Reunión Red Ibérica MM5
26-27 Abril 2007
Aveiro, Portugal

GRID distributed computation of nested climate simulations. The www.eu-EELA.org project

E-Infraestructure shared between Europe and Latin America

Grupo de Meteorología Aplicada
Universidad de Cantabria/Instituto de Física de Cantabria
http://www.meteo.unican.es

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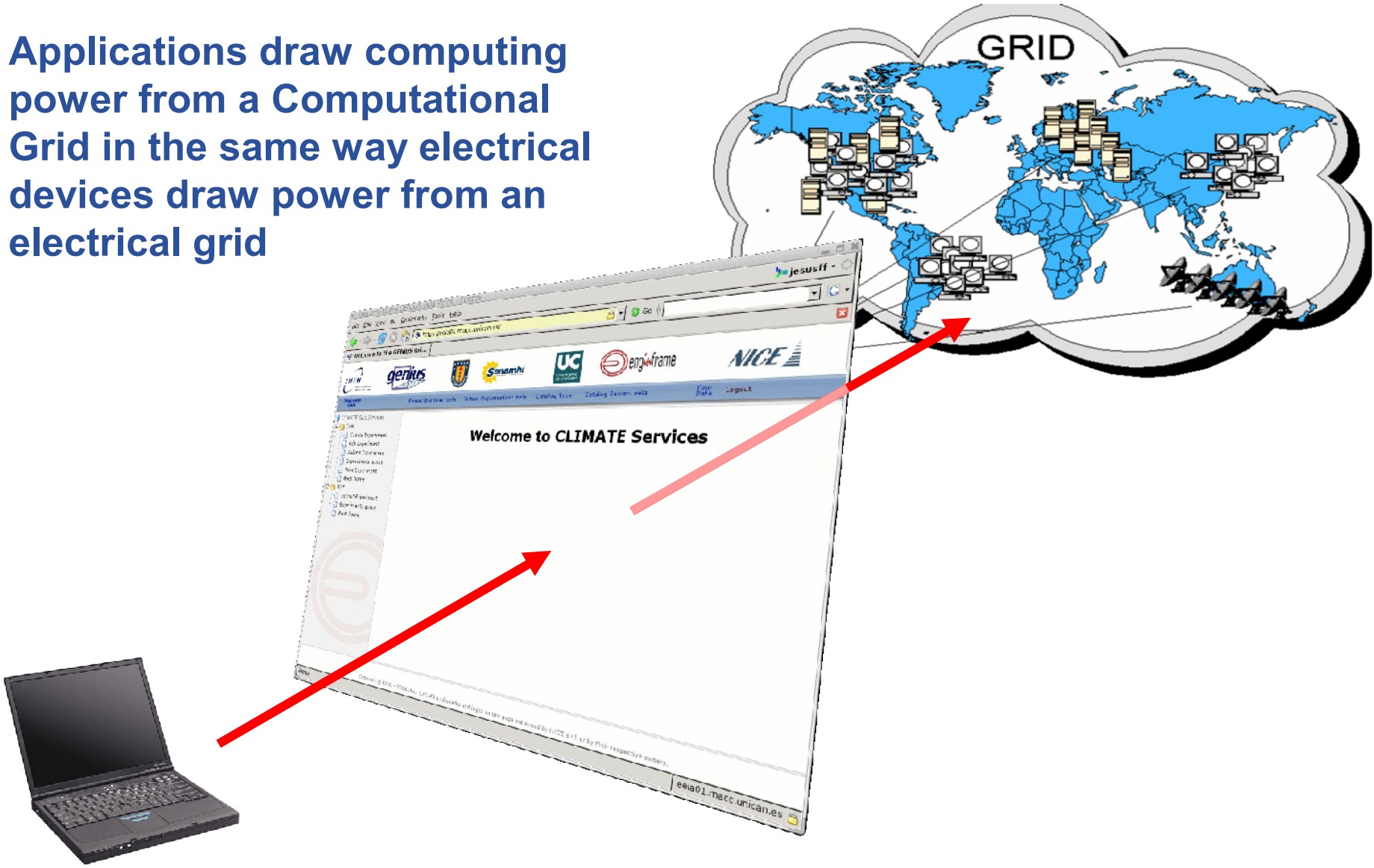
EELA is a project funded by the European Union under contract 026409

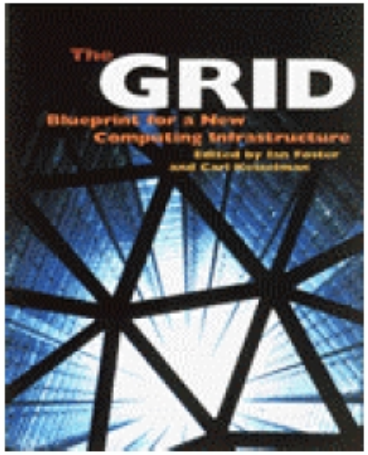
GRID Computing

Applications draw computing power from a Computational Grid in the same way electrical devices draw power from an electrical grid



GRID Computing

Applications draw computing power from a Computational Grid in the same way electrical devices draw power from an electrical grid



- **Developed in the mid-90**
- **Use of distributed, heterogeneous, dynamic and, usually, parallel computational resources.**
- **Middleware and standard software to build applications (Globus Toolkit, OGSA, …)**
- **Several research projects (and comercial products) developing this technology.**

EELA Goals

E-infrastructure shared between Europe and Latin America

- **Goal:**

  To build a bridge between consolidated e-Infrastructure initiatives in Europe and emerging ones in Latin America.

- **Objectives:**
  - Establish a human collaboration network between Europe and Latin America
  - Setting a pilot e-infrastructure in Latin America
  - Identifying and promoting a sustainable framework for e-Science in Latin America

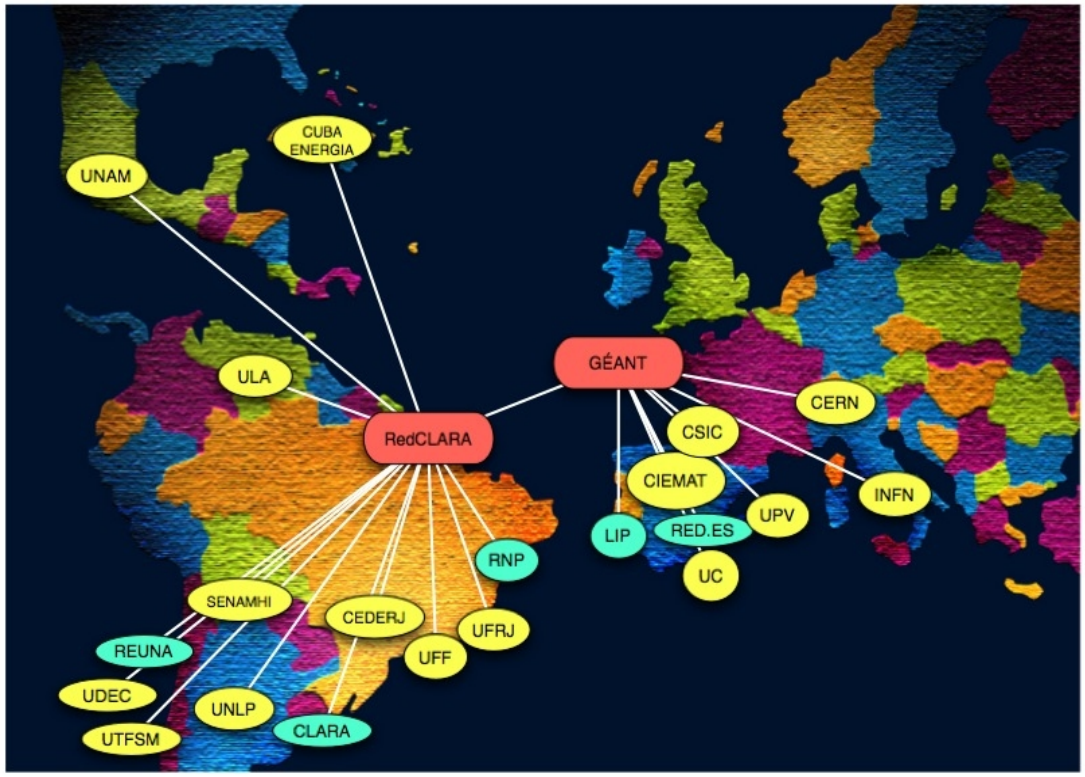
EELA structure

EELA is structured in four Working Packages:

- **WP1. Project administrative and technical management**
- **WP2. Pilot testbed operation and support**
- **WP3. Identification and support of Grid-enhanced applications**
  - Task 3.1. Biomed Applications
  - Task 3.2. High Energy Physics Applications
  - Task 3.3. Additional Applications:
    - E-Learning
    - Climate
- **WP4. Dissemination activities**

Partners

- **EU**
  - Spain: CIEMAT, CSIC, UPV, RED.ES, **UC**
  - Italy: INFN
  - Portugal: LIP
- **Latin America**
  - Venezuela: ULA
  - Cuba: CUBAENERGIA
  - Chile: UTFSM, REUNA, **UDEC**
  - Peru: **SENAMHI**
  - Mexico: UNAM
  - Argentina: UNLP
  - Brazil: UFRJ, CNEN,
  - CECIERJ/CEDERJ, RNP, UFF
- **International**
  - CLARA
  - CERN



Available resources

GridICE >> Site::ALL

General | Gris | Host | Job | Charts | Network

Site	GK#	Q#	RunJob	WaitJob	SlotLoad	MH#	Power	WN#	CPU#	CPULoad	Storage Resources Available	Storage Resources Total	%
	Computing Resources												
CERN-PROD	2	32	6967	2435	99%	-	-	-	-	-	651.2 GB	1.7 TB	64%
EELA-CETA-CIEMAT	1	3	23	0	43%	28	371K	23	92	25%	15 TB	15 TB	0%
EELA-CIEMAT	1	10	61	30	62%	53	1M	47	188	31%	152.7 GB	236.8 GB	36%
EELA-UC	1	2	0	0	0%	8	36K	6	6	0%	89.4 GB	99.5 GB	10%
EELA-UFF	-	-	-	-	-	4	-	-	-	-	26.6 GB	33.8 GB	21%
EELA-UFRJ	1	5	0	3	-	18	175K	12	44	0%	-	-	-
EELA-UNAM	2	8	2	0	26%	22	147K	17	34	6%	89 GB	848.2 GB	90%
EELA-UTFSM	1	6	0	0	64%	-	-	-	-	-	-	-	-
INFN-CATANIA	1	3151	45572	32624	61%	92	1M	84	244	3%	18.5 TB	21.2 TB	13%
LIP-Lisbon	1	8	6	0	3%	42	139K	11	32	0%	27.5 TB	27.9 TB	1%
ULA-MERIDA	1	2786	103	0	✖	-	-	-	-	-	486.4 GB	512.4 GB	5%
UPV-GRyCAP	1	6	0	0	0%	3	-	-	-	-	60 GB	68.7 GB	13%
UdeC-EELA-s1	1	8	0	17776	-	-	-	-	-	-	-	-	-
[cern.ch]	2	32	6964	2438	99%	-	-	-	-	-	-	-	-
TOTAL	**#14**	**16**	**6057**	**59698**	**55306**	**34%**	**270**	**3M**	**200**	**640**	**15%**	**62.5 TB**	**67.6 TB**	**25%**

WP 3.3b. Climate

We deal with a climate challenge with huge socio-economical impact in Latin America: El Niño phenomenon.

