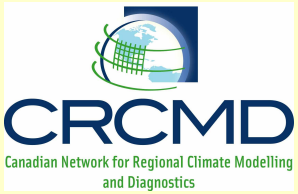
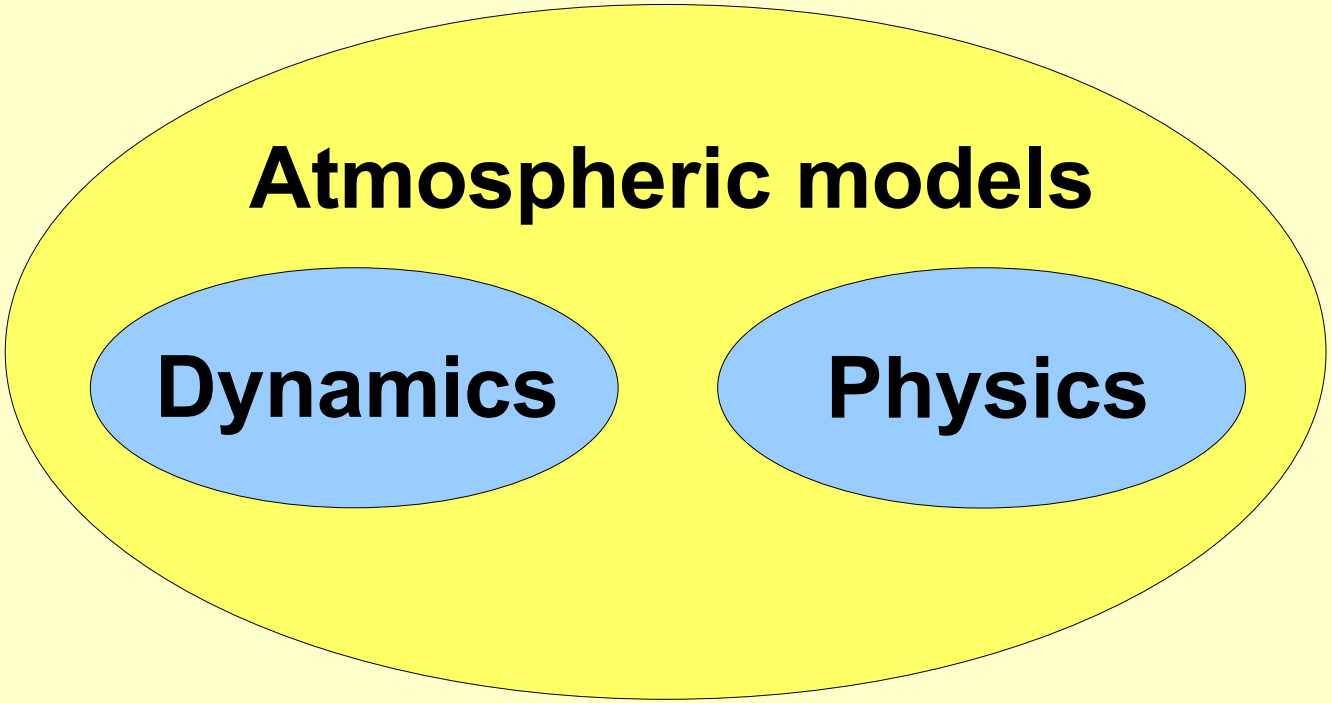


CRCM5

Katja Winger, UQAM
with contributions from Bernard Dugas, RPN
UQAM, 28. Jan. 2010



Dynamics

- grid setup
- parallelism (MPI and OpenMP)
- memory allocations
- advection
- horizontal diffusion
- lateral boundary conditions (LAM)
-
-

Physics

- radiation
- convection
- condensation
- land surface schemes (CLASS, ISBA, ...), ocean, lakes, glaciers, sea ice
- boundary layer vertical diffusion
- specified surface forcings (when no ocean model)
-

Atmospheric models

GEM (**G**lobal **E**nvironmental **M**ultiscale)
Operational weather forecast model of EC (MRD/RPN Dorval)

GEMCLIM
Climate configuration of GEM
Developed as a validation tool for GEM
Operationally used only for monthly and seasonal forecast at EC (MRD/RPN Dorval)

CGCM (**C**anadien **G**lobal **C**limate **M**odel)
Operational global climate model of EC (CCCma Victoria)

CRCM (**C**anadien **R**egional **C**limate **M**odel)
Regional climate model used at **UQAM** and Ouranos

CRCM4: Operational version for past, current and future climate scenarios

CRCM5: - **Current version**: GEMCLIM (past and current climate)
- Upcoming version: GEMCLIM dynamics/physics + CGCM physics

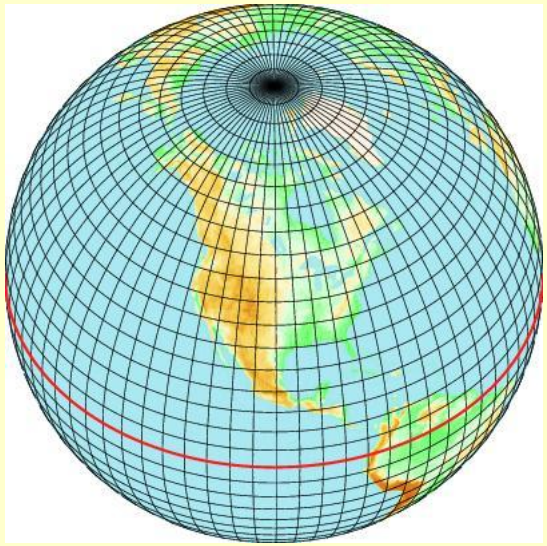
GEMCLIM and CRCM5

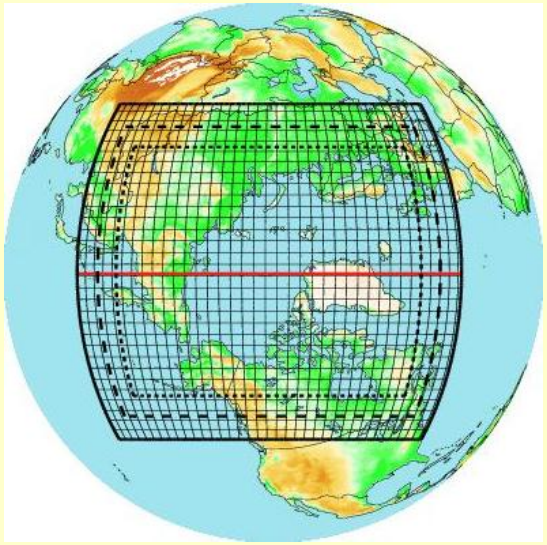
Since almost 2 years GEMCLIM is installed on the Linux cluster 'marvin' of the CRCMD network as CRCM5.

MRD/RPN		UQAM
GEMCLIM v_3.2.2	**=>**	**CRCM5.0.0**
GEMCLIM v_3.3.0	**=>**	**CRCM5.0.1**
GEMCLIM v_3.3.2	**=>**	**CRCM5.0.2**

