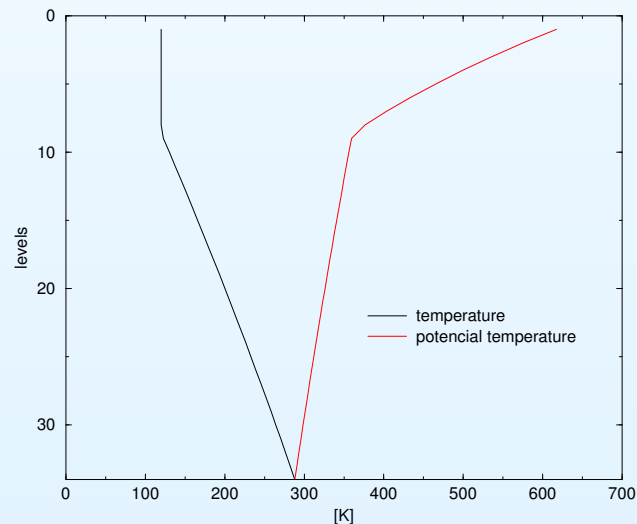
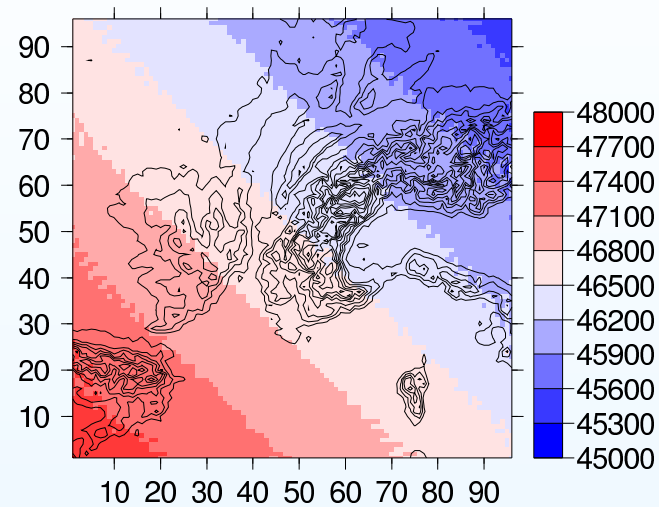
Mainly dedicated for adiabatic testing model's dynamics, but some tests were focused on physics-dynamics interface or very simple diabatic experiments.

Bubnova, R., 2000: High Resolution Tests of the (IFS)/ARPEGE/ALADIN Dynamics Using a Quasi Academic Case *The ECMWF Workshop Proceedings on Developments in Numerical Methods for Very High Resolution Global Models, 5 - 7 June 2000, 21 - 29.*

Geleyn, J.-F., Trojakova, A. and Giard, D., 2002: Validation of ALADIN dynamics at high resolution using ALPIA, *ALADIN Newsletter 22*

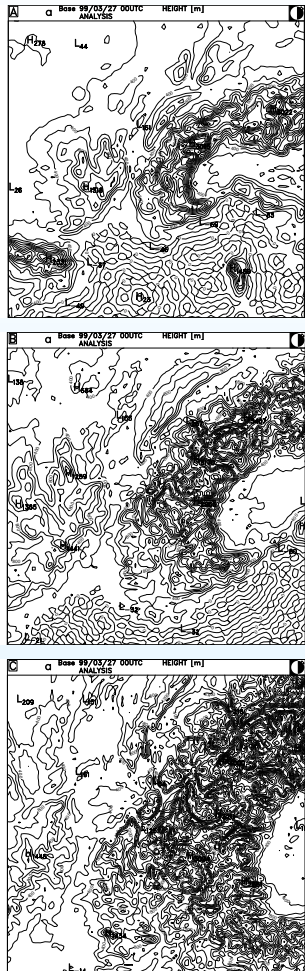
Catry, B., 2003: Orographic forcing in ALADIN, *ALADIN Newsletter 24*

Setup idealized atmosphere



- dry, inviscid, hydrostatic equilibrium
- geostrophic equilibrium
- static stability given by Brunt-Vaisala frequency (with possible use of the tropopause or simple isothermal profile)
- no projection (map factor $m=1$), (x, y, η) system is used

