Dominique GIARD
Jean-Daniel GRIL

Computation of “clim” files for ALADIN : what's new ?

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CONTENTS

- **New geometry**

- **New options**

- **Updated computation of orography**

- **Corrections in biperiodization**
  - Source code available in the **second** CY29T2 export version
    thanks to :
    F. Bouyssel, Y. Bouteloup, R. El Khatib, D. Giard, J.D. Gril, S. Ivatek-Sahdan,
    M. Janousek, F. Taillefer, J. Woyciechowska, and many phasers
  - Scripts available by Françoise Taillefer and the GCO team

- **New databases to be tested next summer ? next winter ?**

→ to be discussed !

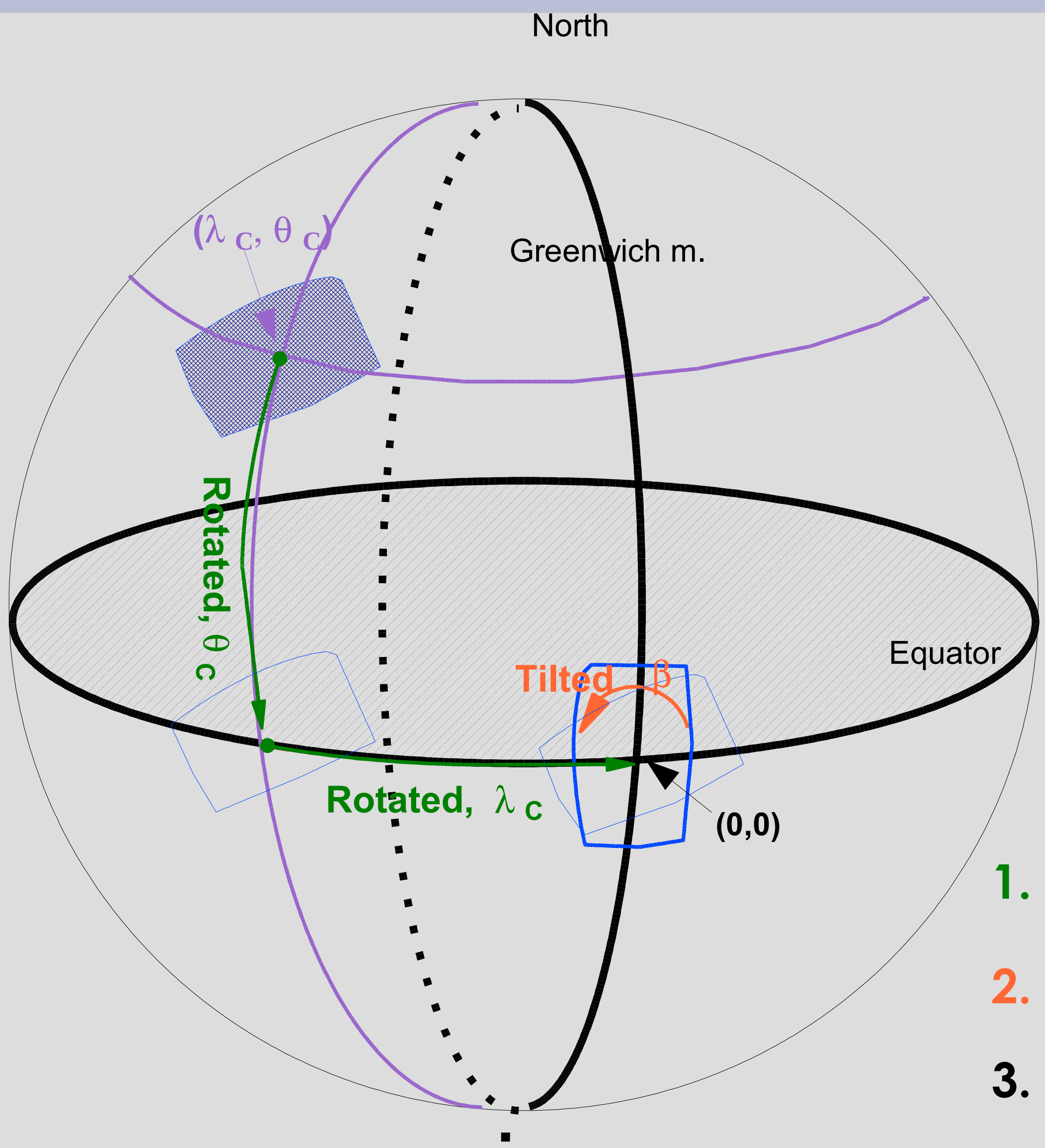
New geometry /1 : simplified setup of domains (*"new EGGX"*)

- **both safer and simpler**

- **3 types of projections : Mercator, polar stereographic, Lambert**
  - according to the reference latitude *(θ_0 = 0°, ±90°, else)*

- **6 main pieces of information required :**
  - reference point : ***(θ_0, λ_0),*** **(ELAT0,ELON0)** ***(°)***
  - centre of the domain : ***(θ_C, λ_C)*** **(ELATC,ELONC)** ***(°)***
  - gridpoint resolution : ***(δx, δy)*** **(EDELX,EDELY)** ***(m, °)***
  - number of points in the (C+I) zone **(NDGUX,NDLUX)**
  - grid type : "model" : **LRPLANE=.T.** or "latlon" : **LRPLANE=.F.**
  - rotated tilted Mercator projection : **LMRT=.T.**