GEMCLIM / CRCM5 grid types

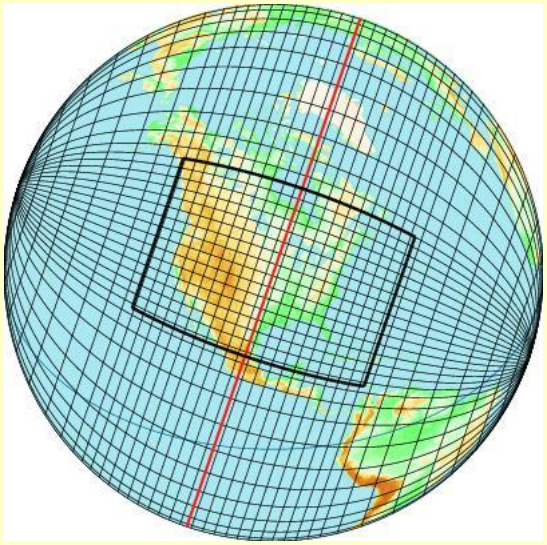
global uniform





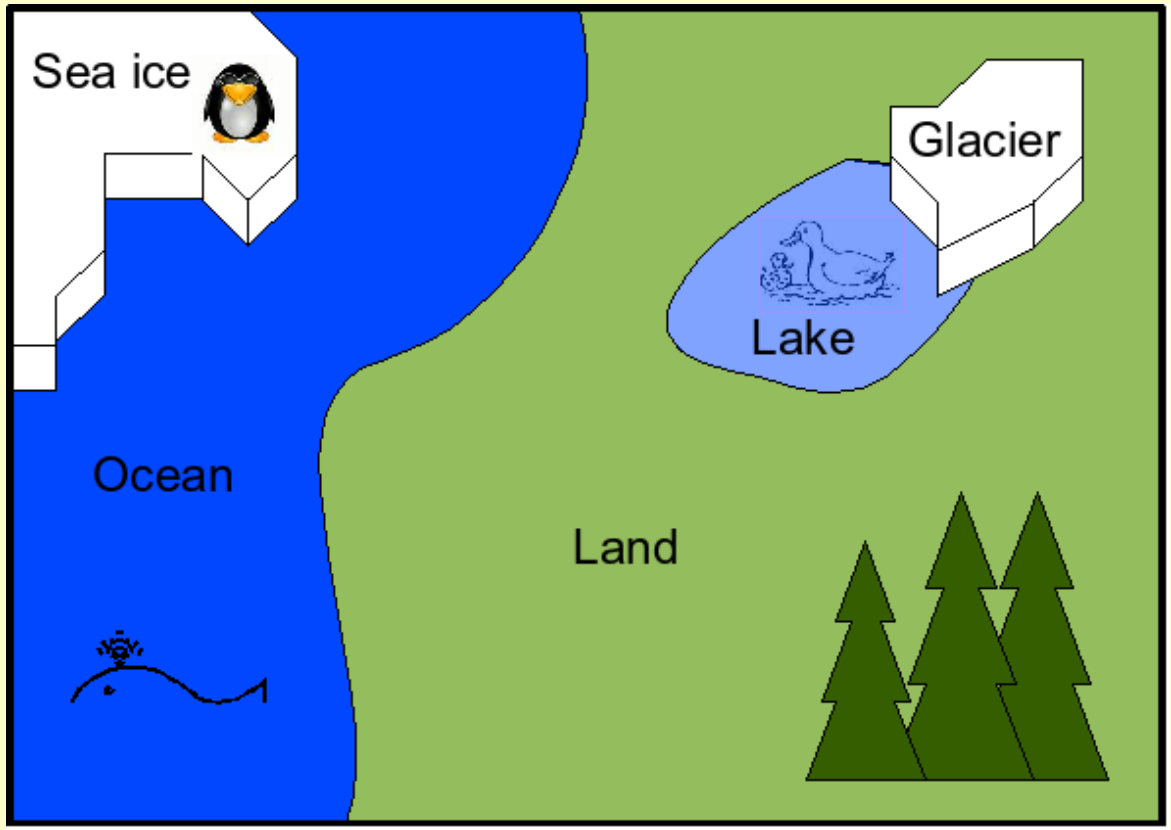
limited area
LAM

global variable



Aggregation

One grid cell:



CRCM5 physics configurations

SST & Sea Ice:
- Prescribed SST and sea ice fraction
- soon possibility to coupled ocean model

Aerosols:
- Information in SST and sea ice fraction
- will soon have an aerosol climatology (build from CGCM aerosols)

Radiation:
- correlated-k radiation (Li and Barker) with trace gas “climatology”
- newrad (Fouquart-Bonnel (1980), short-wave
  Garand and Mailhot (1990), long-wave
  Fomichev, stratospheric long-wave)

Surface scheme:
- ISBA
- CLASS 3.4 and CLASS 3.5
- Force-Restore

CRCM5 physics configurations

Convection:

- deep: • Kain-Fritsch
  • classical Kuo
- shallow: (Girard and Pellerin)

Clouds:

- prognostic cloud scheme (Sundquist)

Gravity wave drag:

- McFarlane (orographic)
- Hines (non-orographic)

- Mass fix (log of surface pressure)
  only global

Outlook for GEMCLIM / CRCM5

- CGCM4 physics (CCCma, RPN)
- Vertical staggered grid (Charney-Phillips) (RPN)
- Single column mode (RPN)

Current CRCM5 projects at UQAM

Minwei Qian:
Coupling **ocean** model **RCO** (**R**ossby **C**entre **O**cean)

Andrey Martynov:
Implementation & validation of **lake** models

Samira Ben Said:
Implementation & validation of **ice sheet** models

Luis Duarte & Camille Garnaud:
Implementation & validation of **CTEM** (**C**anadian **T**errestrial **E**cosystem **M**odel)

Gwénaëlle Paque:
Implementation & validation & amelioration of **dynamic glacier** model

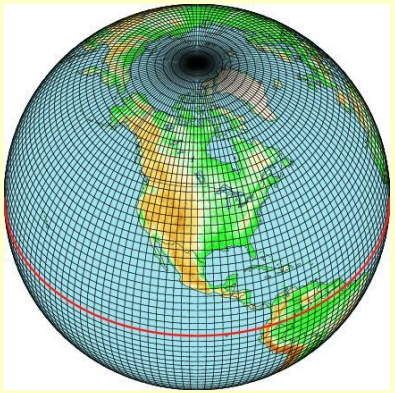
Alex Matveev:
Implementation & validation of **thermokarst lake** model (parameterization)

Recent runs done with GEMCLIM and CRCM5

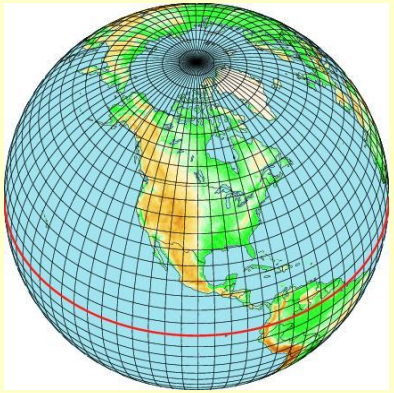
GEMCLIM v_3.2.1

Period: 197801 - 200402
Output: full diagnostics
(+ 3 hourly high res area)
(+ pilot files from 1.5° global)

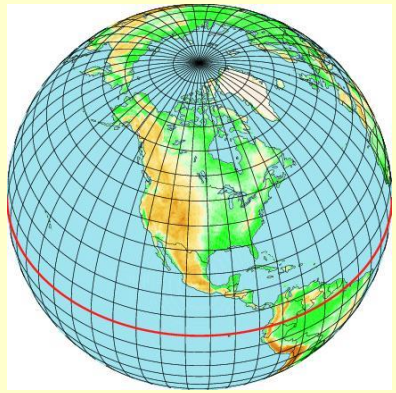
global, 0.5°



global, 1.0°

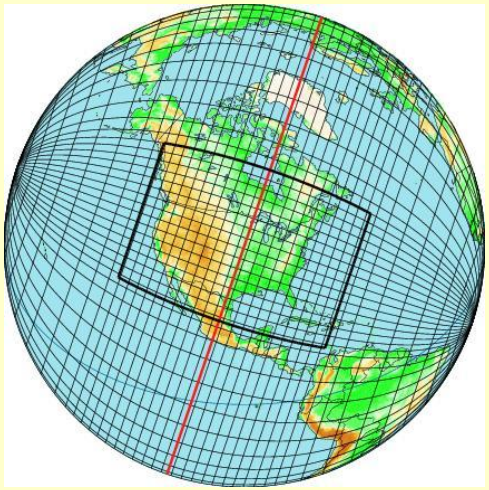


global, 1.5°



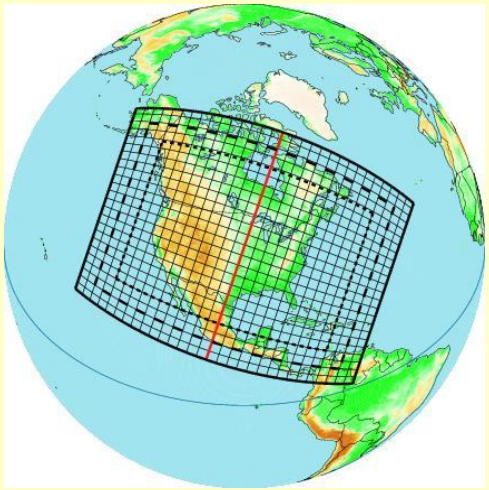
SGMIP2 project:
- stretched grid, North America, 0.5°-1.5°
- stretched grid, Europe, 0.5°-1.5°
- global, 1.0°
- global, 0.5° (just Jan.+Jul.)