The Grid helps to access the infrastructure and know-how in a user-friendly way.

Three different applications have been identified:

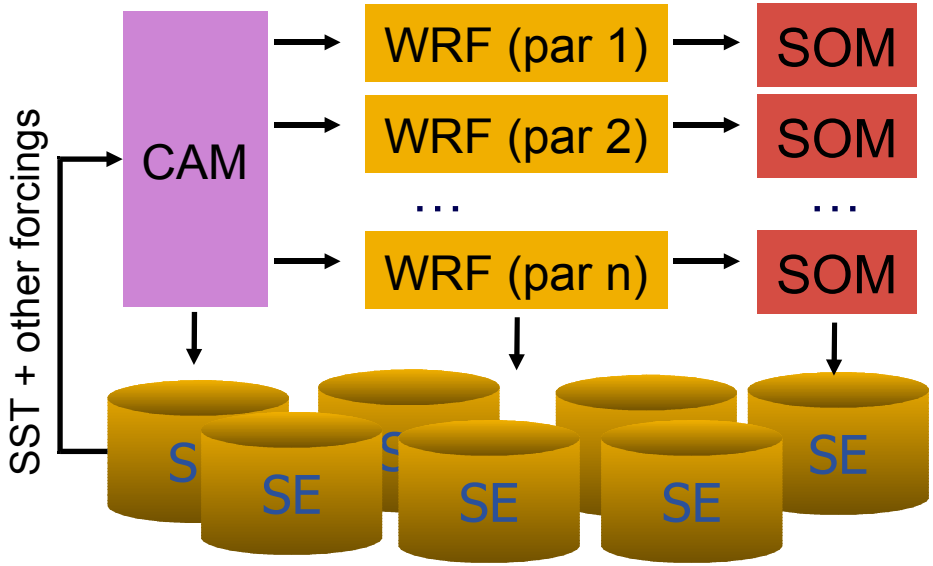
- Global atmospheric circulation model (CAM) deployed!
- Regional weather model (WRF) deployed!
- Datamining clustering tools (SOM)

Scientific challenge: High resolution regional simulations over Latin American regions for El Niño 1982-1983 and 1997-98 strong events. Comparison with historical local data, including sensitivity studies to SST and parameterizations.

The problem is well suited for its execution on the Grid since many independent simulations will be needed.

Computational challenge

Challenging computational problem with nontrivial dependent relationships among the applications. A cascade of dynamic dependent jobs is adopted.



The cascade of applications interacts with the middleware to:

- Prepare and submit dependent jobs.
- Store and retrieve the generated data sets (data sharing).
- Manage metadata (for the data sets and application status).
- Restarting broken experiments

CAM & WRF

The Community Atmosphere Model (CAM) and the Weather Research and Forecasting (WRF) models are state-of-the-art atmosphere (global and regional) models developed at NCAR.

Output format: NetCDF

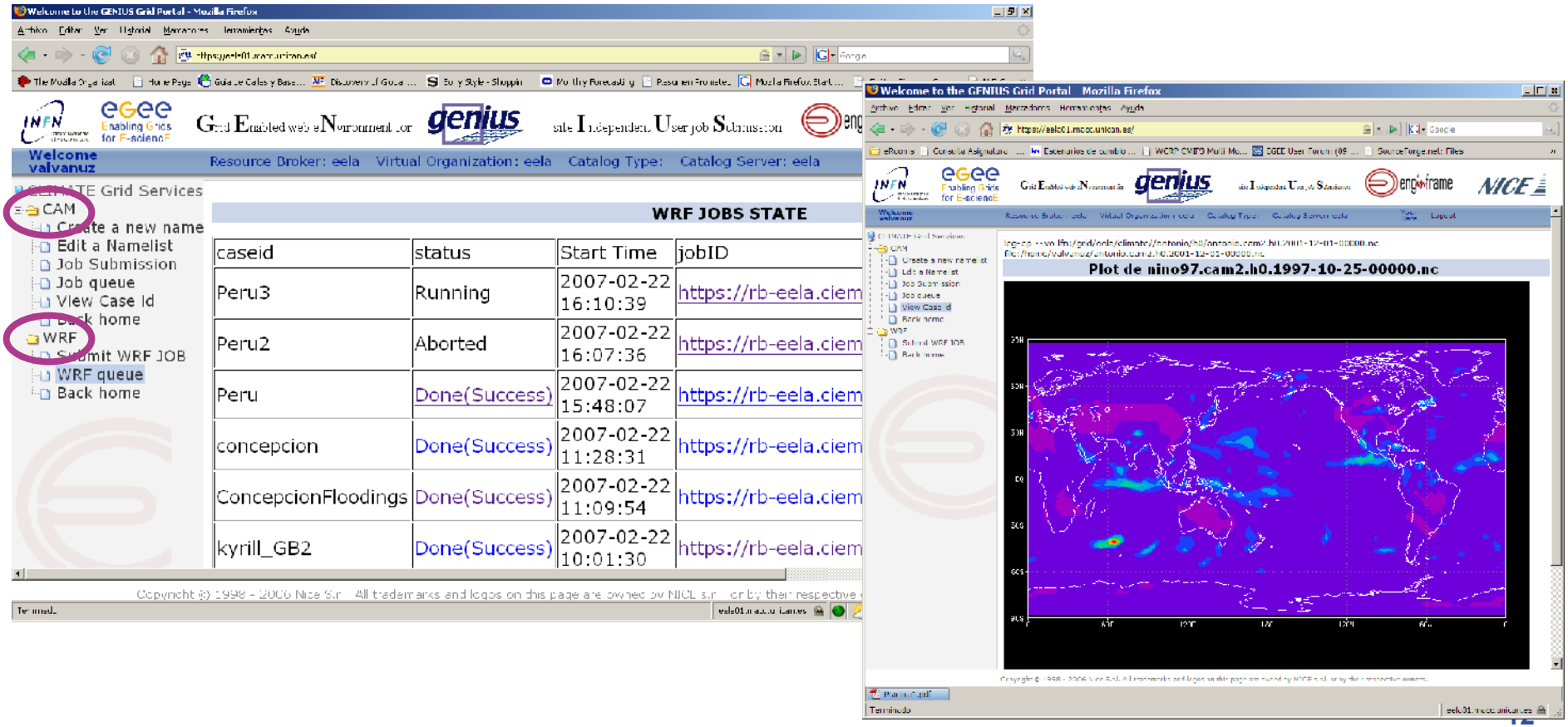
CAM: FORTRAN90 system() calls were introduced into the model to make it move data and status info to the Grid catalogs (LFC and AMGA)

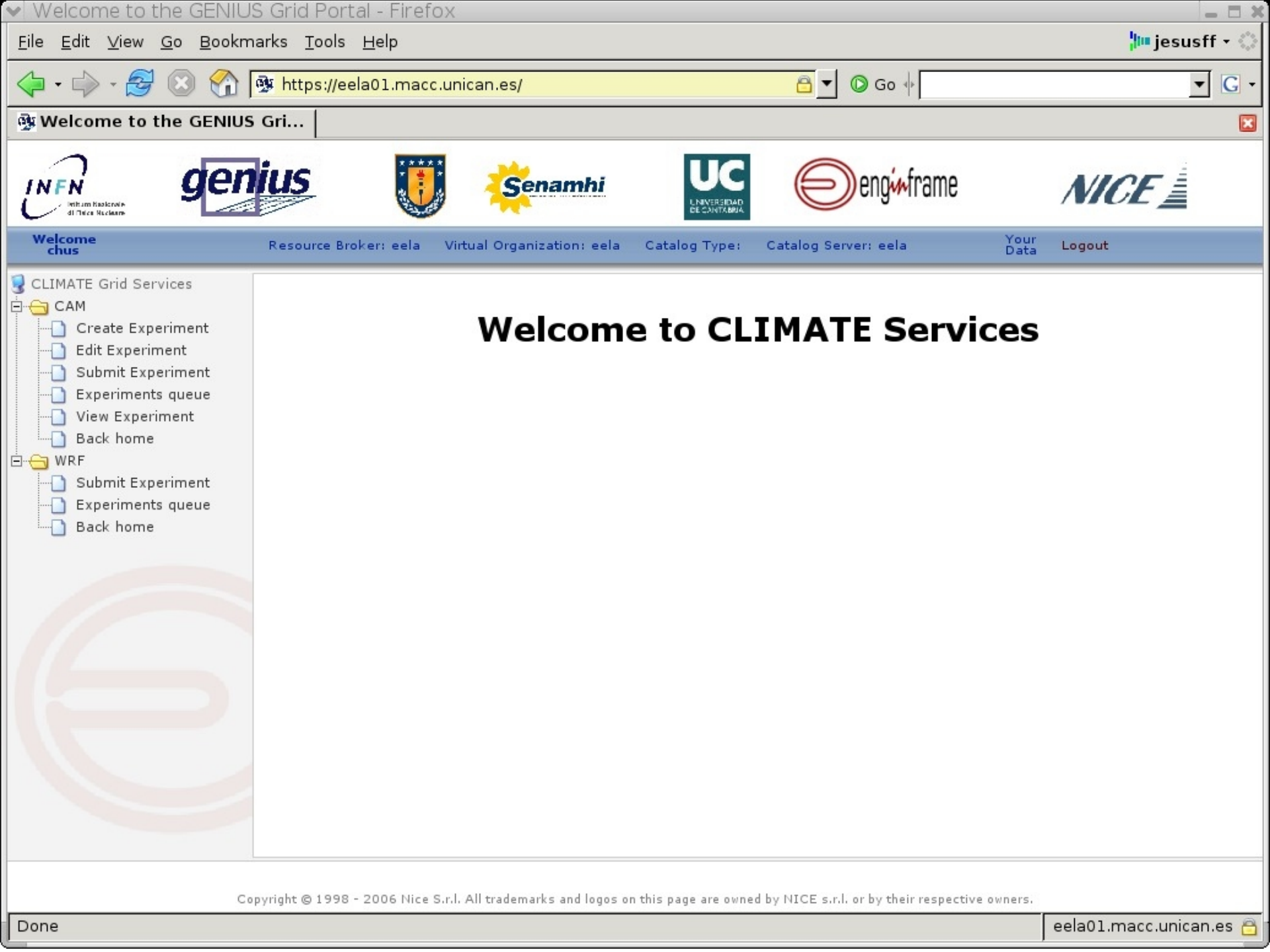
WRF: The model does not yet interact with the middleware. Although it runs in the Grid testbed, it is not yet coupled to CAM.

