



NextData, WP2.5 - “Archivio digitale di dati numerici e previsionali”:

CMCC, CASPUR-CINECA, ENEA, ICTP, ISAC-CNR

WP dedicato alla costruzione di un archivio dei risultati di simulazioni climatiche globali, regionali e locali, e di rianalisi oceaniche, sia già esistenti sia effettuate durante il progetto.

- Rendere disponibili i dati prodotti da modelli numerici (sia già esistenti sia prodotti durante il Progetto) mediante un sistema di archivi e portali tematici collegati al Portale Generale.
- Scientific questions → Grand Challenges

Primo anno

- **Censimento** delle simulazioni numeriche globali e regionali da includere negli archivi (D2.5.1)
- Definizione dei **protocolli di archiviazione** dei dati numerici, della rete di sottoarchivi e delle modalità di accesso ai dati e alle procedure di trasferimento di dati di grandi dimensioni.
- Definizione e alla preparazione di specifici esperimenti numerici da eseguire durante il secondo anno del progetto: *Scientific Questions* (D2.5.2)

Organizzati quattro meeting di work-package

Secondo anno (Attività previste per il secondo anno rimodulate in accordo ai tagli di budget)

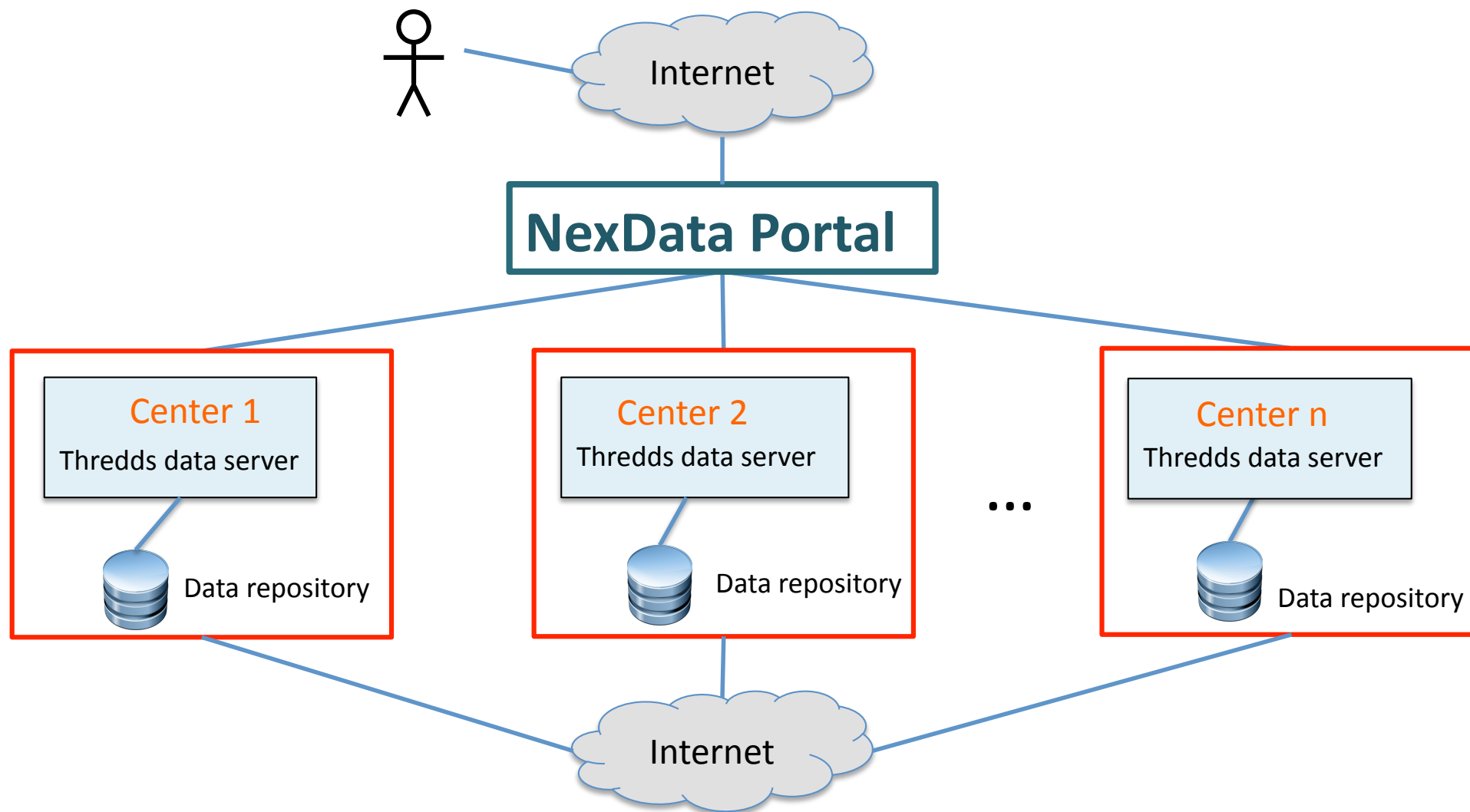
- **produzione di simulazioni** numeriche globali e regionali mirate alle aree d'interesse del progetto;
- costruzione **archivio di dati numerici**, globali e regionali con particolare attenzione per l'area Mediterranea, la regione Alpina e la regione HKKH;
- implementazione **modelli numerici a scala locale, non idrostatici**, per la simulazione della dinamica climatica e ambientale in zone montane con orografia complessa;
- downscaling **statistico/stocastico** e la produzione di scenari futuri ad alta risoluzione nelle aree di interesse;
- **confronto tra diverse tecniche di downscaling** (din., stat., stoc.), per comprenderne le caratteristiche e i limiti di applicabilità ai diversi casi studio.