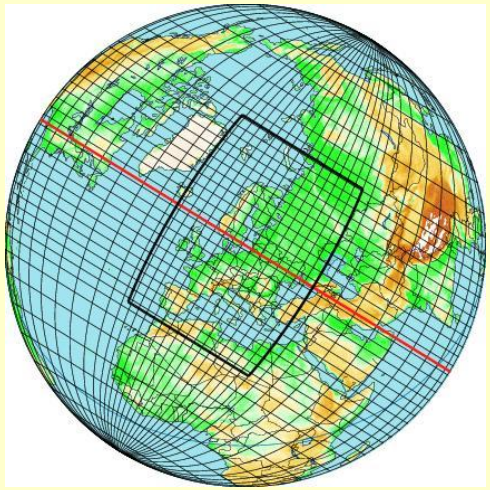
Also done:
- LAM over high res of NA stretched grid, 0.5°
- LAM over high res of EU stretched grid, 0.5°
- global, 1.5° (used as pilot for LAM's)



stretched, NA

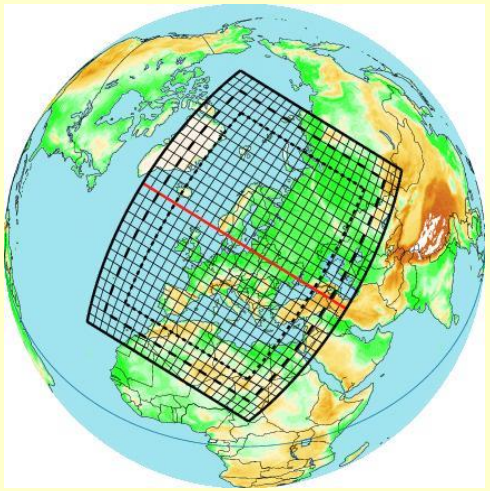
LAM, NA



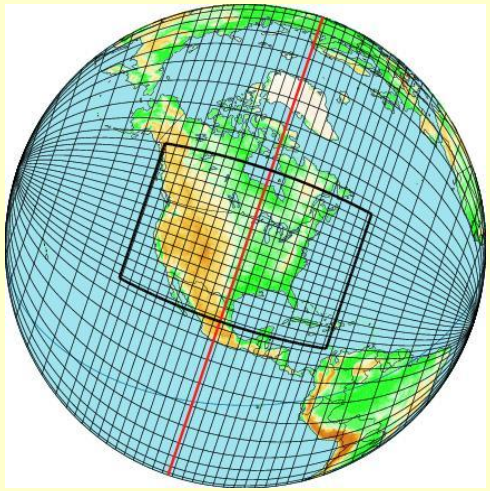


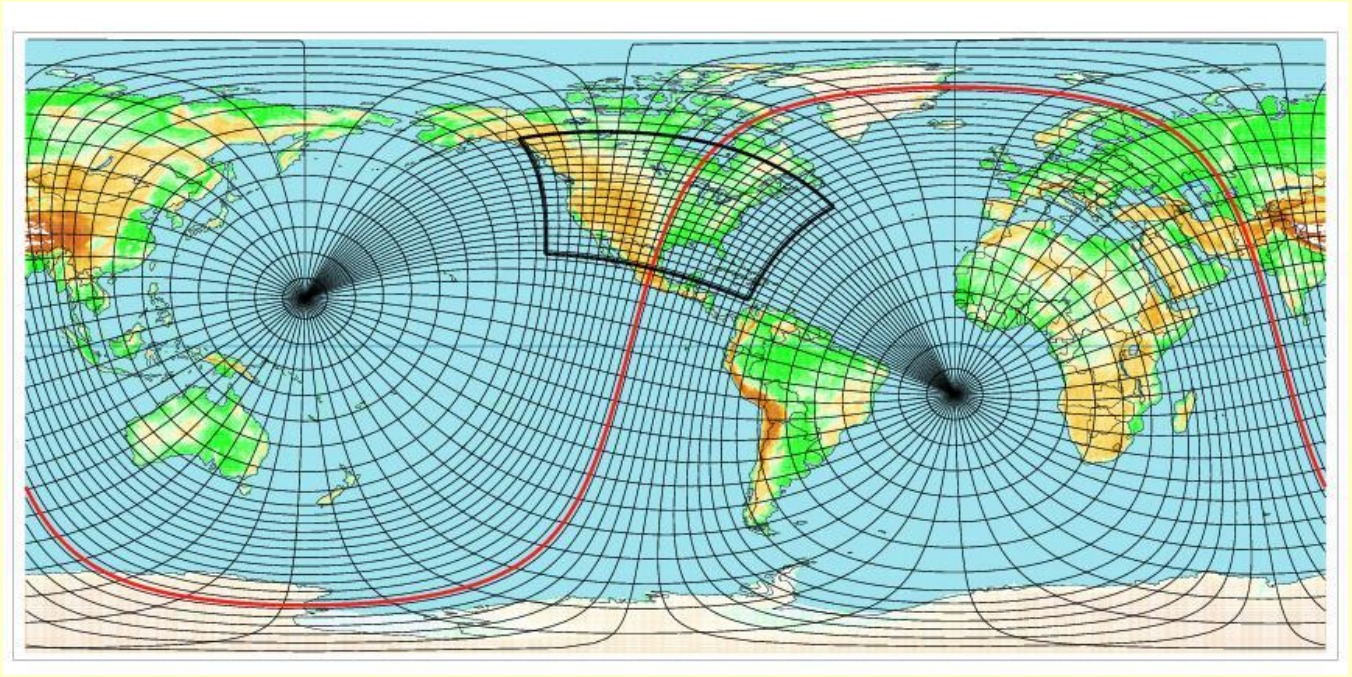
stretched, EU

LAM, EU

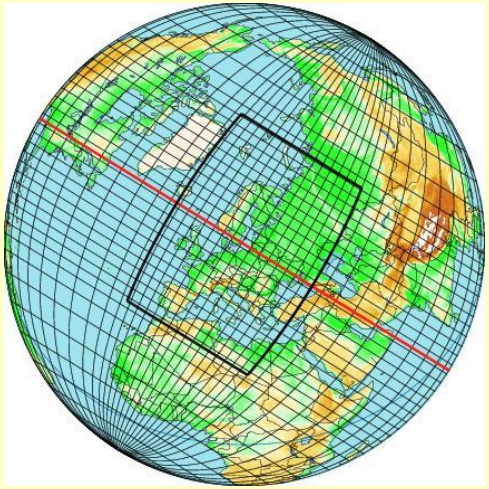


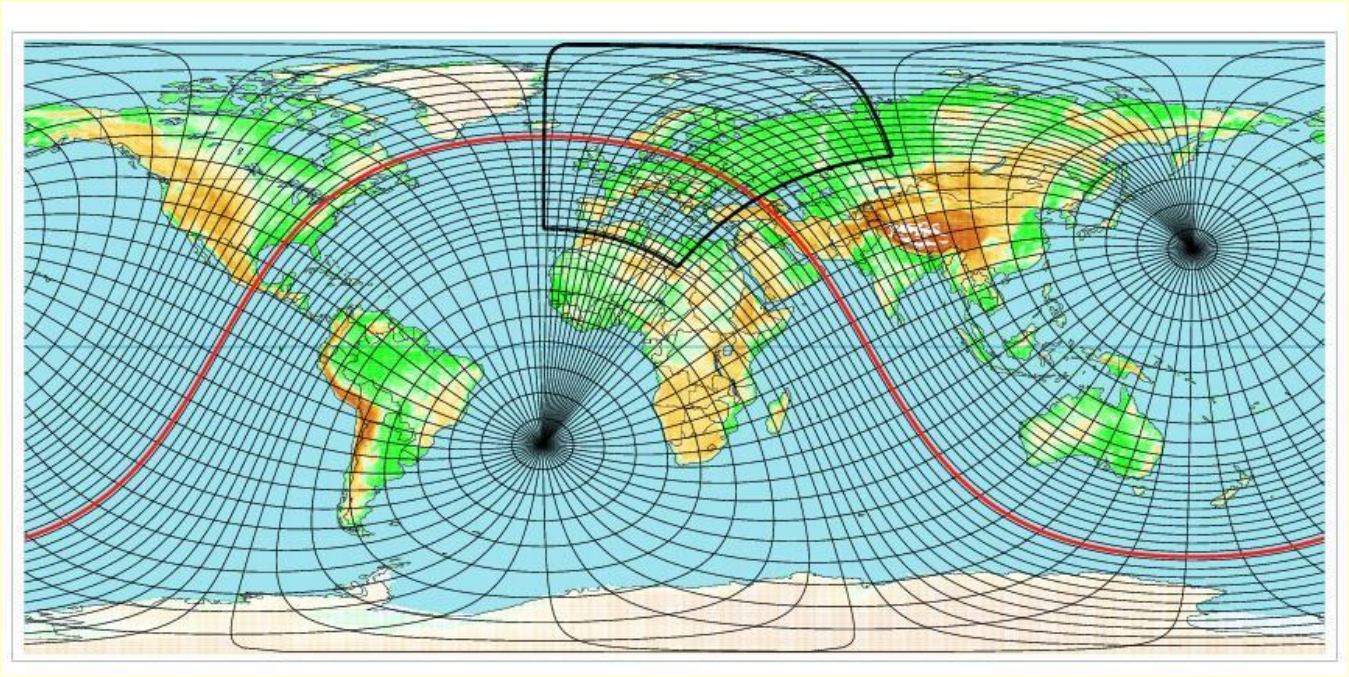
stretched grid over
North America, 0.5°-1.5°





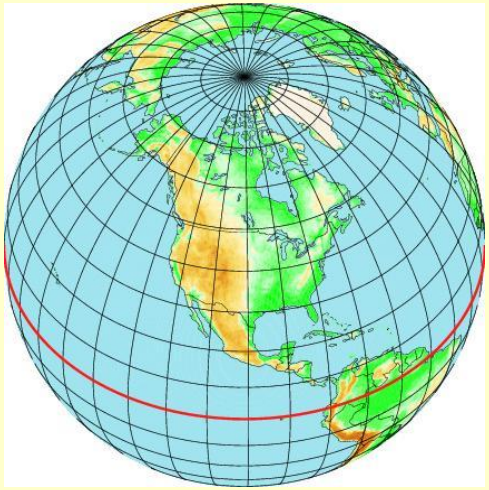
stretched grid over
Europe, 0.5°-1.5°



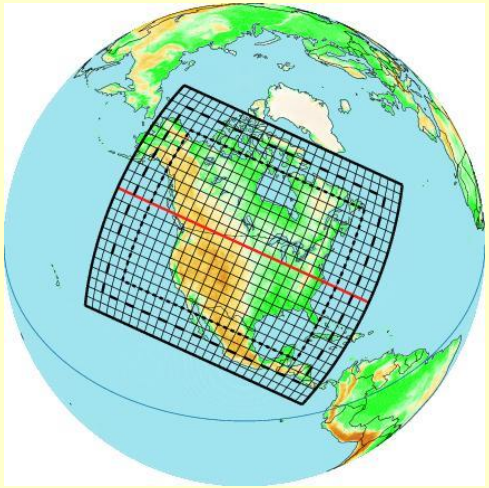


GEMCLIM v_3.2.2

Global, 2.0°
Period: 197801 - 200402