Setup orography

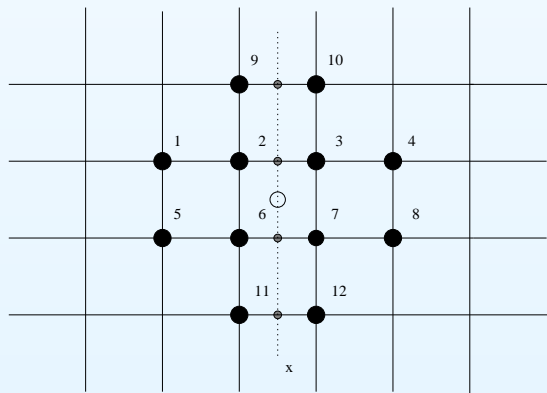


- idealized (Agnesi shape mountain)
- real orography from FA file
- real orography from ASCII data set
(e.g. ALPIA case - high resolution orography provided by GMME/GMAP centered around $5.90^{\circ}\text{E}/45.22^{\circ}\text{N}$, quite high slopes at all scales from 10km to 156.5 m)

Coupling and/or possible downscaling

Standard tools (E927) for a change of horizontal and vertical geometry does not work for academic cases.

- constant coupling (INIT file = LCB file)
- special tools (ACADHOR/ACADVER) for horizontal and vertical interpolation have to be used for creation LBC



(12-points) horizontal interpolation of $(u, v, T, \hat{q}, w, p_s, T_s)$ is performed in grid-point space and afterwards vertical interpolation preserving PBL structure (T and q stratification, wind shear) by its transfer due to change of orography is done

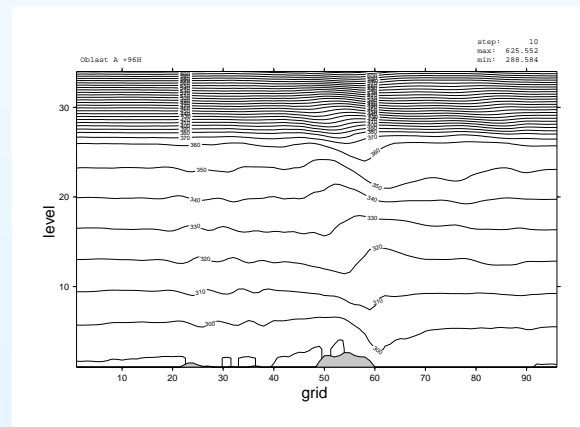
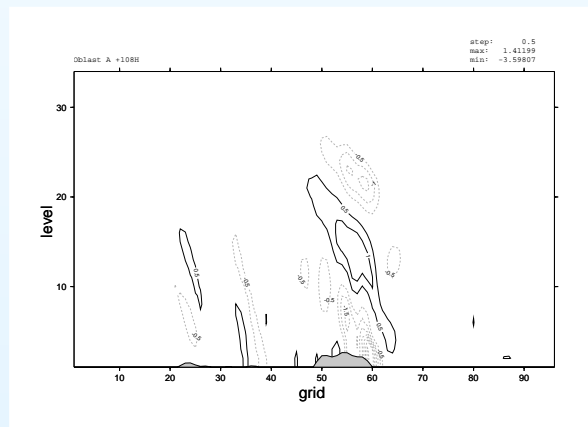
Post processing

Special tool ACADPOS provides only very simple ASCII outputs:

- horizontal cross-section at predefined level
- vertical cross-section on xz, yz and diagonal

for following variables (more can be easily added)

T, u, v, w, θ , pressure, orography



ASCII files one can plot with any graphic tool.

Technical notes 1/2

input file

ACADFA

- geometry

NDLON,NDLUX,NDGL,NDGUX,NMSMAX,
NSMAX,NBZONL,NBZONG,ELX,ELY,
NFLEVG,EDELZ,RX0,RY0

- orography

LROROG,LRORFA,
RAGNESI,ZPOSITION,RWIDTH

- vertical coordinate

LSIGMA,LPRECOORD,NEPONBT

- initial condition

RT00,RU00,RV00,RSP00,RQ00,
RHO0,RPD00,RVD00,RCORI,RBRVAF,
LIZOT,LGEOST,LNHDYN,LMPHYS,
LREASUR,LMAP,LTROPO,RZTROPO

run model

ALADIN

- academic case

LMAP=.F.