Deliverable: D2.5.3: Archivi di simulazioni climatiche globali disponibili presso i server dati dei centri partner.

Deliverable: D2.5.4: Report sui risultati ottenuti dalle simulazioni modellistiche compiute alle varie scale e analisi dati.

Archivi e accesso ai dati dalle simulazioni

Rendere disponibili i dati prodotti da modelli numerici (sia già esistenti sia prodotti durante il Progetto) mediante un sistema di archivi e portali tematici collegati al Portale Generale.



Server Thredds in servizio presso ISAC-CNR – accesso ai dati EC-Earth CMIP5 e diversi dataset climatici



ISAC-CNR Test TDS

THREDDS Data Server

Catalog http://sansone.to.isac.cnr.it:8080/thredds/catalog/EC-Earth_CMIP5/rcp85/day/atmos/tas/r8i1p1/catalog.html

Dataset: [r8i1p1/tas_day_EC-Earth_rcp85_r8i1p1_20760101-21001231.nc](#)

- *Data size:* 1.870 Gbytes
- *Data type:* GRID
- *ID:* EC-Earth_CMIP5/rcp85/day/atmos/tas/r8i1p1/tas_day_EC-Earth_rcp85_r8i1p1_20760101-21001231.nc

Access:

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2. **HTTPServer:** [/thredds/fileServer/EC-Earth_CMIP5/rcp85/day/atmos/tas/r8i1p1/tas_day_EC-Earth_rcp85_r8i1p1_20760101-21001231.nc](#)
3. **WMS:** [/thredds/wms/EC-Earth_CMIP5/rcp85/day/atmos/tas/r8i1p1/tas_day_EC-Earth_rcp85_r8i1p1_20760101-21001231.nc](#)
4. **NetcdfSubset:** [/thredds/ncss/grid/EC-Earth_CMIP5/rcp85/day/atmos/tas/r8i1p1/tas_day_EC-Earth_rcp85_r8i1p1_20760101-21001231.nc](#)