DEMO

Current status

Using GENIUS to interact with the applications (CAM+WRF). In the future a climate specific portal will be developed (JSR168) to run and track scientific experiments.

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Your Data
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CLIMATE Grid Services
CAM
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Edit Experiment
Submit Experiment
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View Experiment
Back home
WRF
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Experiments queue
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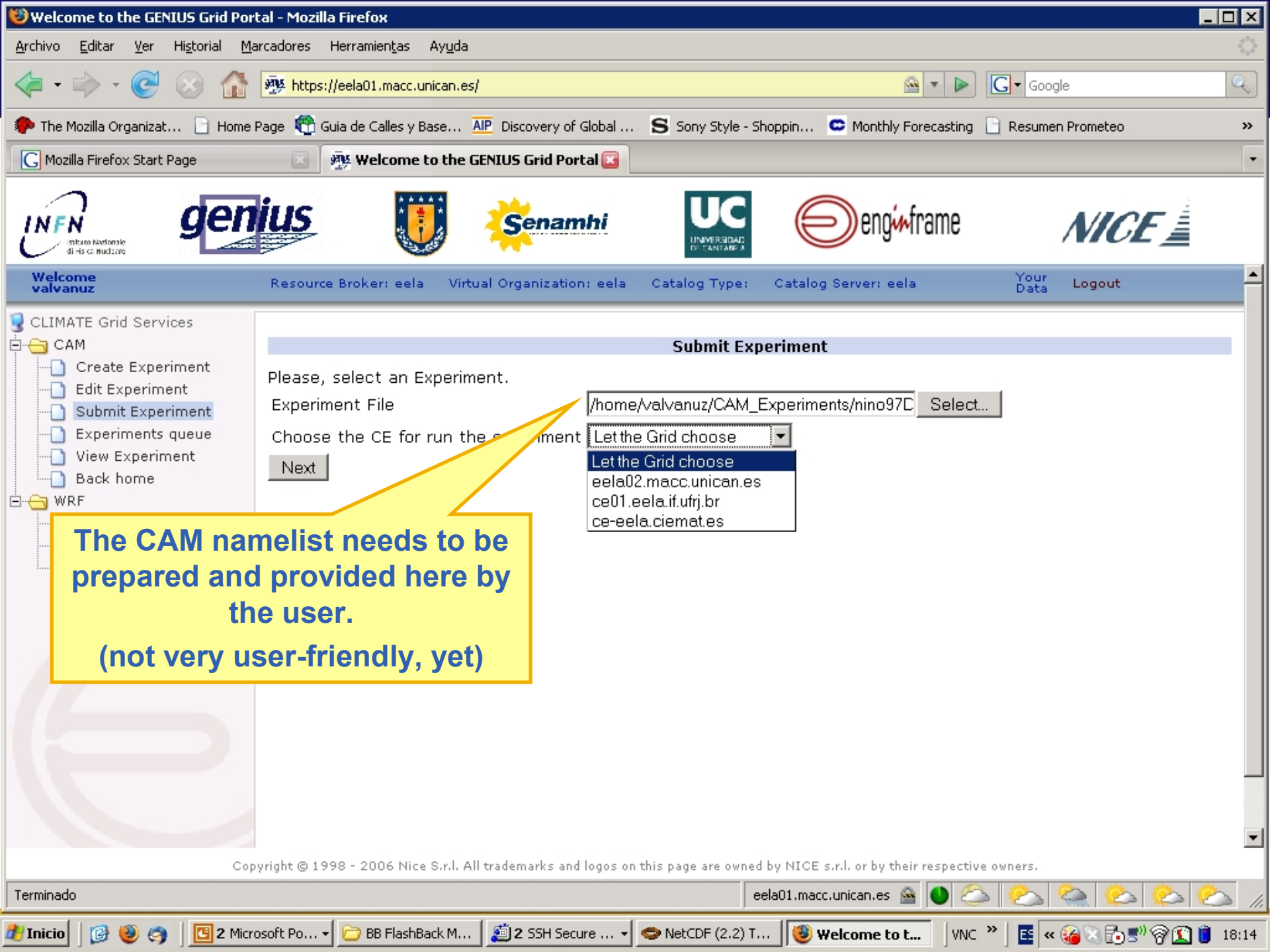
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CLIMATE Grid Services
CAM
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WRF
Submit Experiment
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Experiment File
/home/valvanuz/CAM_Experiments/nino97C
Select...
Choose the CE for run the
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eela02.macc.unican.es
ce01.eela.if.ufrj.br
ce-eela.ciemat.es
Next
The CAM namelist needs to be prepared and provided here by the user.
(not very user-friendly, yet)
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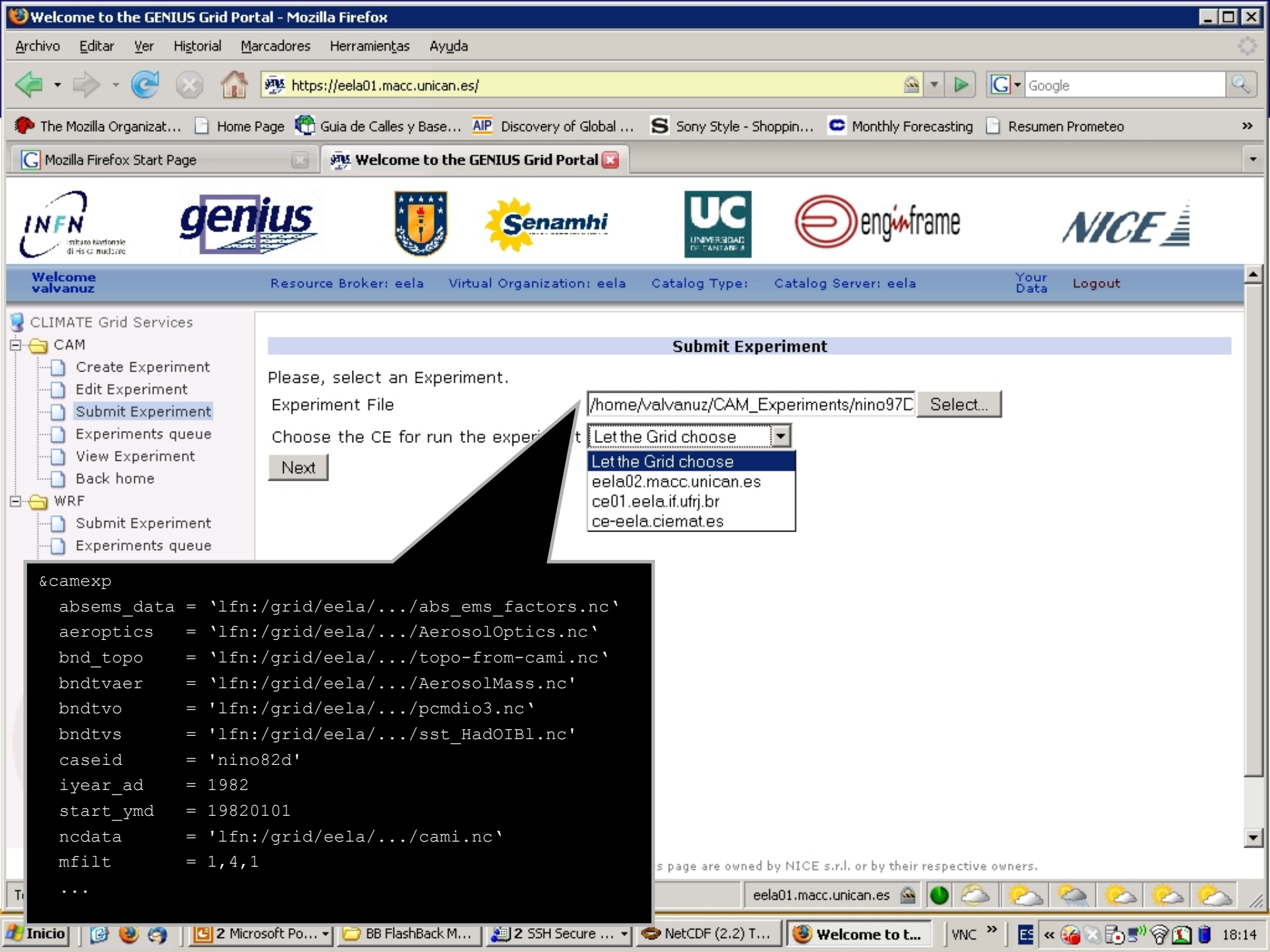
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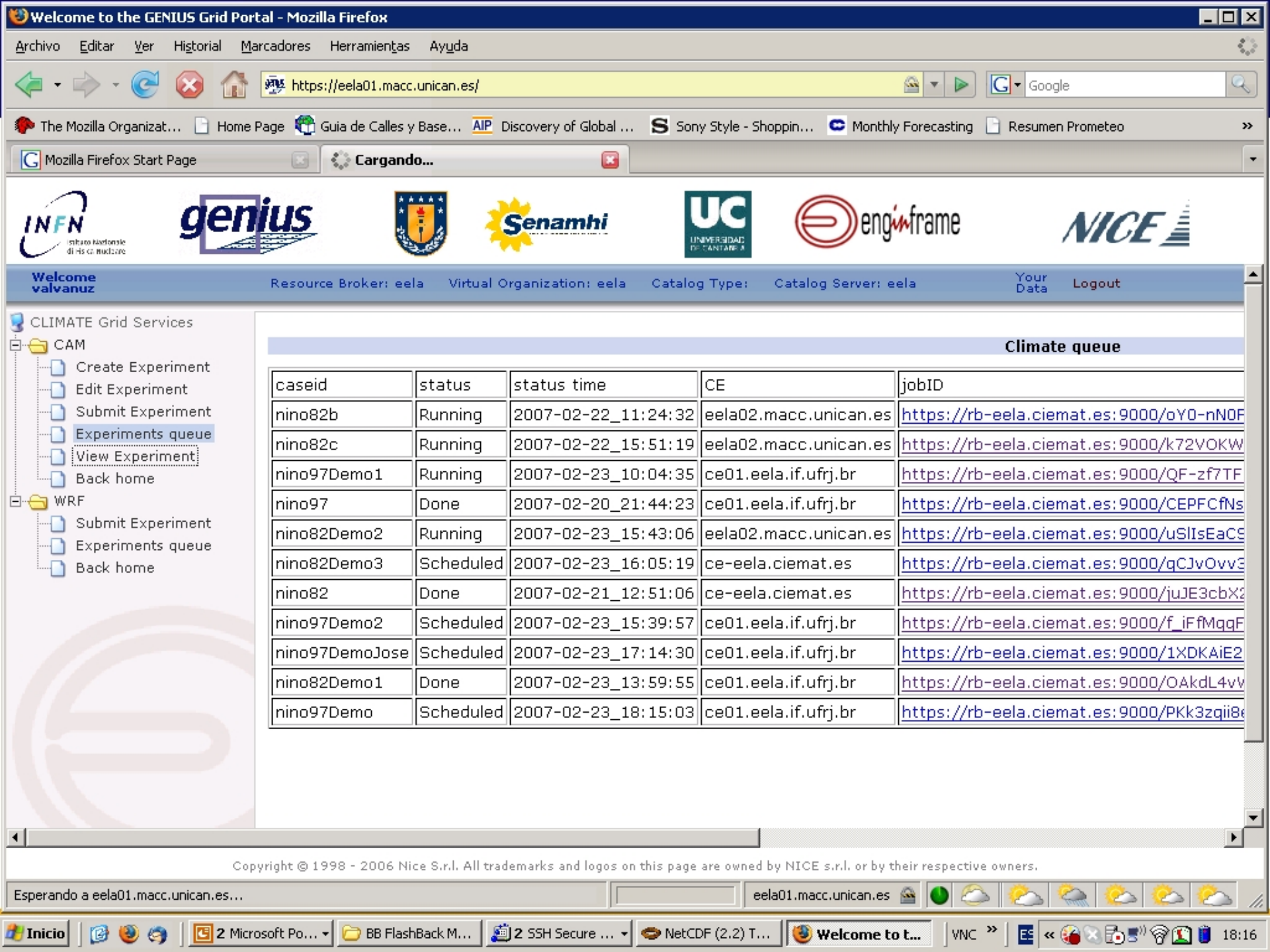
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nino82b | Running | 2007-02-22_11:24:32 | eela02.macc.unican.es | https://rb-eela.ciemat.es:9000/oY0-nN0F
nino82c | Running | 2007-02-22_15:51:19 | eela02.macc.unican.es | https://rb-eela.ciemat.es:9000/k72VOKW