Output: full diagnostics

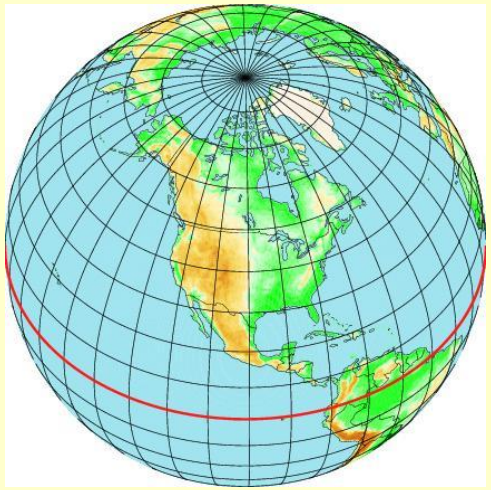


LAM over North America, 0.5°
piloted with ERA40
Period: 195709 - 200208
Output: full diagnostics
+ station time series starting 1998

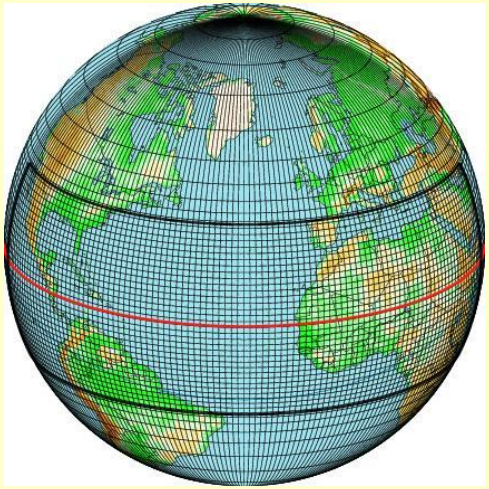


CRCM5.0.0

Global, 2.0°
Period: 197809 - 200611
Output: 3 hourly output
+ pilot files

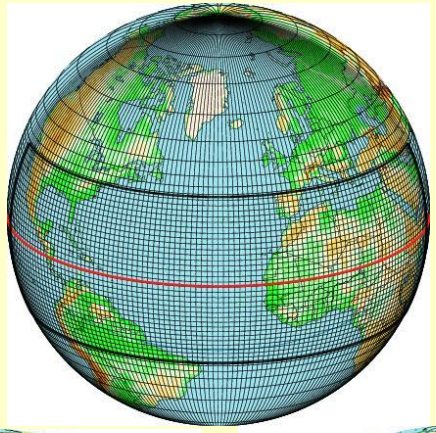


Stretched grid over hurricane tracks, 0.3°-2.0°
Period: 197809 - 200611
Output: 3 hourly output

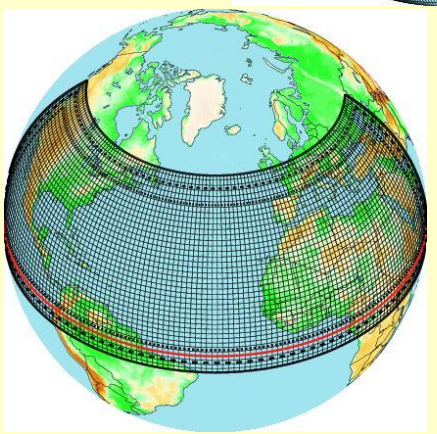


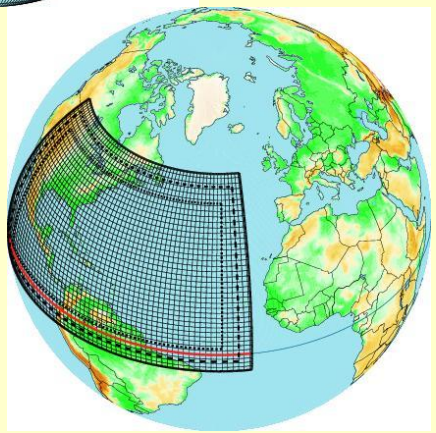
CRCM5.0.1

Stretched grid over hurricane tracks, 0.3°-2.0°
Period: 197809 - 200611
Output: 3 hourly output