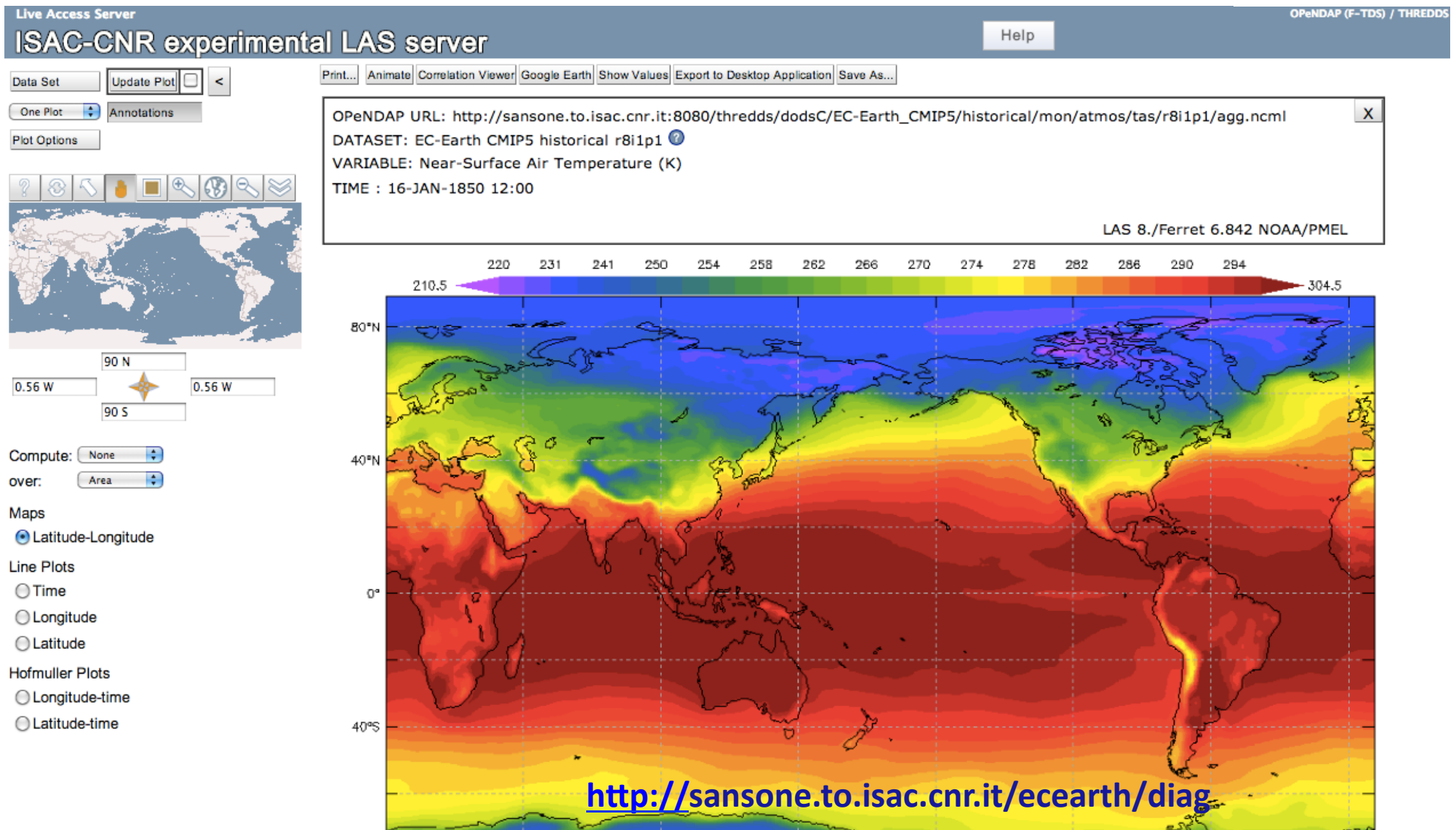
Dates:

- 2012-01-23 10:48:00Z (modified)

Viewers:

- [Integrated Data Viewer \(IDV\) \(webstart\)](#)
- [NetCDF-Java ToolsUI \(webstart\)](#)
- [Godiva2 \(browser-based\)](#)