nino97Demo1 | Running | 2007-02-23_10:04:35 | ce01.eela.if.ufrj.br | https://rb-eela.ciemat.es:9000/QF-zf7TF
nino97 | Done | 2007-02-20_21:44:23 | ce01.eela.if.ufrj.br | https://rb-eela.ciemat.es:9000/CEPFCfNs
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nino82Demo1 | Done | 2007-02-23_13:59:55 | ce01.eela.if.ufrj.br | https://rb-eela.ciemat.es:9000/OAkdL4vV
nino97Demo | Scheduled | 2007-02-23_18:15:03 | ce01.eela.if.ufrj.br | https://rb-eela.ciemat.es:9000/PKk3zqii8
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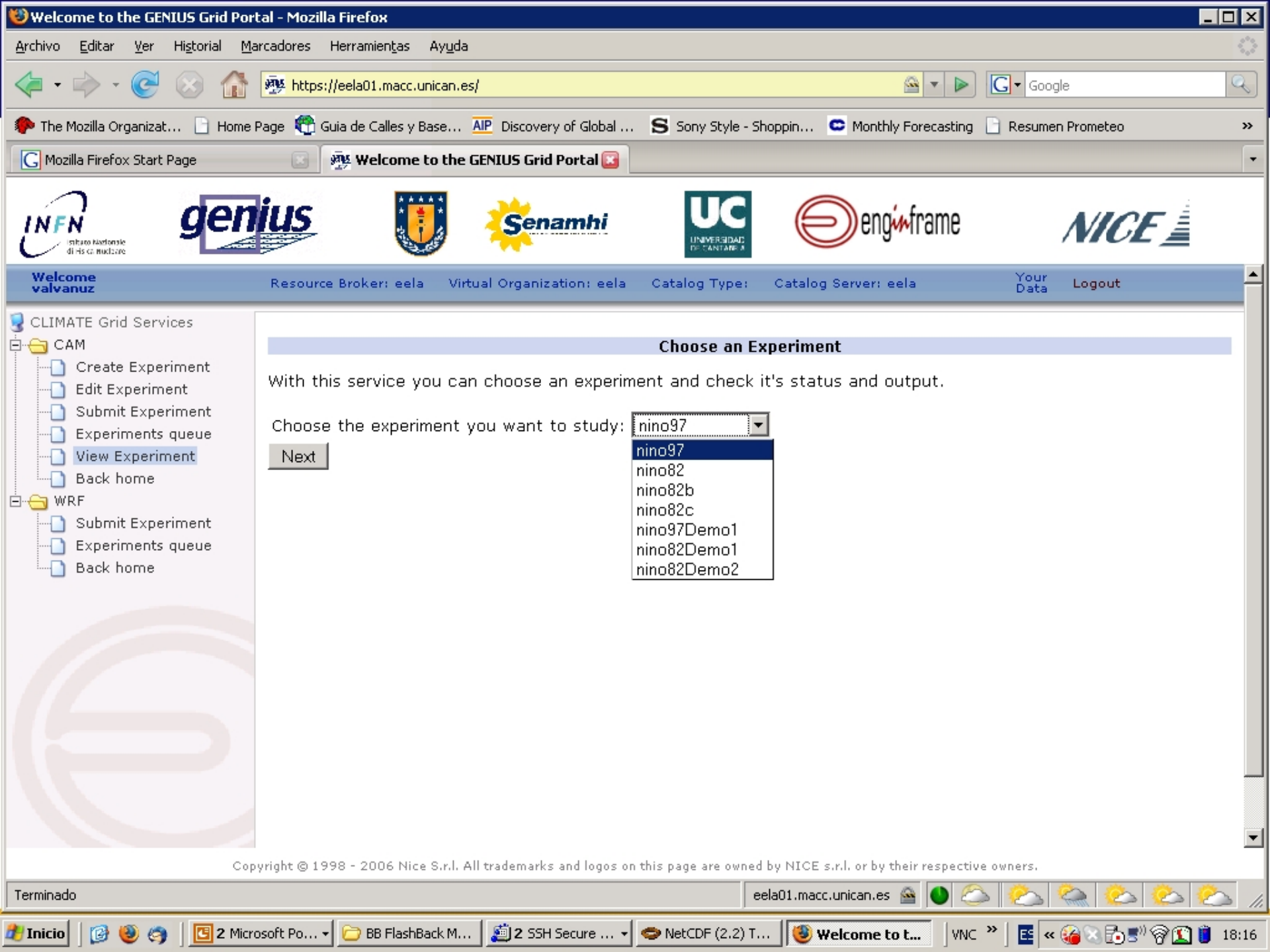
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Choose an Experiment
With this service you can choose an experiment and check it's status and output.
Choose the experiment you want to study:
nino97
Next
nino97
nino82
nino82b
nino82c
nino97Demo1
nino82Demo1
nino82Demo2
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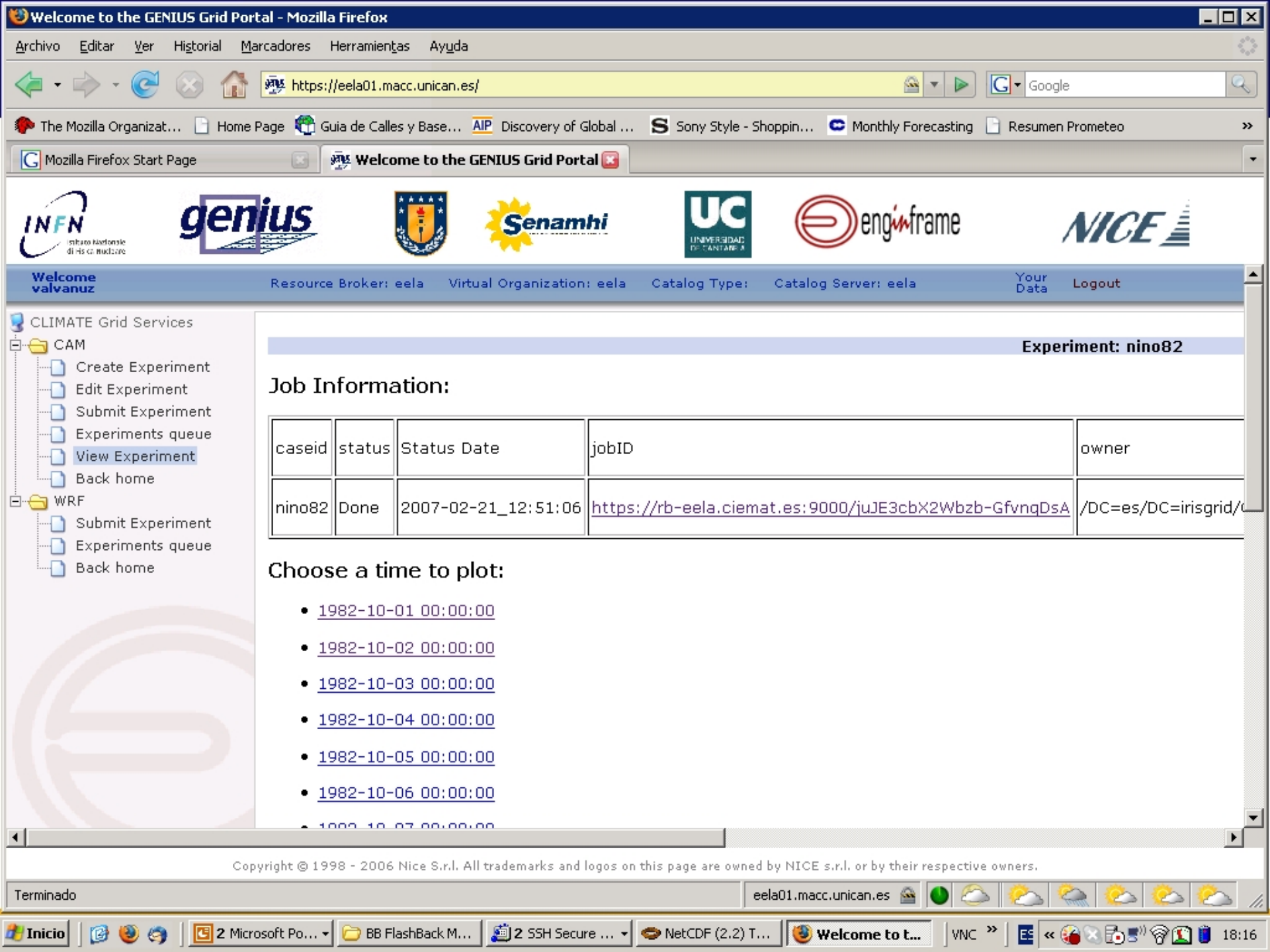
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Create Experiment
Edit Experiment
Submit Experiment
Experiments queue
View Experiment
Back home
WRF
Submit Experiment
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Back home
Experiment: nino82
Job Information:
caseid
status
Status Date
jobID
owner
nino82
Done
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Choose a time to plot:
1982-10-01 00:00:00
1982-10-02 00:00:00
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1982-10-04 00:00:00
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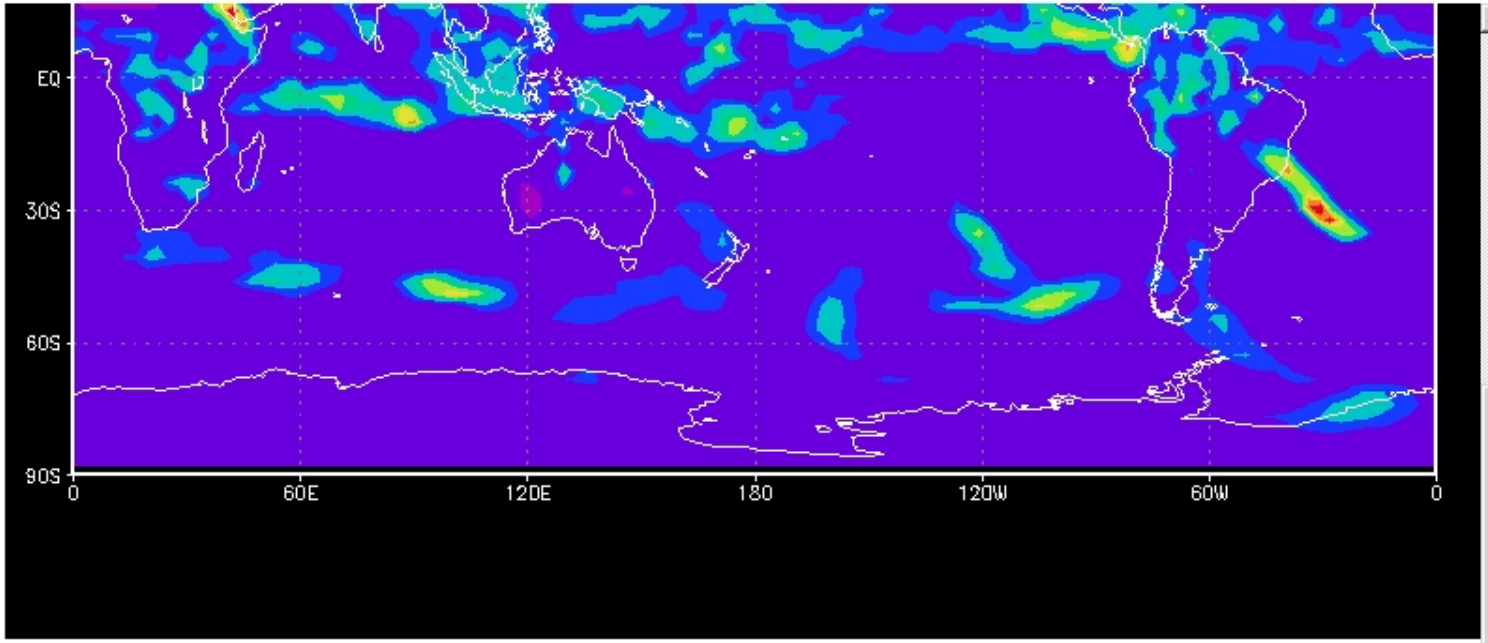