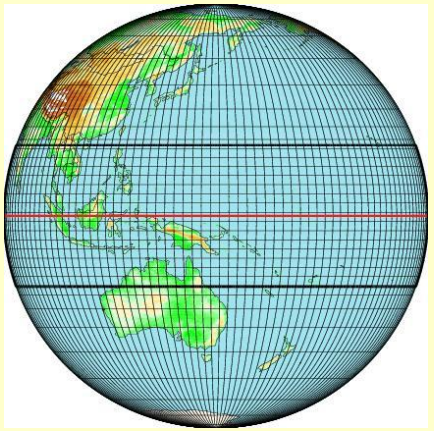


2 LAM grids over hurricane tracks, 0.3°
Piloted with ERA40 resp. ECMWF analysis data and also with CRCM5 global 2.0°.
Period: 197906 – 200611; June - November
Output: 3 hourly output

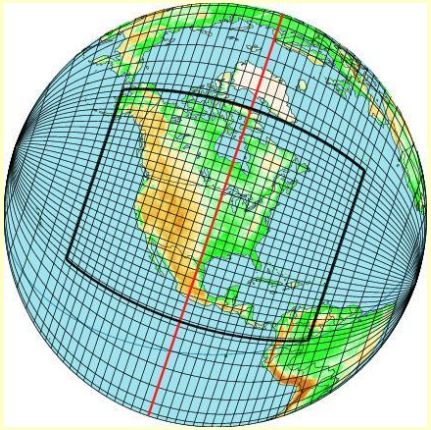




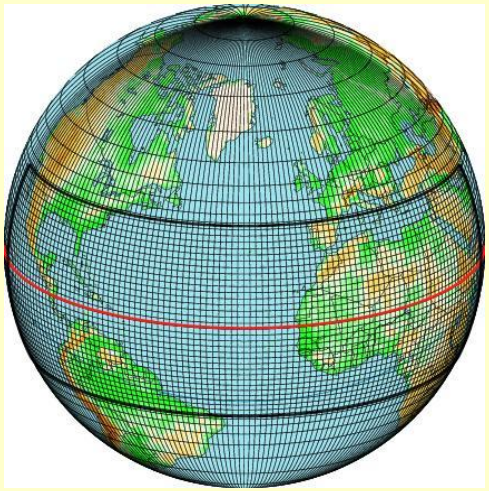
Stretched grid over Indian Ocean and tropical Pacific, 0.5°-2.0°
Period: 197801 - 200611
Output: 3 hourly output

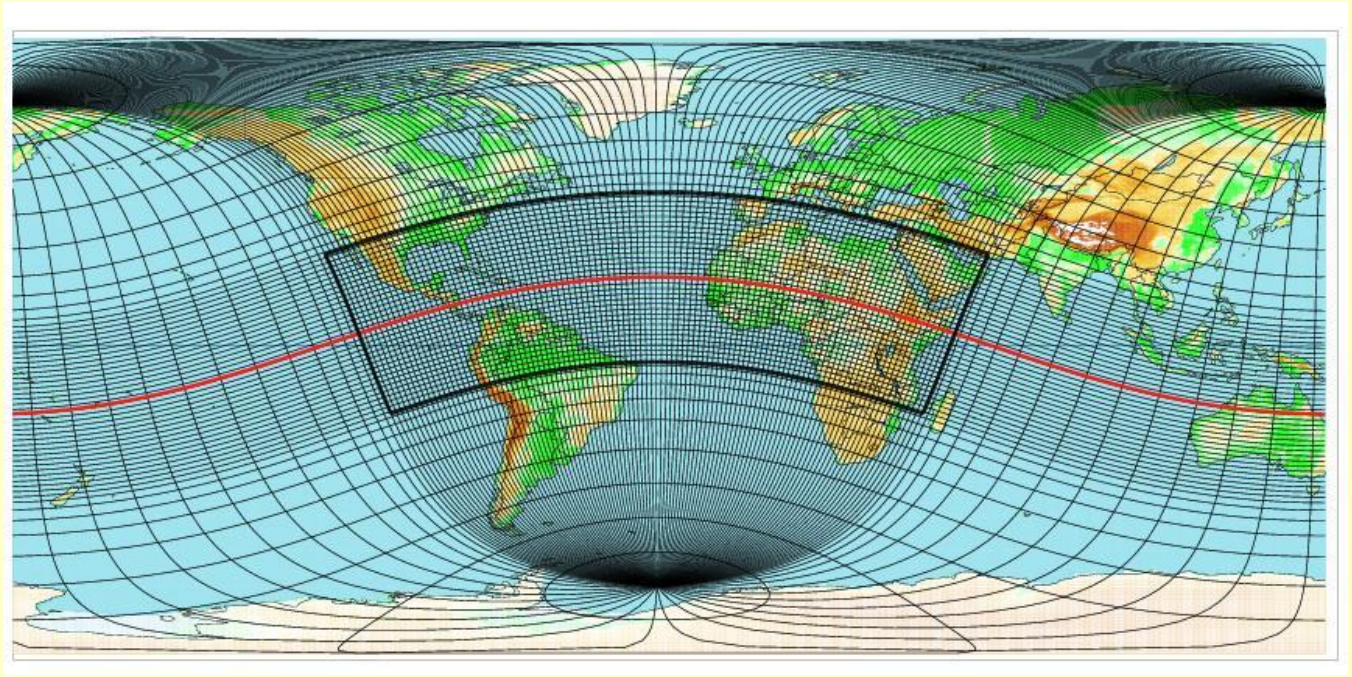


Stretched grid over North America, 0.5°-2.0°
Period: 197801 - 200611
Output: 3 hourly output