Server LAS sperimentale attivo presso ISAC Collegato al server thredds



Atmospheric and oceanic diagnostics



EC-EARTH RCP 4.5 Simulation - Ocean



Home

Historical

RCP 4.5

RCP 8.5

RCP 3-PD

Benchmark

Video

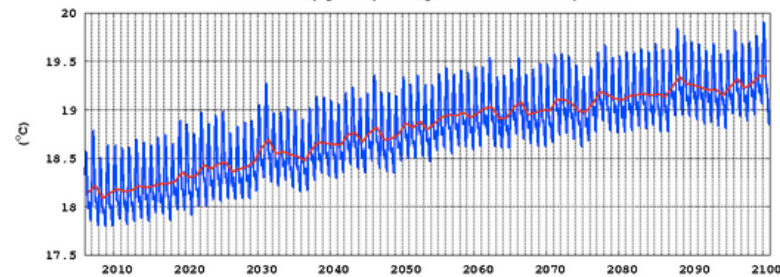
EC
Earth3

Ocean diagnostics for EC-EARTH2.3 coupled experiment IC41

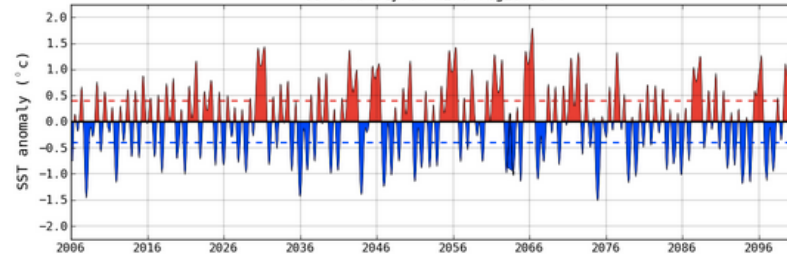
Last updated: Fri Sep 30 15:47:09 CEST 2011

Created on 'neo025'

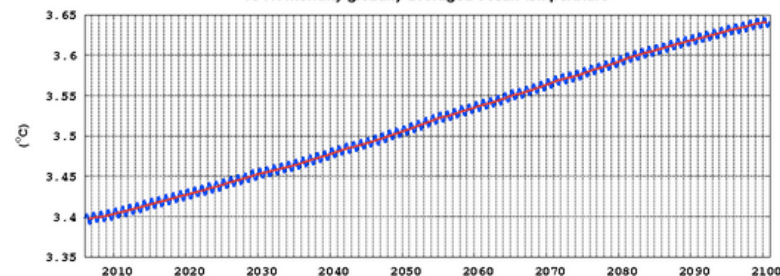
IC41: monthly globally-averaged Sea Surface Temperature



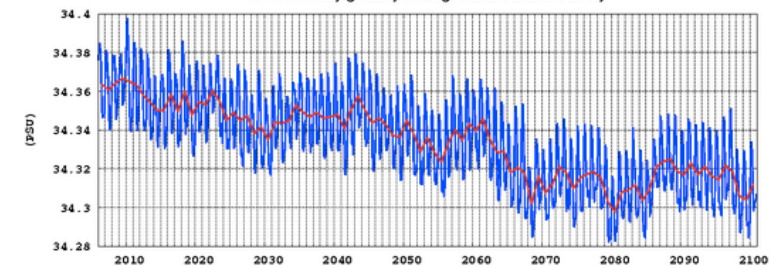
SST anomaly on Nino region 3.4



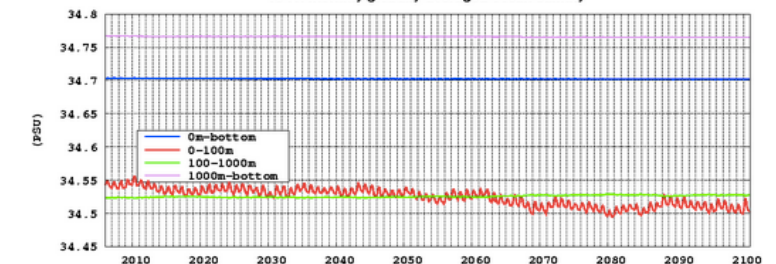
IC41: monthly globally-averaged ocean temperature



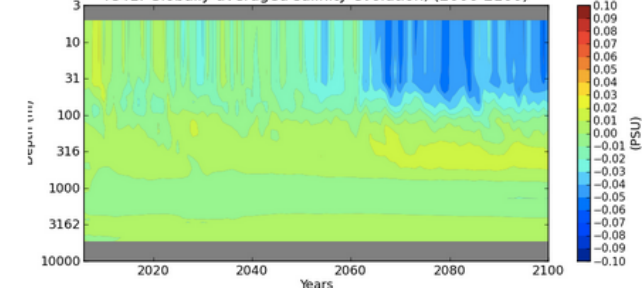
IC41: monthly globally-averaged Sea Surface Salinity