RCORI_ACAD

LADVF=.F. for SL scheme

post processing

ACADPOS

- geometry

NLEVZ,RDELZ,ILKUK,NX,NY

- constants

RSP00,RHO0,RBRVAF

- other

LNHDYN,LINTERPOL

Technical notes (2/2)

horizontal interpolation

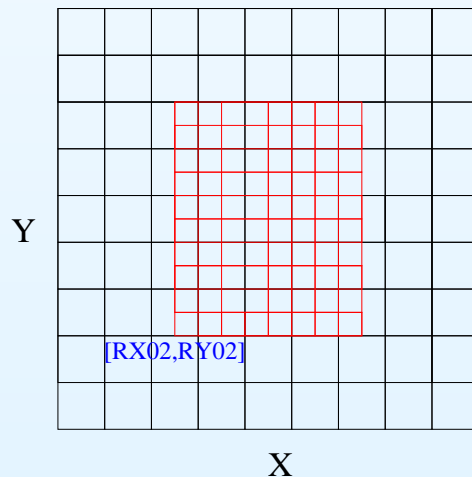
ACADHOR

- geometry

IDLUX2,IDLON2,IDGUX2,IDGL2,ZDELX2,ZDELY2
IMSMAX2,ISMAX2,IFLEV2,NBZONL,NBZONG,
RX02,RX02

- misc

LNHDYN,CLFILEIN,LREASUR,LMPHYS



vertical interpolation

ACADVER

- vertical coordinate

IFLEVG2,DVALH,DVBH

- atmosphere

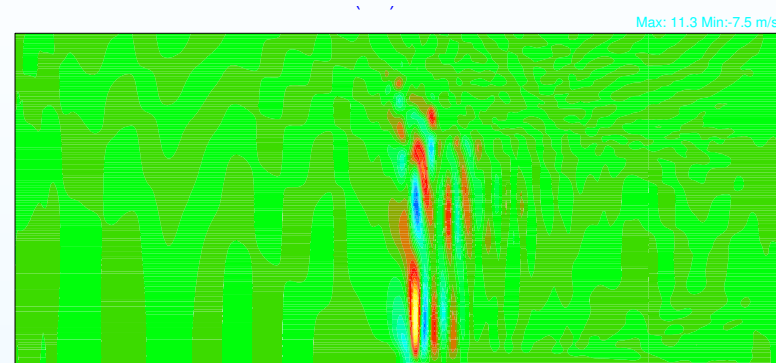
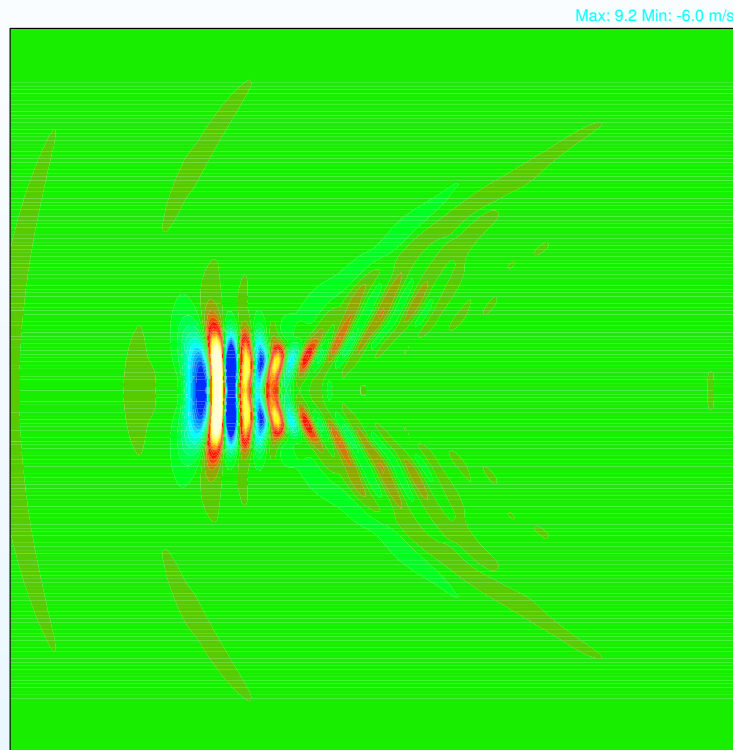
RBRVAF,PDPBLC