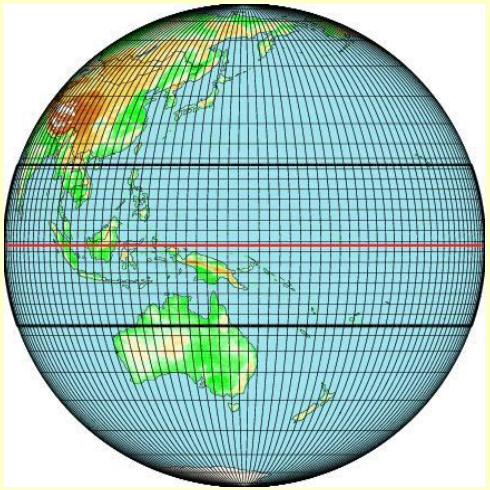


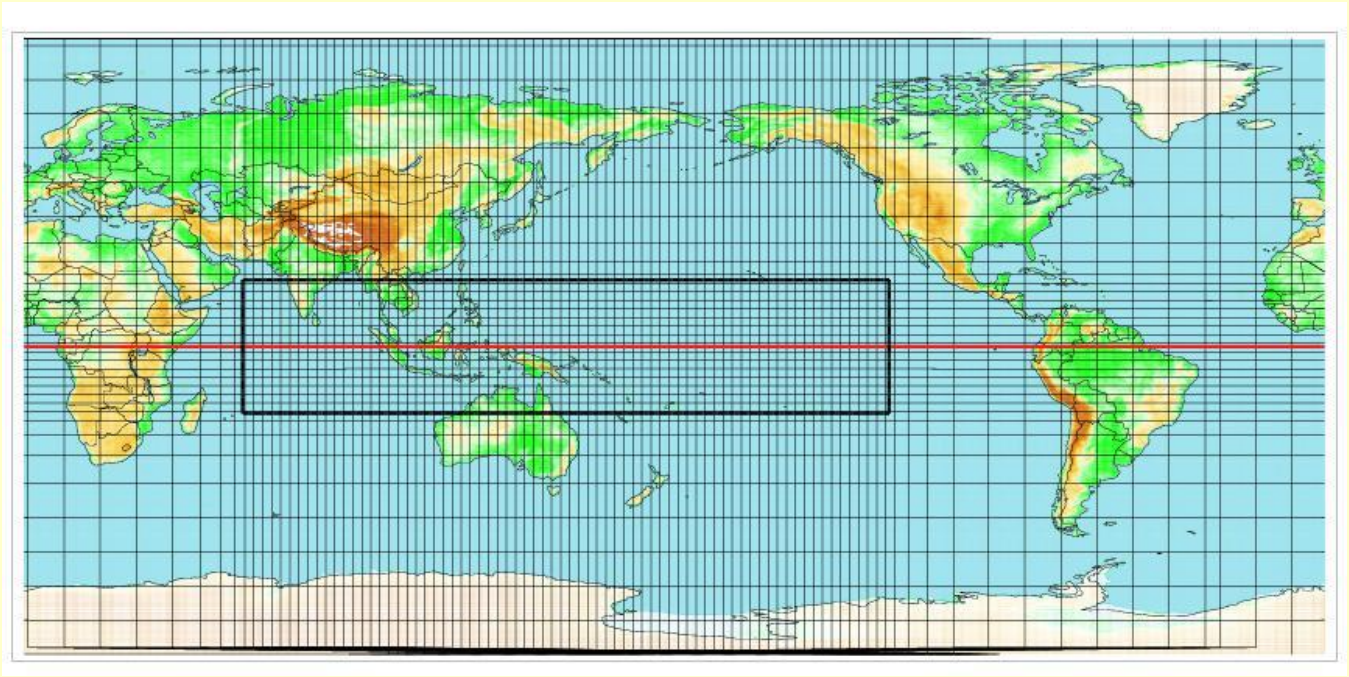
stretched grid over
Hurricane tracks, 0.3°-2.0°





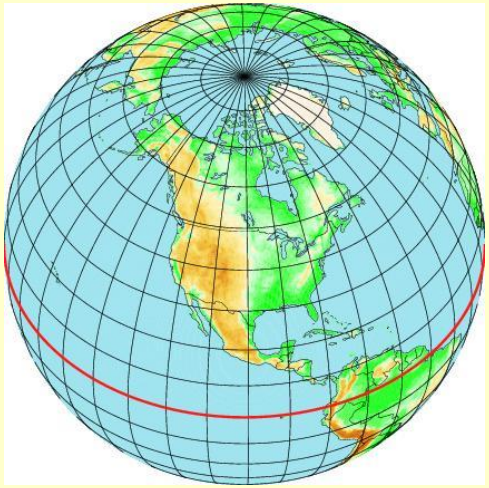
stretched grid over
Indian Ocean and
tropical Pacific, 0.5°-2.0°



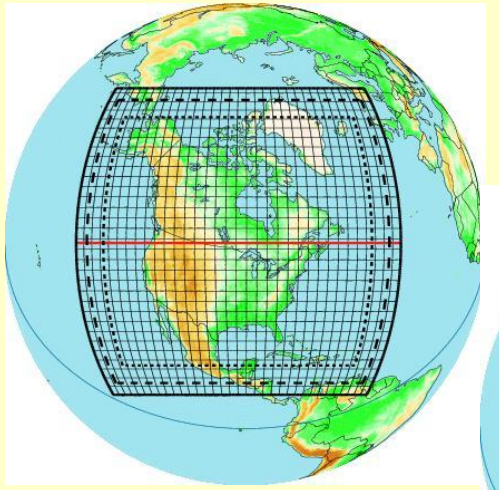


CRCM5.0.1

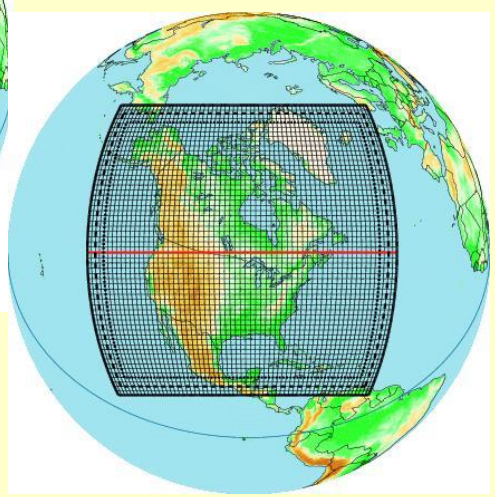
Global, 2.0°
Period: 197801 - 200402
Output: full diagnostics



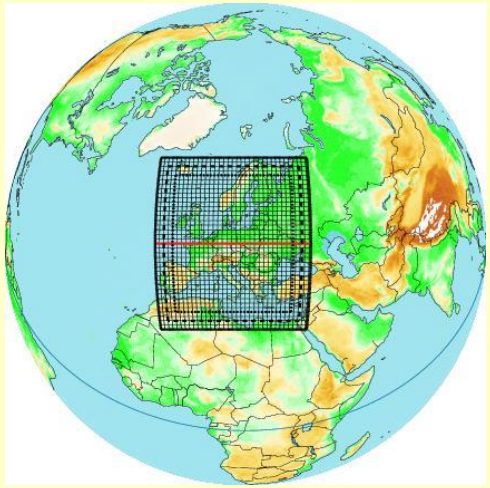
LAM over North America, 0.5°
Piloted with ERA40
Period: 195709 - 200208
Output: 3 hourly output



LAM over North America, 0.25°
Piloted with ERA40
Period: 195709 - 200208
Output: 3 hourly output