IC41: monthly globally-averaged ocean salinity



IC41: Globally-averaged salinity evolution, (2006-2100)



<http://sansone.to.isac.cnr.it/ecearth/diag>

AMWG Diagnostic Package for climate simulations



AMWG Diagnostics Package
itr1

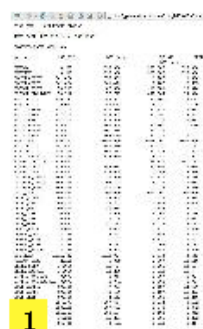
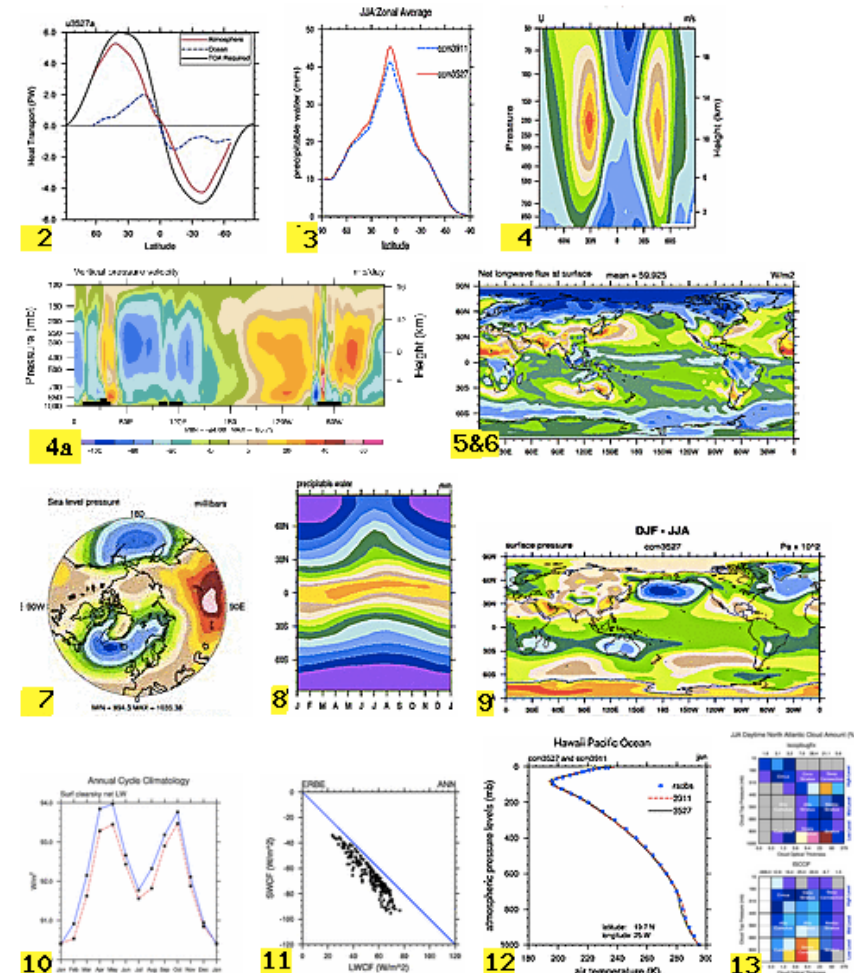


Plots Created
Thu Jul 4 18:20:48 CEST 2013
AMWG - EC-Earth interface by
Laurent Brodeau (MISU) 2012