Download NETCDF: nino82.cam2.h0.1982-10-22-00000.nc

THREDDS access: nino82.cam2.h0.1982-10-22-00000.nc

OPeNDAP access: nino82.cam2.h0.1982-10-22-00000.nc [link] [html] [info] [das] [dds] [dods]

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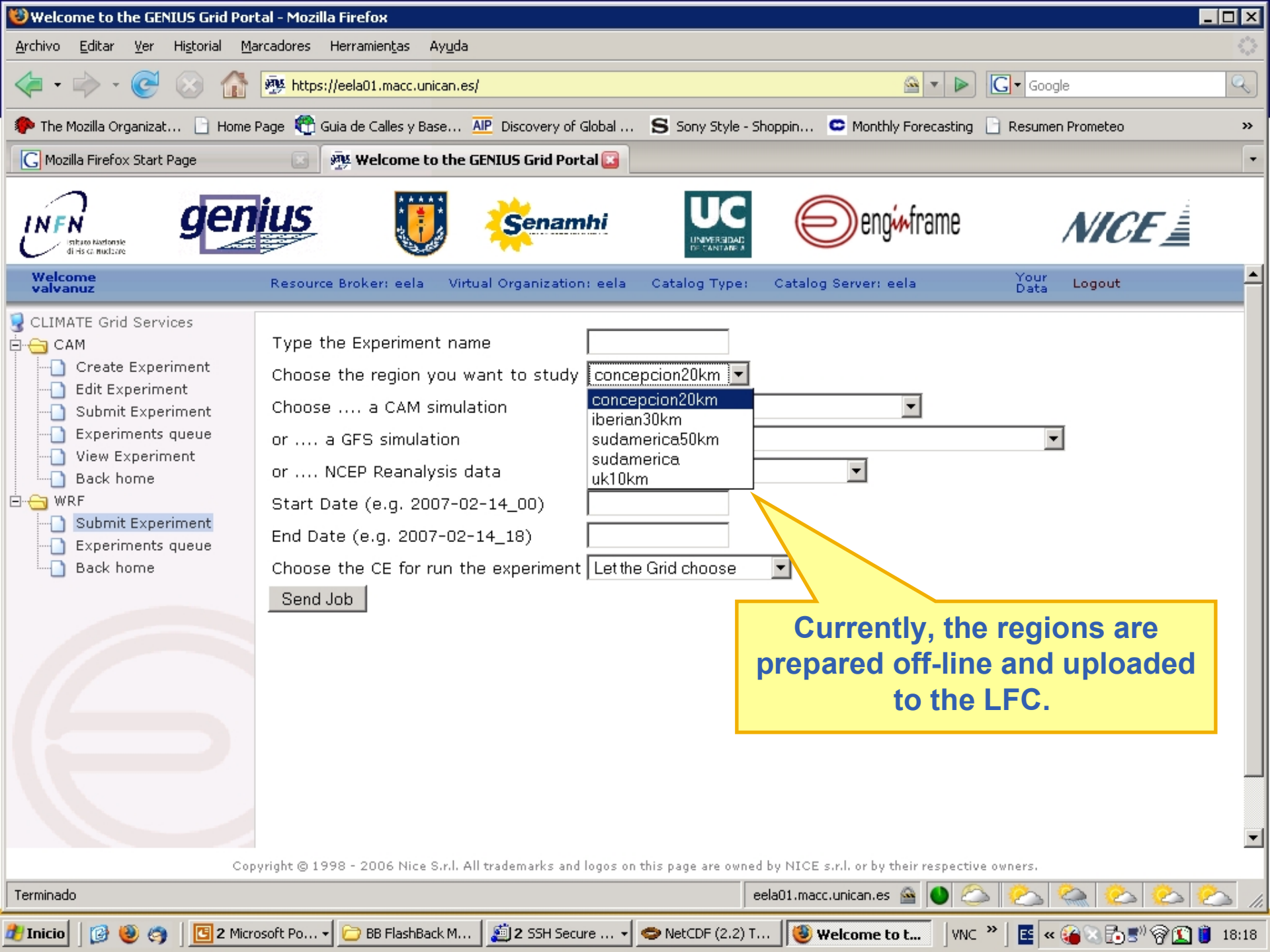
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Welcome valvanuz
Resource Broker: eela
Virtual Organization: eela
Catalog Type:
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Your Data
Logout
CLIMATE Grid Services
CAM
Create Experiment
Edit Experiment
Submit Experiment
Experiments queue
View Experiment
Back home
WRF
Submit Experiment
Experiments queue
Back home
Type the Experiment name
Choose the region you want to study
concepcion20km
concepcion20km
iberian30km
sudamerica50km
sudamerica
uk10km
Choose .... a CAM simulation
or .... a GFS simulation
or .... NCEP Reanalysis data
Start Date (e.g. 2007-02-14_00)
End Date (e.g. 2007-02-14_18)
Choose the CE for run the experiment
Let the Grid choose
Send Job
Currently, the regions are prepared off-line and uploaded to the LFC.
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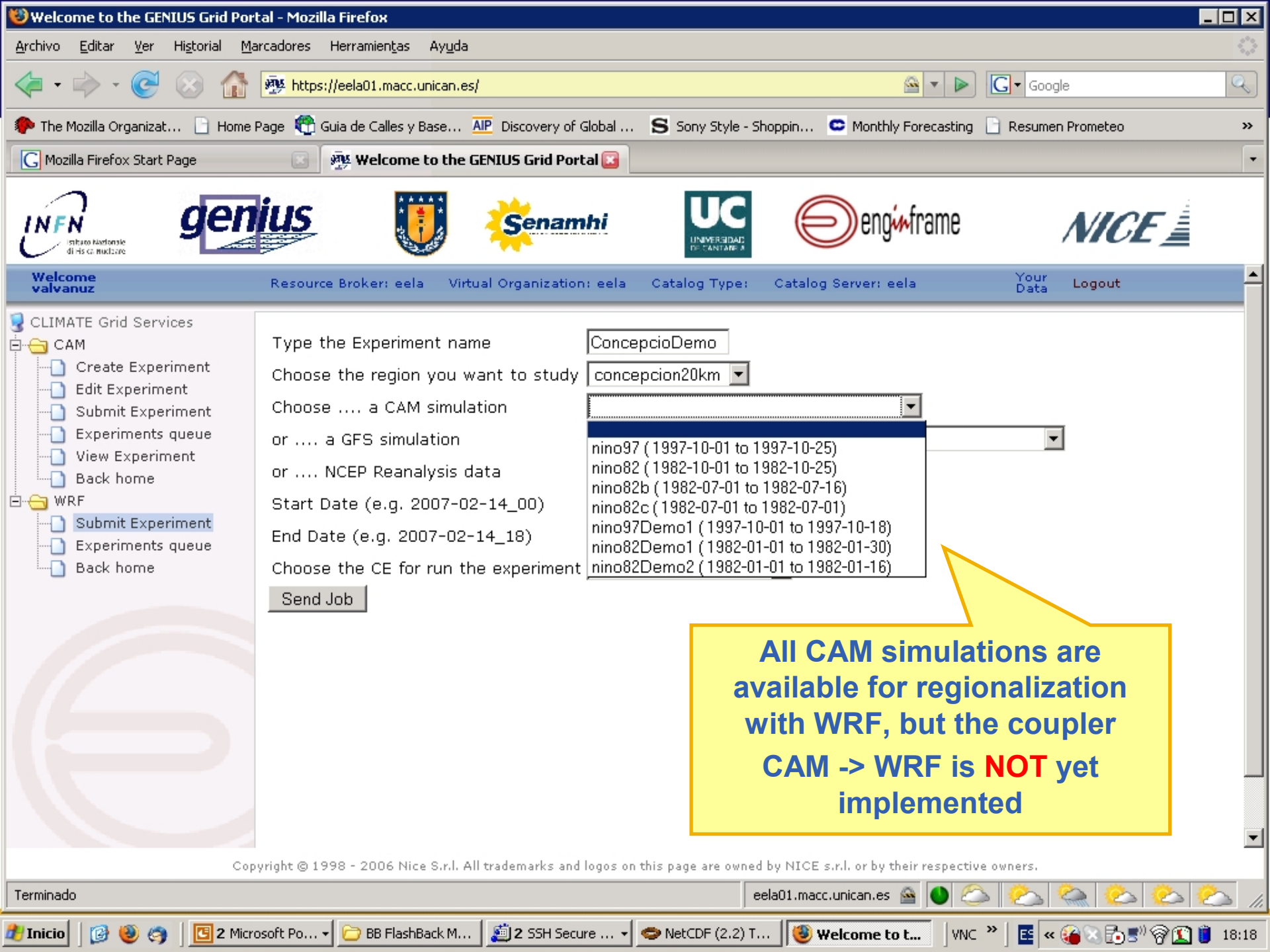
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Your Data
Logout
CLIMATE Grid Services
CAM
Create Experiment
Edit Experiment
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View Experiment
Back home
WRF
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Type the Experiment name
ConcepcioDemo
Choose the region you want to study
concepcion20km
Choose .... a CAM simulation
or .... a GFS simulation
or .... NCEP Reanalysis data
Start Date (e.g. 2007-02-14_00)
End Date (e.g. 2007-02-14_18)
Choose the CE for run the experiment
nino97 (1997-10-01 to 1997-10-25)
nino82 (1982-10-01 to 1982-10-25)
nino82b (1982-07-01 to 1982-07-16)
nino82c (1982-07-01 to 1982-07-01)
nino97Demo1 (1997-10-01 to 1997-10-18)
nino82Demo1 (1982-01-01 to 1982-01-30)
nino82Demo2 (1982-01-01 to 1982-01-16)
Send Job
All CAM simulations are available for regionalization with WRF, but the coupler CAM -> WRF is NOT yet implemented