- misc

LNHDYN,LREASUR,LMPHYS,LZAPISGP
CLFILEIN,CLFILEOROG

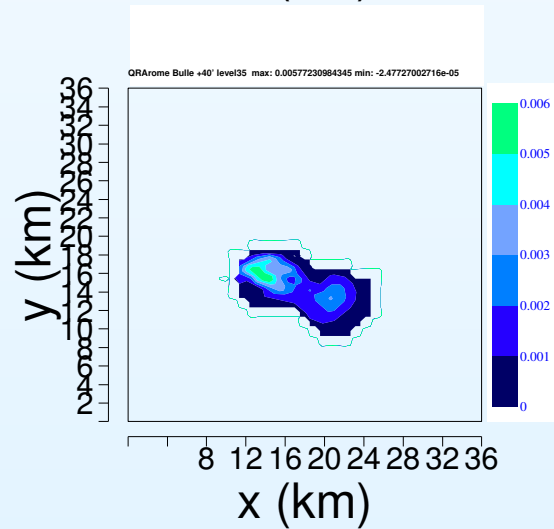
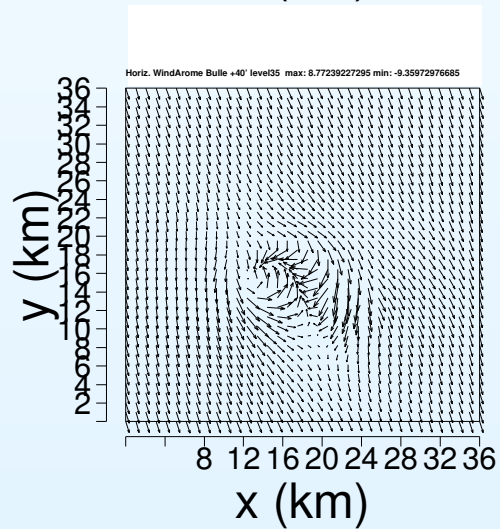
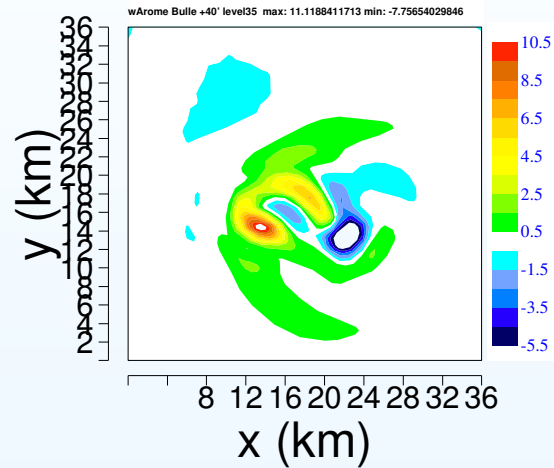
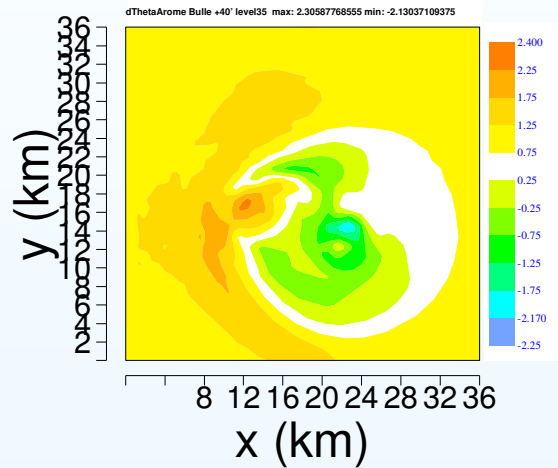
- file with the target spectrally fitted orography
- file with horizontally interpolated fields

Some examples - 3D trapped lee wave



horizontal and vertical cross-section for w (acknowledgement R.Brozkova)

Some examples - radiation + microphysics



horizontal cross-section for trend of θ , w , V , $rain$ (acknowledgement G.Hello)

Thank you for your attention.