New geometry /2 :
rotated tilted Mercator projection



1. Rotation to the Equator (θ_C , λ_C)
2. Tilting (β)
3. Projection

New geometry /3 : Formulae

1. Rotation to the Equator

$$(\lambda, \theta) \rightarrow (\lambda', \theta')$$
$$\theta' = \arcsin\left[\cos\theta_C \sin\theta - \sin\theta_C \cos\theta \cos(\lambda - \lambda_C)\right]$$
$$\cos\lambda' = \frac{1}{\cos\theta'}\left[\sin\theta_C \sin\theta + \cos\theta_C \cos\theta \cos(\lambda - \lambda_C)\right]$$
$$\sin\lambda' = \frac{1}{\cos\theta'}\left[\cos\theta \sin(\lambda - \lambda_C)\right]$$

2. Tilting

$$(\lambda', \theta') \rightarrow (\lambda'', \theta'')$$
$$\theta'' = \arcsin\left[\cos\beta \sin\theta' + \sin\beta \cos\theta' \sin\lambda'\right]$$
$$\cos\lambda'' = \frac{1}{\cos\theta''}\left[\cos\theta' \cos\lambda'\right]$$
$$\sin\lambda'' = -\frac{1}{\cos\theta''}\left[\sin\beta \sin\theta' - \cos\beta \cos\theta' \sin\lambda'\right]$$

3. Projection

$$(\lambda'', \theta'') \rightarrow (x, y)$$
$$x = a\ \lambda''$$
$$y = a\ \ln\left[\tan\left(\frac{\pi}{4} + \frac{\theta''}{2}\right)\right]$$

New geometry /4 : Advantages

Flexibility

- It can replace the 3 previous ALADIN projections
- It can simulate precisely latitude × longitude domains, such as HIRLAM ones, with just slight differences for *y* grid lines

Simple formulation of the map factor :

$$m = \cosh\left(\frac{y}{a}\right) \approx \alpha\cos(y) + \beta\cos(2y)$$

Computation of the other geometry-related parameters :

of equivalent complexity ...

Few changes in the setup of domains

reference point :	$\theta_0 = 0$, $\lambda_0 = \beta$	***(Mercator + Tilt definition)***
centre of the domain :	(θ_C, λ_C)	*(Rotation definition)*
gridpoint resolution :	$(\delta x, \delta y)$	
number of points in the (C+I) zone		
grid type :	`LRPLANE=.T.`	*(Model type)*
new definitions :	**`LMRT=.T.`**	***(Model domain definition)***
	`LFPMRT=.T.`	***(FullPos domain definition)***

The 10 Options of 923 Configuration /1 :

- **1 : description of orography**
  moving to GLOB95 to GTOPT030 : resolution 2'30 everywhere ?
  higher resolution required for research applications (e.g. AROME)
  - new Manu files at higher resolution ?
  - using local data and EE923 ?
  - using other interpolation tools and importing orography ?
  - gathering local data into a larger database ?
- **2 : other permanent surface characteristics**

The 10 Options of 923 Configuration /2 :

- **3 : SST, old relaxation values for surface variables**
- **4 : vegetation characteristics**
- **5 : correcting land fields using local high resolution data**
- **6 : correcting relaxation values for surface variables**

  moving to new global databases *(E. Bazile, I. Kos, R.Zaaboul, 2000)* ?
  - resolution 1° instead of 1.5°
  - moisture from the GSWP experiments
  - temperature and snow from 2 years of ARPEGE analyses

The 10 Options of 923 Configuration /3 :

- **7 : improving sea and lakes description using local data**
- **8 : coefficients for ozone description**
  3 monthly 2d fields
  input : 1 global file, resolution 2.5°
- **9 : aerosols**
  4 monthly 2d fields
  input : 1 global file, resolution 5°
- **10 : aqua-planet**

  all fields in one run, SST as input (file or namelist)

Update of the computation of spectral orography /1 :

- **a jump of 5 cycles and significant cleaning**
  now independent from changes in minimization for variational applications
  increased ARPEGE - ALADIN consistency, unused options removed

- **formulation of the cost function to be minimized (or not)**
  $J = \boldsymbol{J^{GP}} + \boldsymbol{J^{SP}}$
  $\boldsymbol{J^{GP}}$: **gridpoint** component, to damp Gibbs oscillations, especially over **low** areas

"Bouteloup" :

"Jerczynski" :

f_{ext} : weight in the extension zone, from **`1`** to `1`/(`1`+**`SCEXT`**)

Update of the computation of spectral orography /2 :

J^{SP} : **spectral** component, to damp the smallest scales (at least $2\Delta x$)

$$J^{SP} = \sum_{m,n} \exp\left((k_{m,n} - \mathbf{FLISB})^{\mathbf{FLISA}} \right) h_{m,n}^2$$

Tuning parameters are domain dependent !

- **case of a "linear" spectral truncation**

  spectral orography must be filtered :

  - optimization with a quadratic spectral truncation, based on J^{GP}, then import
  - direct optimization, based on J^{GP} + J^{SP}

Changes in biperiodization :

Physically meaningful values are required also in the extension zone :

➔ performed by Full-Pos

Mistake in the original design :

➔ correction by Full-Pos over the whole domain : too much !

Bug corrected now :

➔ impact on climatological snow coverage (wider)

➔ potential positive impact on the initialization of snow cover