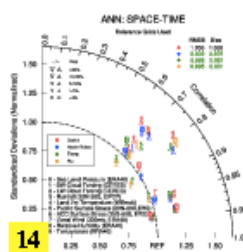
Set Description

- 1 **Tables** of ANN, DJF, JJA, global and regional means and RMSE.
- 2 **Line plots** of annual implied northward transports.
- 3 **Line plots** of DJF, JJA and ANN zonal means
- 4 **Vertical contour plots** of DJF, JJA and ANN zonal means
- 4a **Vertical (XZ) contour plots** of DJF, JJA and ANN meridional means
- 5 **Horizontal contour plots** of DJF, JJA and ANN means
- 6 **Horizontal vector plots** of DJF, JJA and ANN means
- 7 **Polar contour and vector plots** of DJF, JJA and ANN means
- 8 **Annual cycle contour plots** of zonal means
- 9 **Horizontal contour plots** of DJF-JJA differences
- 10 **Annual cycle line plots** of global means
- 11 **Pacific annual cycle, Scatter plot plots**
- 12 **Vertical profile plots** from 17 selected stations
- 13 **Cloud simulators plots**
- 14 **Taylor Diagram plots**
- 15 **Annual Cycle at Select Stations plots**

Click on Plot Type

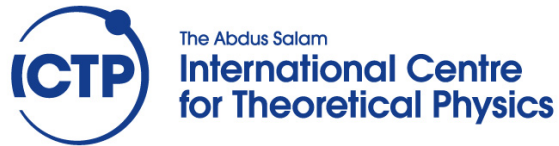


TABLES

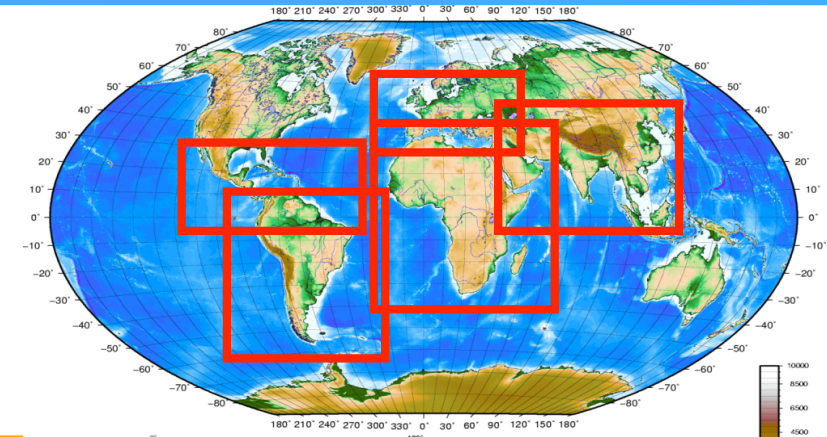


METRICS

Laura Mariotti mariotti@ictp.it



Regional Climate Simulations



Already copied To Cineca

Domain	Boundary conditions	Resolution	period
MED-44	HadGEM scenarios: RCP4.5, <u>RCP8.5</u>	50 km	1970-2100
MED-44	MPI ECHAM6 scenario RCP8.5	50 km	1970-2100
AFR-44	HadGEM scenarios: RCP4.5, RCP8.5	50 km	1970-2100
AFR-44	MPI ECHAM6 scenario <u>RCP8.5</u>	50 km	1970-2100