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VNC
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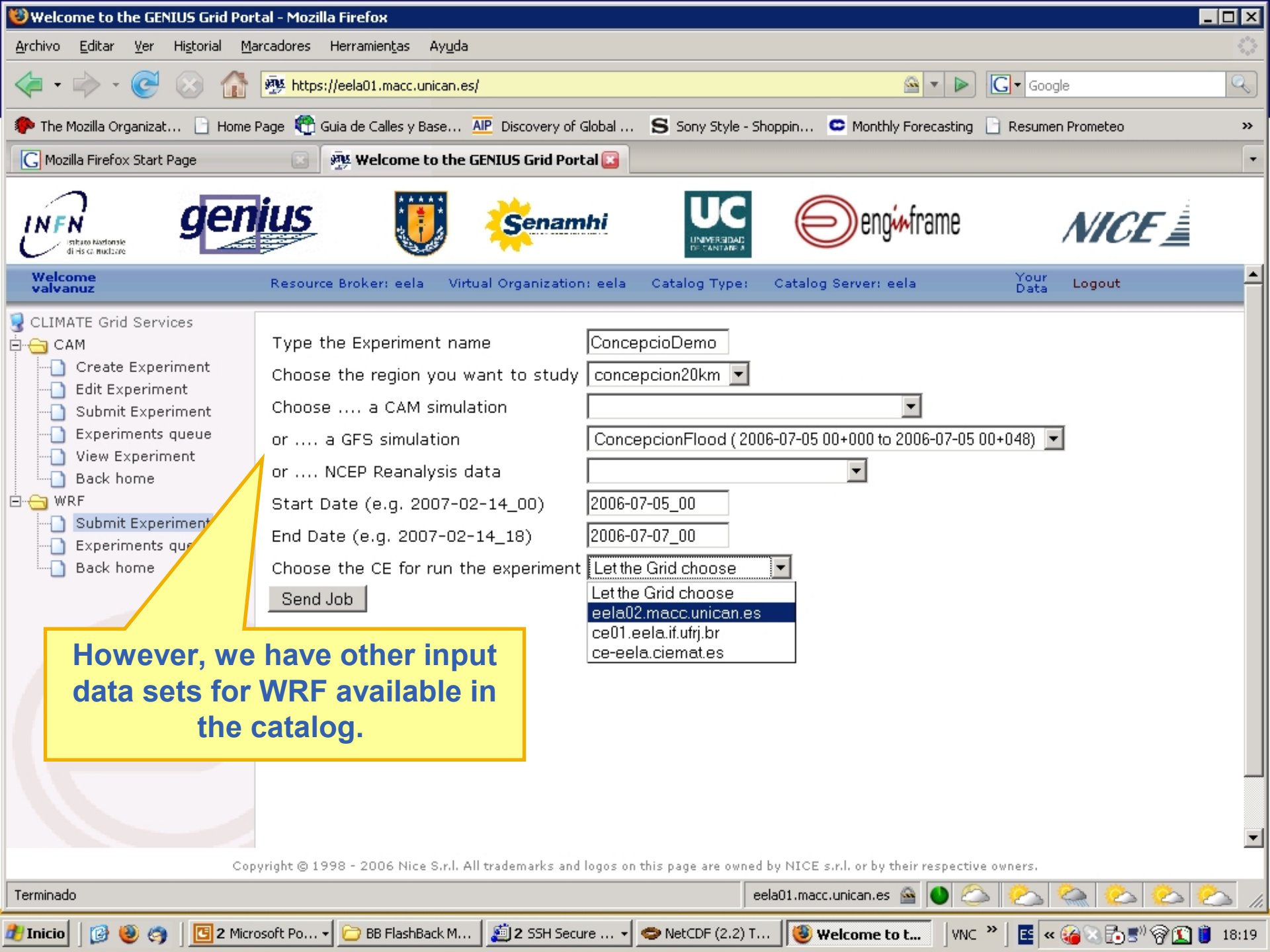
Welcome to the GENIUS Grid Portal - Mozilla Firefox
Archivo Editar Ver Historial Marcadores Herramientas Ayuda
https://eela01.macc.unican.es/
Google
The Mozilla Organizat... Home Page Guia de Calles y Base... Discovery of Global ... Sony Style - Shoppin... Monthly Forecasting Resumen Prometeo
Mozilla Firefox Start Page
Welcome to the GENIUS Grid Portal
INFN
genius
Senamhi
UC
engineframe
NICE
Welcome valvanuz
Resource Broker: eela
Virtual Organization: eela
Catalog Type:
Catalog Server: eela
Your Data
Logout
CLIMATE Grid Services
CAM
Create Experiment
Edit Experiment
Submit Experiment
Experiments queue
View Experiment
Back home
WRF
Submit Experiment
Experiments qu
Back home
Type the Experiment name
ConcepcioDemo
Choose the region you want to study
concepcion20km
Choose .... a CAM simulation
or .... a GFS simulation
ConcepcionFlood (2006-07-05 00+000 to 2006-07-05 00+048)
or .... NCEP Reanalysis data
Start Date (e.g. 2007-02-14_00)
2006-07-05_00
End Date (e.g. 2007-02-14_18)
2006-07-07_00
Choose the CE for run the experiment
Let the Grid choose
Let the Grid choose
eela02.macc.unican.es
ce01.eela.if.ufrj.br
ce-eela.ciemat.es
Send Job
However, we have other input data sets for WRF available in the catalog.
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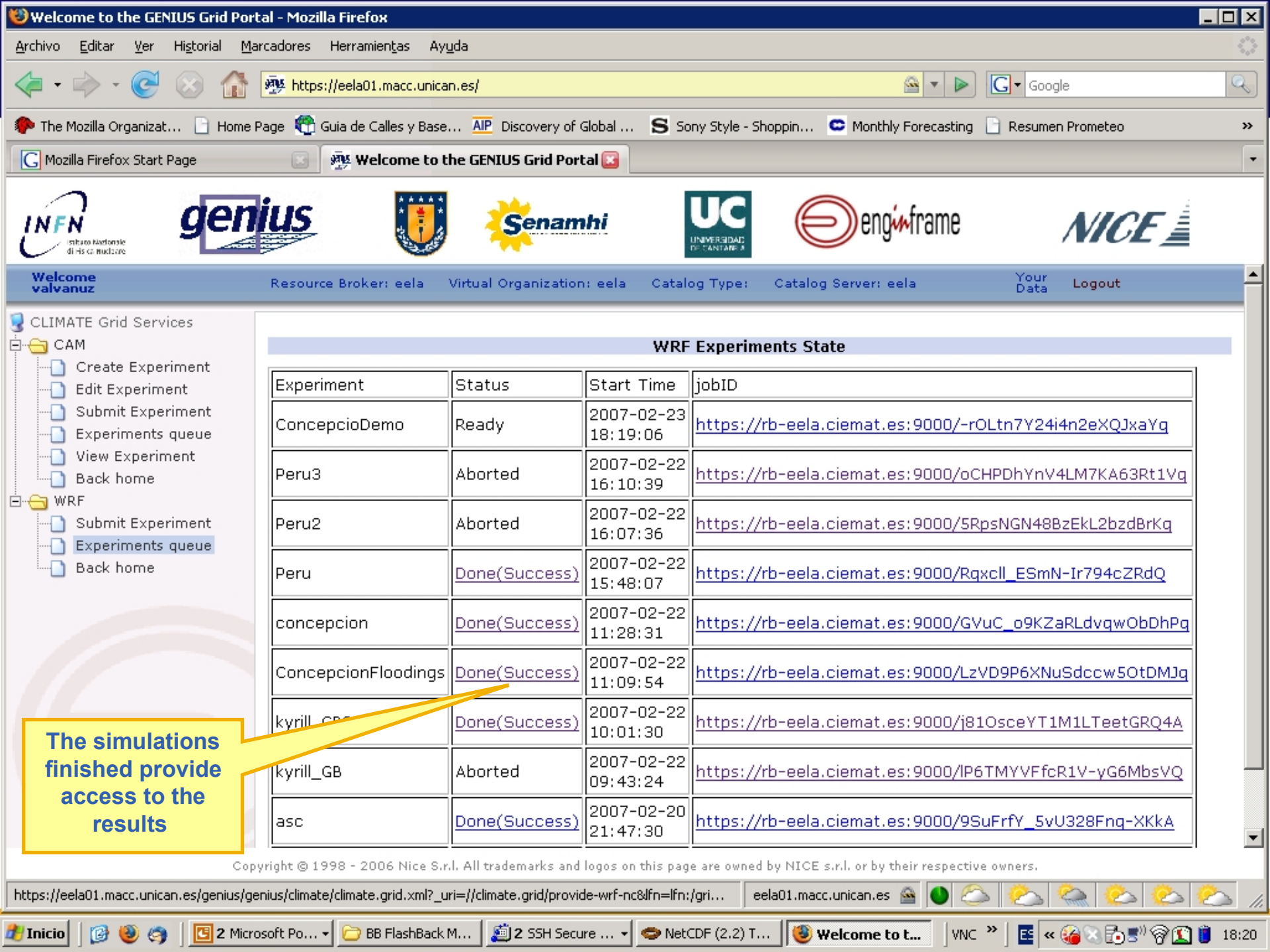
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Experiments queue
View Experiment
Back home
WRF
Submit Experiment
Experiments queue
Back home
WRF Experiments State
Experiment | Status | Start Time | jobID
ConcepcioDemo | Ready | 2007-02-23 18:19:06 | https://rb-eela.ciemat.es:9000/-rOLtn7Y24i4n2eXQJxaYq
Peru3 | Aborted | 2007-02-22 16:10:39 | https://rb-eela.ciemat.es:9000/oCHPDhYnV4LM7KA63Rt1Vq
Peru2 | Aborted | 2007-02-22 16:07:36 | https://rb-eela.ciemat.es:9000/5RpsNGN48BzEkL2bzdBrKq
Peru | Done(Success) | 2007-02-22 15:48:07 | https://rb-eela.ciemat.es:9000/Rqxcll_ESmN-Ir794cZRdQ