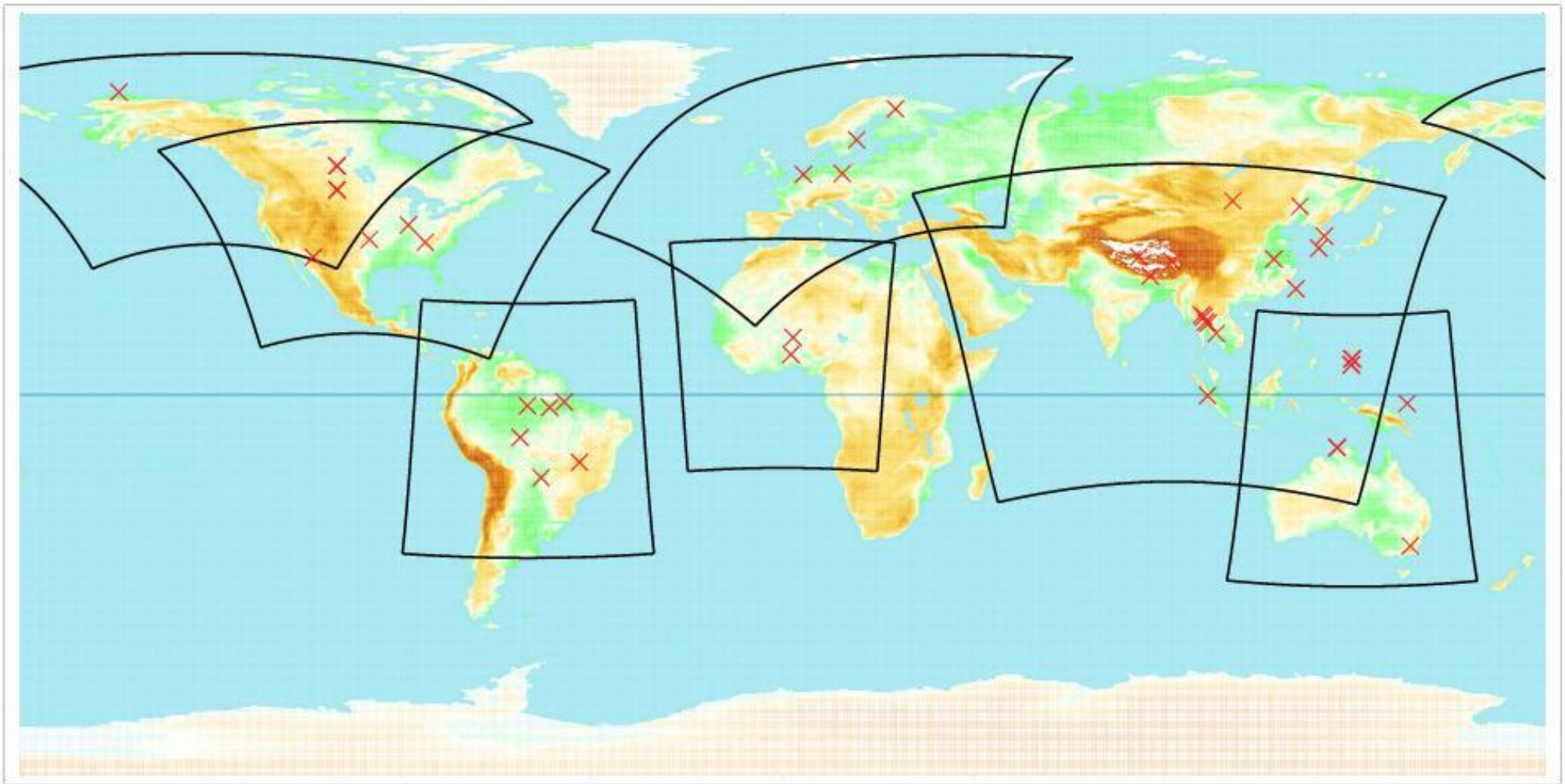


ENSEMBLES project
LAM over Europe, 0.22°
Piloted with ERA40
Period: 195709 - 200208
Output: full diagnostics
+ several 2D fields 3 hourly

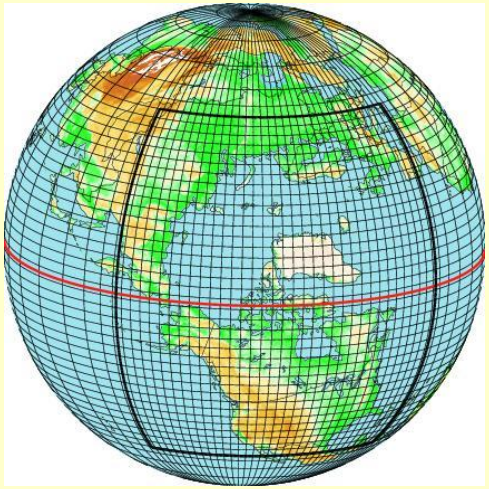


GEMCLIM v_3.3.0

ICTS project (**I**nter-**C**ontinental Scale Experiments **T**ransferability **S**tudy)
LAM piloted with NCEP, 0.5°, 7 different regions:
Canada, USA, South America, Europe, Africa, Asia, Australia
Period: 199907 - 200411
Output: full diagnostics + time series



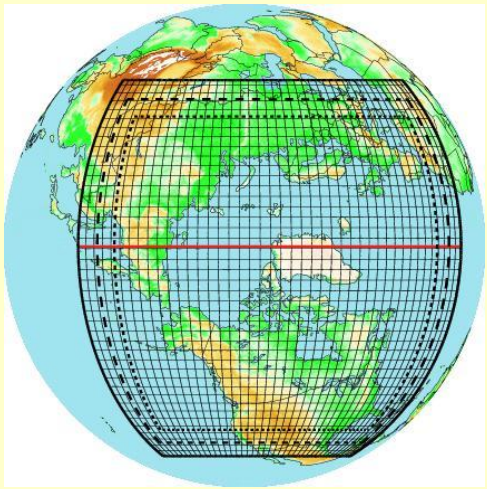
CRCM5.0.1

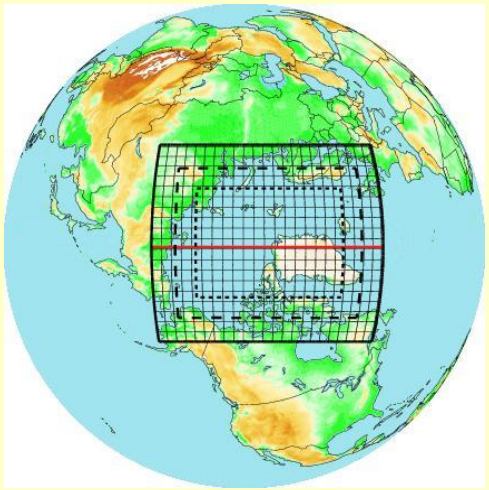


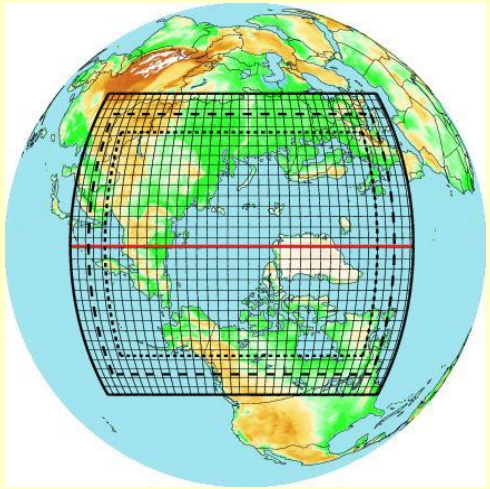
Arctic

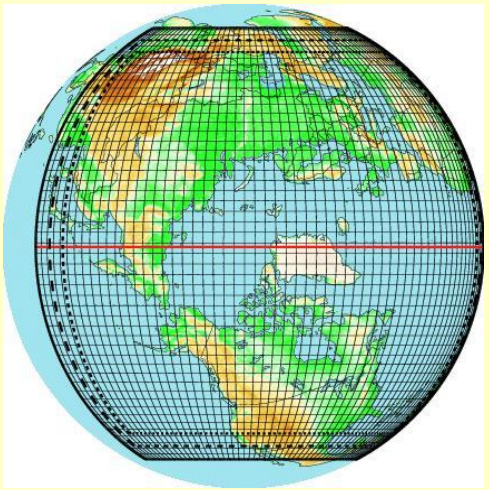
1 stretched grid, 0.5°-2.0°
Period: 197801 – 200611

7 LAM runs, 0.5°
Piloted with ERA40 resp. CRCM5 global 2.0°
Period: 197801 – 200611, resp. 197706 – max. 200208
Output: 3 hourly output