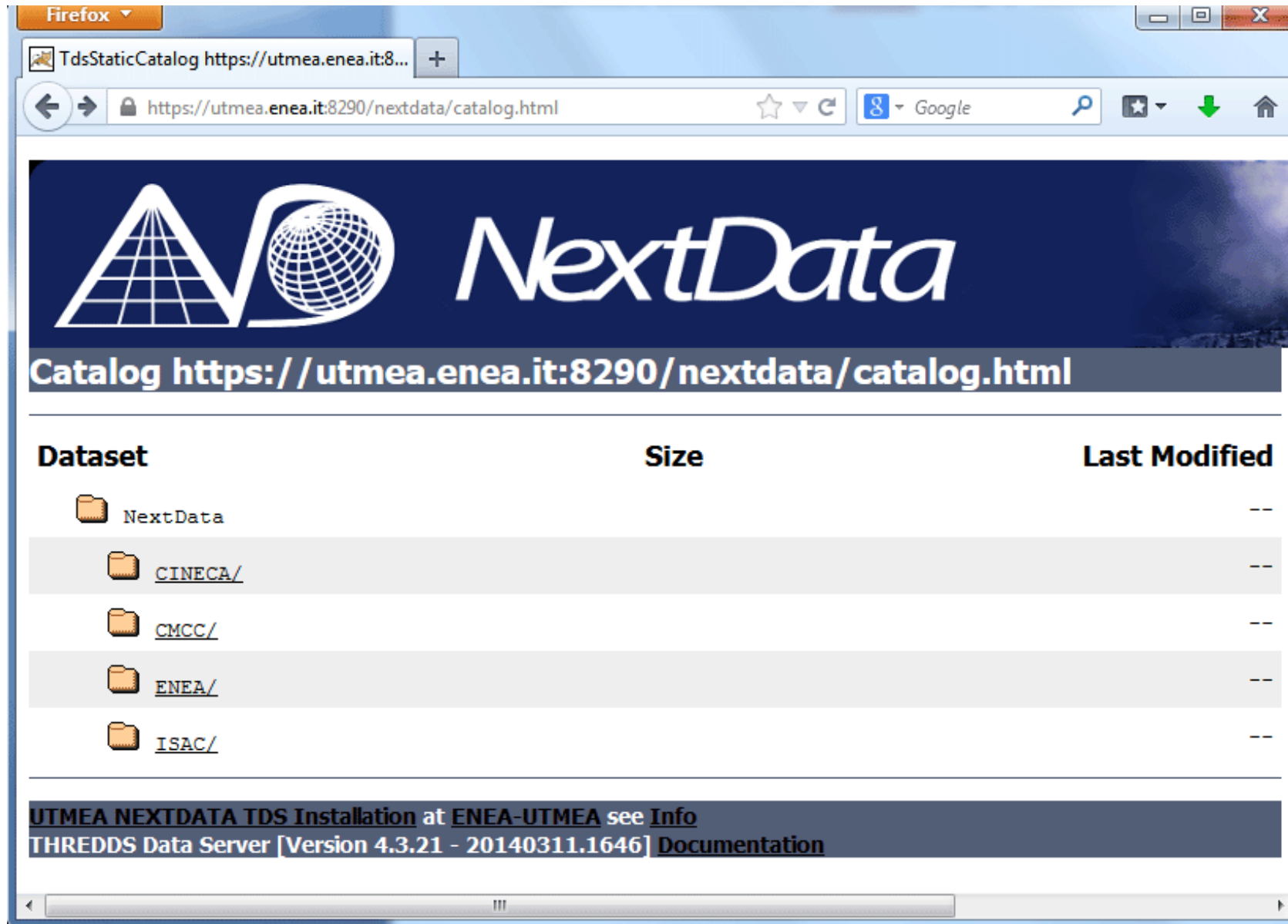
In Post-Processing

Domain	Boundary conditions	Resolution	period
Central America	HadGEM scenarios: RCP4.5, RCP8.5	50 km	1970-2100
Central America	MPI ECHAM6 scenario RCP8.5	50 km	1970-2100
South America	HadGEM scenarios: RCP4.5, RCP8.5	50 km	1970-2100
South America	GDFL, scenario RCP8.5	50 km	1970-2100
South America	MPI ECHAM6 scenario RCP8.5	50 km	1970-2100

ENEA NextData TDS

<http://utmea.enea.it/nextdata>

THREDDS Data Server
[Version 4.3.17 - 20130607.1641]



The screenshot shows a Firefox browser window displaying the ENEA NextData TDS web interface. The address bar shows the URL <https://utmea.enea.it:8290/nextdata/catalog.html>. The page features the NextData logo and a banner with the text "Catalog https://utmea.enea.it:8290/nextdata/catalog.html". Below the banner is a table listing datasets.