concepcion | Done(Success) | 2007-02-22 11:28:31 | https://rb-eela.ciemat.es:9000/GVuC_o9KZaRLdvqwObDhPg
ConcepcionFloodings | Done(Success) | 2007-02-22 11:09:54 | https://rb-eela.ciemat.es:9000/LzVD9P6XNuSdccw5OtDMJg
kyrill_GB | Done(Success) | 2007-02-22 10:01:30 | https://rb-eela.ciemat.es:9000/j81OsceYT1M1LTeetGRQ4A
kyrill_GB | Aborted | 2007-02-22 09:43:24 | https://rb-eela.ciemat.es:9000/lP6TMYVFfcR1V-yG6MbsVQ
asc | Done(Success) | 2007-02-20 21:47:30 | https://rb-eela.ciemat.es:9000/9SuFrfY_5vU328Fnq-XKkA
The simulations finished provide access to the results
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https://eela01.macc.unican.es/genius/genius/climate/climate.grid.xml?_uri=//climate.grid/provide-wrf-nc&lfn=lfn:/gri...
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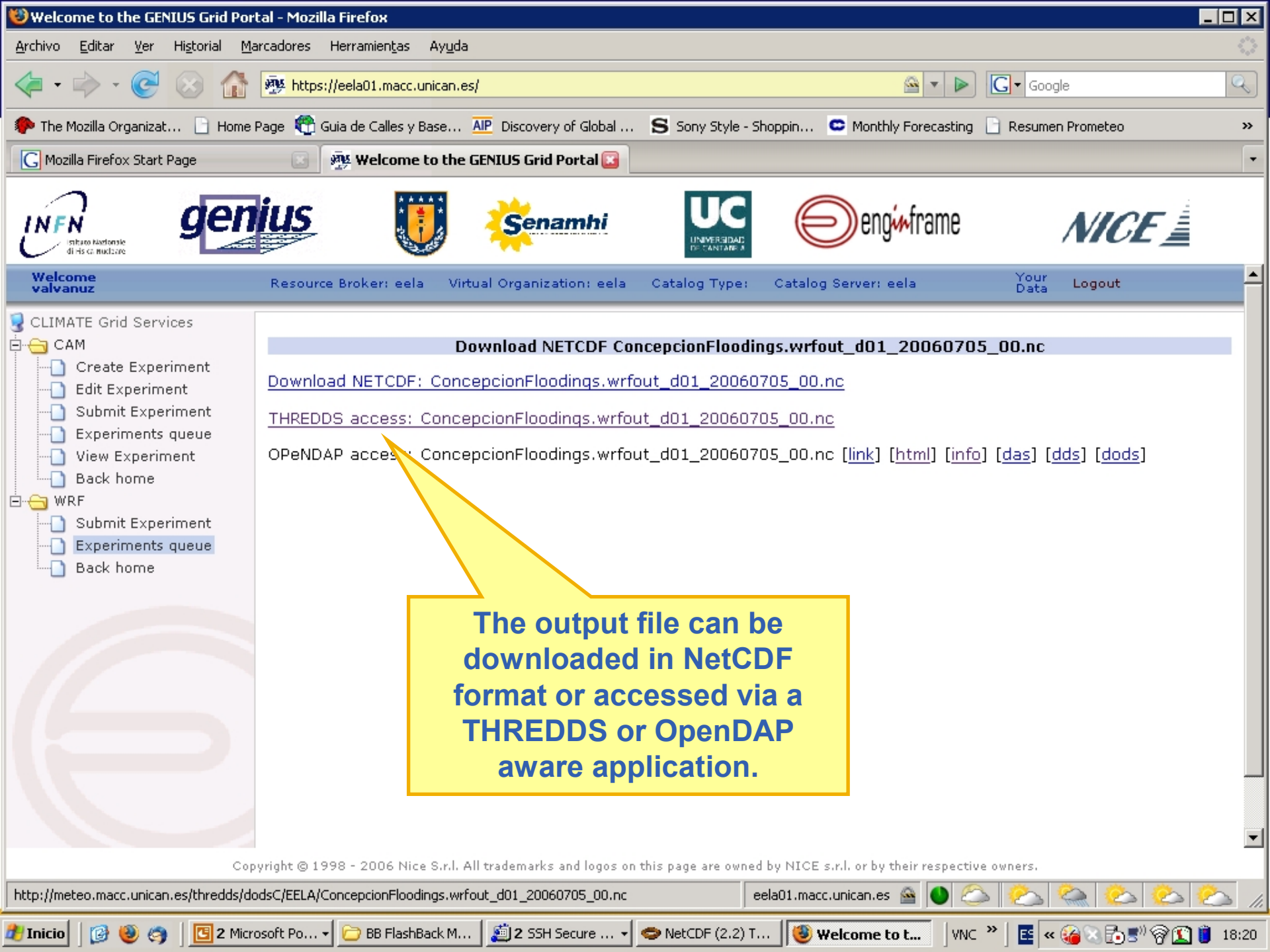
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Download NETCDF: ConcepcionFloodings.wrfout_d01_20060705_00.nc
THREDDS access: ConcepcionFloodings.wrfout_d01_20060705_00.nc
OPeNDAP access: ConcepcionFloodings.wrfout_d01_20060705_00.nc [link] [html] [info] [das] [dds] [dods]
The output file can be downloaded in NetCDF format or accessed via a THREDDS or OpenDAP aware application.
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http://meteo.macc.unican.es/thredds/dodsC/EELA/ConcepcionFloodings.wrfout_d01_20060705_00.nc
eela01.macc.unican.es
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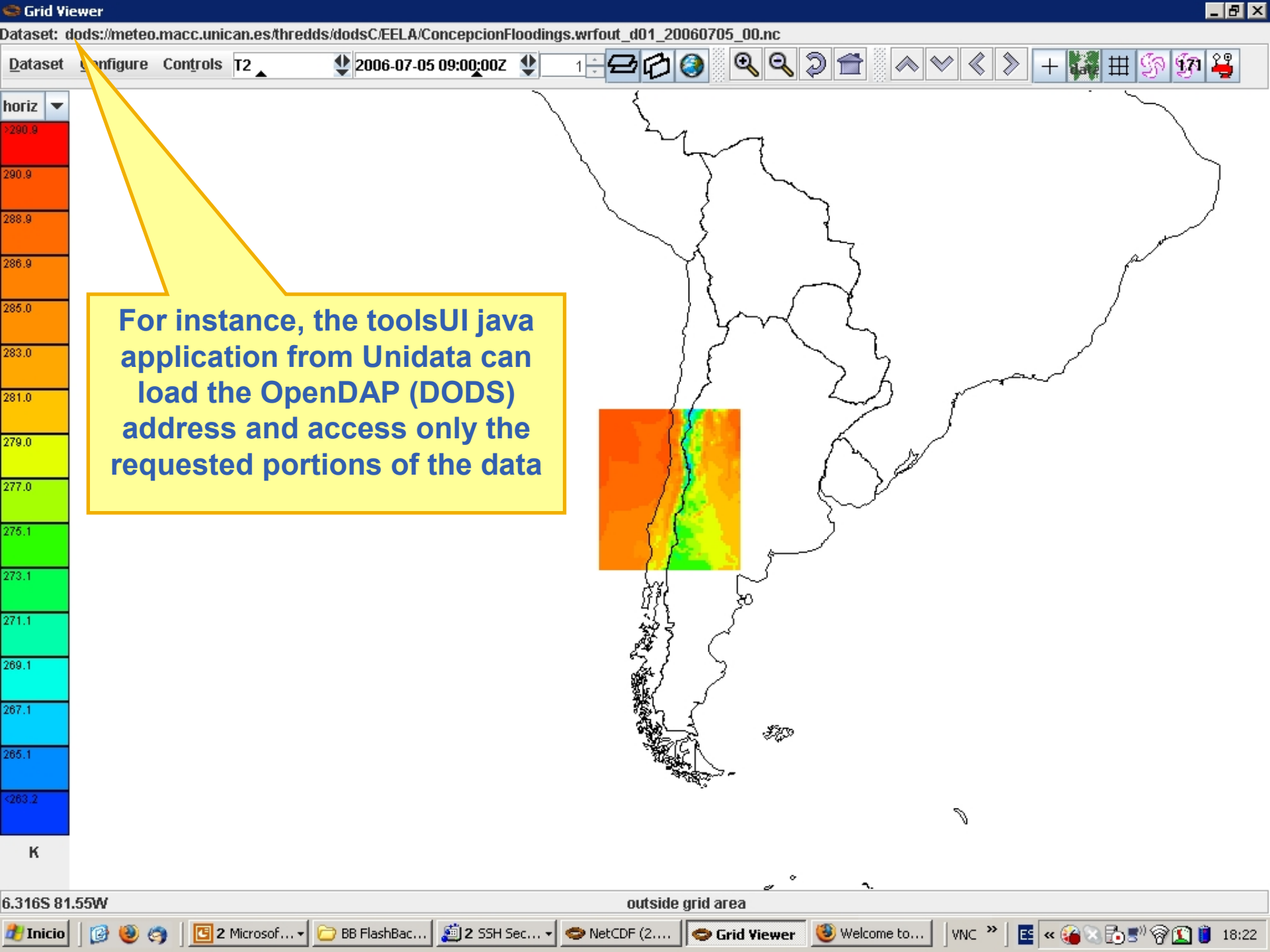
Grid Viewer
Dataset: dods://meteo.macc.unican.es/thredds/dodsC/EELA/ConcepcionFloodings.wrfout_d01_20060705_00.nc
Dataset
Configure
Controls
T2
2006-07-05 09:00:00Z
1
horiz
>290.9
290.9
288.9
286.9
285.0
283.0
281.0
279.0
277.0
276.1
273.1
271.1
269.1
267.1
265.1
<263.2
K
For instance, the toolsUI java application from Unidata can load the OpenDAP (DODS) address and access only the requested portions of the data
6.316S 81.55W
outside grid area
Inicio
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Domain Wizard - Firefox