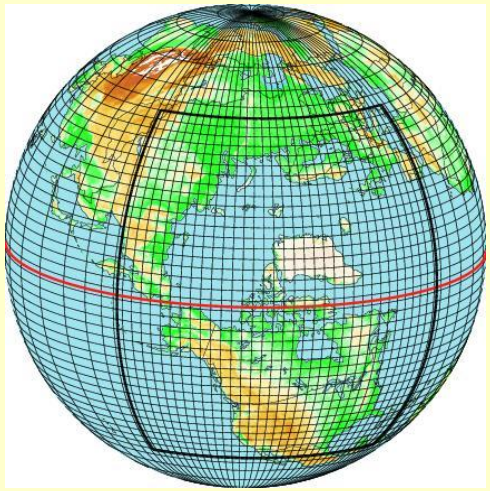


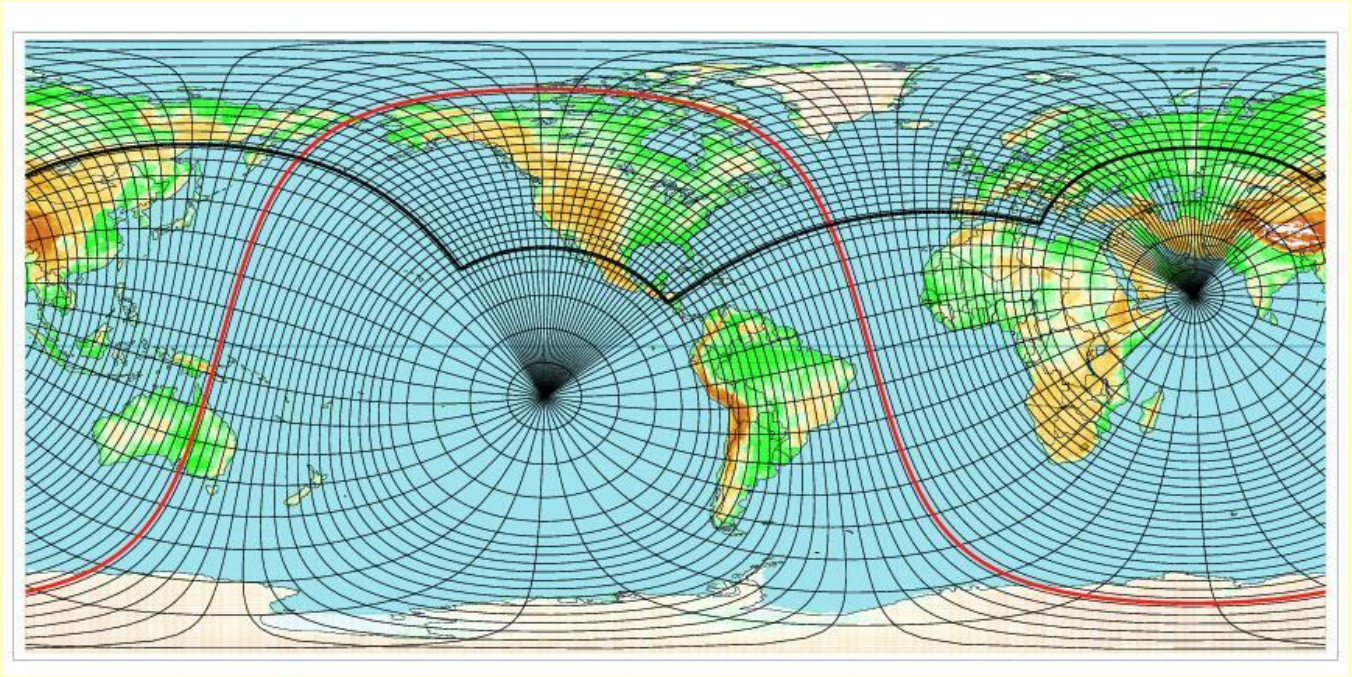




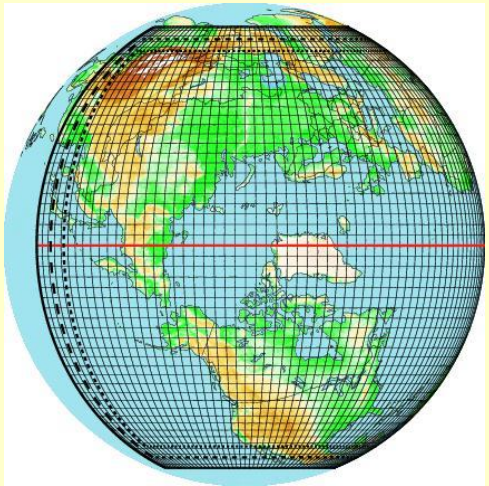
Arctic

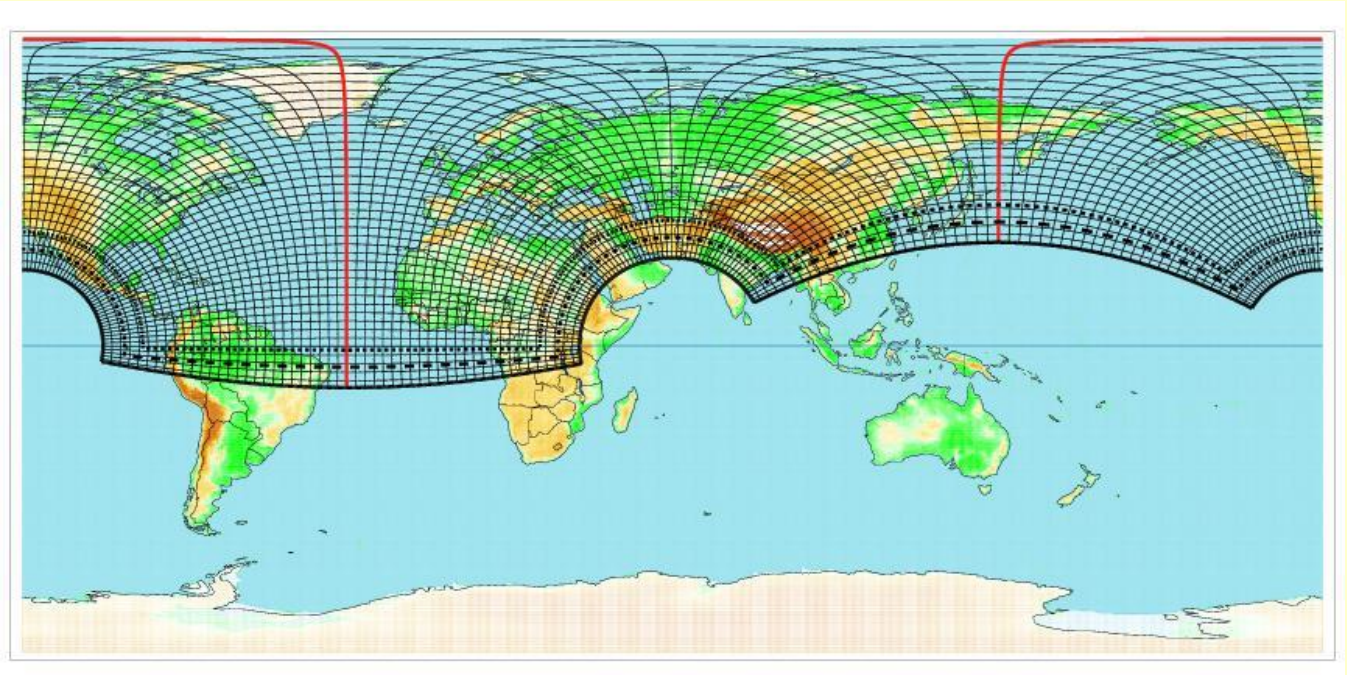
1 stretched grid, 0.5°-2.0°





Largest LAM grid, 0.5°





Research activities

North America

D. Paquin-Ricard:
A study on the representation of cloud microphysics and its interaction with radiation in the GEM model
Reference: Evaluation of cloud representation in the Canadian GEM model using ARM data, D. Paquin-Ricard, C. G. Jones, P. Vaillancourt, Geophysical Research Abstracts, Vol. 9, 5-2-2007

M. Markovic:
Evaluation of the Surface Radiation Budget over North America for a suite of Regional Climate Models
Reference: The Surface Radiation Budget over North America: An assessment of Gridded Data Sets for Model Evaluation and the Evaluation of a Suite of Regional Climate Models, Markovic, M., C. Jones, K. Winger, D. Paquin, International Journal of Climatology, in print.

F. Dorsaz:
Evaluation of regional climate model simulations of snow cover over Québec

L. Separovic:
Methodological approach to parameter perturbations in GEM-LAM seasonal simulations

Y. He (UVic):
Surface wind probability distributions over N. American regions: observations and RCM simulations

E. P. Diaconescu:
Analysis of Internal Variability of a regional Climate Model using Singular Vectors

North America & Europe
M. Verville:
Comparison of two regional climate modelling approaches using the GEM model, global variable-resolution versus one-way nested limited-area

ICTS
Z. Kothavala:
The Transferability of Regional Climate Models to non-native domains

Arctic
M. Qian:
The behavior of GEM-LAM over the Arctic using different simulation domains

Hurricanes
L.-P. Caron:
A study on tropical cyclone activity using the GEM model

Tropics - mid-latitudes
M. Markovic:
Tropical mid-latitude interactions

Sheba
P.-L. Carpentier:
Evaluation of the stable boundary layer processes in GEM over the Arctic ocean during SHEBA

CRCM5.0.1

Africa

A.-S. Daloz:
Study of the benefits of increased resolution on the precipitation in Sub-Saharan Africa

Merci...

Check recent runs on the web:
http://people.sca.uqam.ca/~winger/GEM/Version_3.3.2/Recent_runs.html