File Edit View Go Bookmarks Tools Help

jesusff

http://www.wrfportal.org/DomainWizard.html

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WRF Portal

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WRF Domain Wizard

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FSL website

Accessibility statement

WRF Domain Wizard: GUI For The WRF Preprocessor System (WPS)

WRF Domain Wizard is the successor to the WRFSI GUI and is a graphical user interface (GUI) for the new WRF Preprocessing System (WPS). It enables users to easily define and localize domains (cases) by selecting a region of the Earth and choosing a map projection. They can also define nests using the nests editor, and run the WPS programs (geogrid, ungrib, and metgrid) through the GUI.

View some WRF Domain Wizard screen shots or tutorials.

WRF Domain Wizard can be run as a stand-alone application
to launch the standalone version of WRF Domain Wizard: by d
Web Start. The advantages of running the Java Web Start vers
automatically receiving program updates. Having trouble runnin

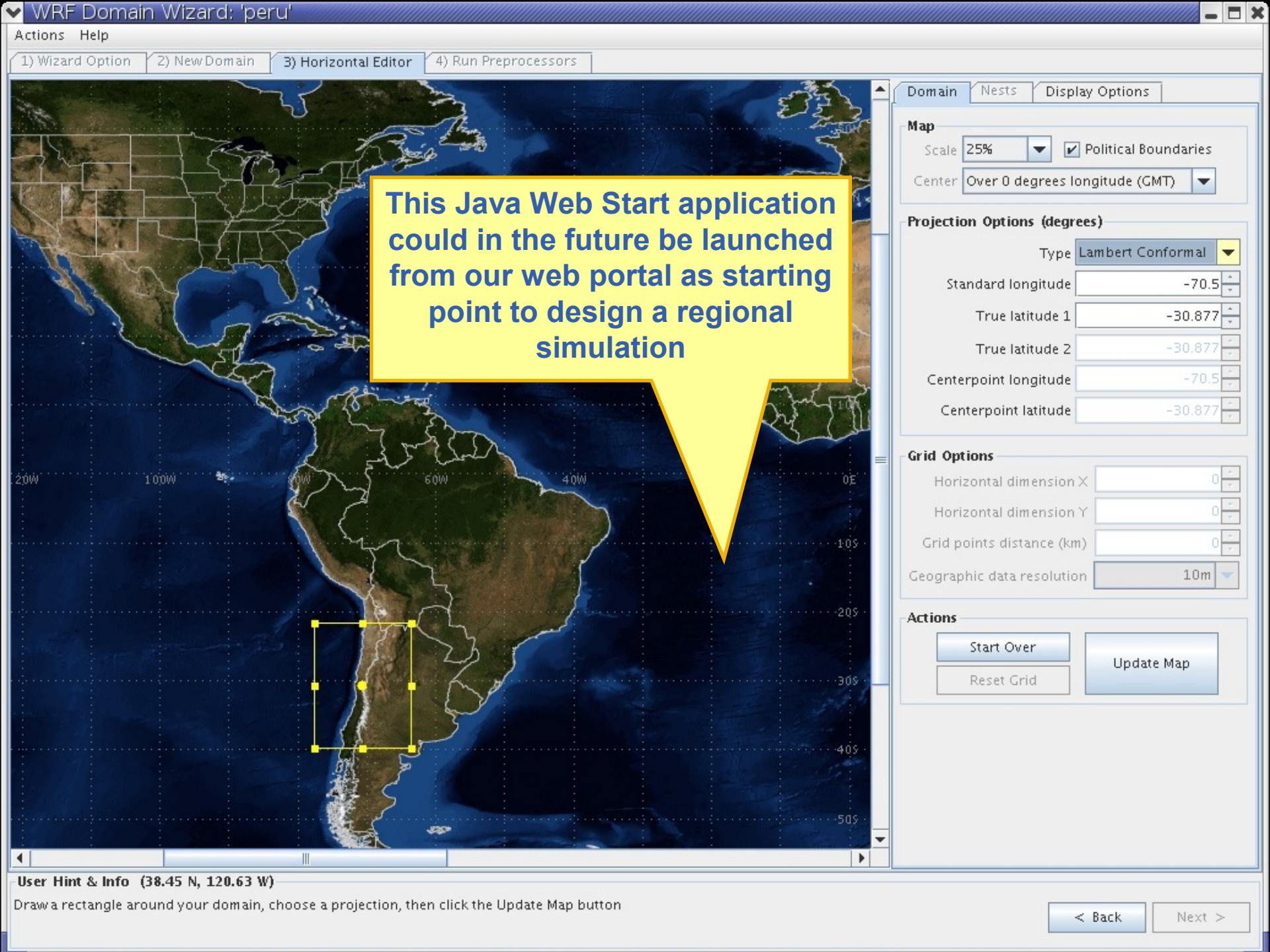
o ways
ava

NOAA provides user-friendly access to setup regional domains for WRF

Run WRF Domain Wizard using Java Web Start

Click here to launch WRF Domain Wizard
(03-29-2007 beta)

Done


WRF Domain Wizard: 'peru'
Actions Help
1) Wizard Option
2) New Domain
3) Horizontal Editor
4) Run Preprocessors
This Java Web Start application could in the future be launched from our web portal as starting point to design a regional simulation
Domain
Nests
Display Options
Map
Scale 25%
Political Boundaries
Center Over 0 degrees longitude (GMT)
Projection Options (degrees)
Type Lambert Conformal
Standard longitude -70.5
True latitude 1 -30.877
True latitude 2 -30.877
Centerpoint longitude -70.5
Centerpoint latitude -30.877
Grid Options
Horizontal dimension X 0
Horizontal dimension Y 0
Grid points distance (km) 0
Geographic data resolution 10m
Actions
Start Over
Reset Grid
Update Map
User Hint & Info (38.45 N, 120.63 W)
Draw a rectangle around your domain, choose a projection, then click the Update Map button
< Back
Next >