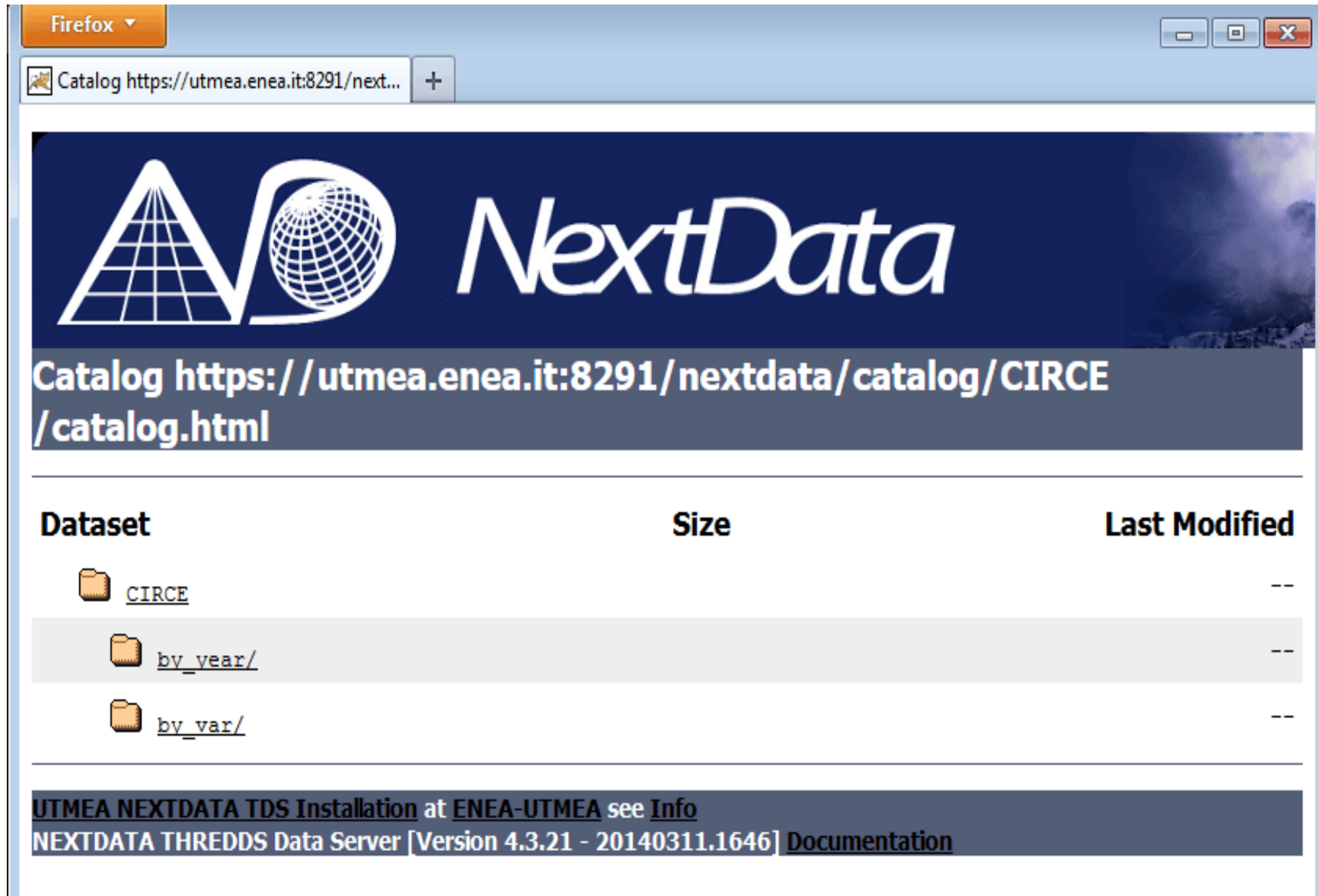
Dataset	Size	Last Modified
 NextData		--
 CINECA/		--
 CMCC/		--
 ENEA/		--
 ISAC/		--

At the bottom of the page, there is a dark blue banner with white text: "UTMEA NEXTDATA TDS Installation at ENEA-UTMEA see [Info](#) THREDDS Data Server [Version 4.3.21 - 20140311.1646] [Documentation](#)".

ENEA NextData TDS

<http://utmea.enea.it/nextdata>

THREDDS Data Server
[Version 4.3.17 - 20130607.1641]



The screenshot shows a Firefox browser window with the address bar displaying "Catalog https://utmea.enea.it:8291/next...". The main content area features the NextData logo (a stylized 'N' with a globe) and the text "NextData". Below the logo, the URL "Catalog https://utmea.enea.it:8291/nextdata/catalog/CIRCE/catalog.html" is displayed. A table lists the datasets available in the catalog:

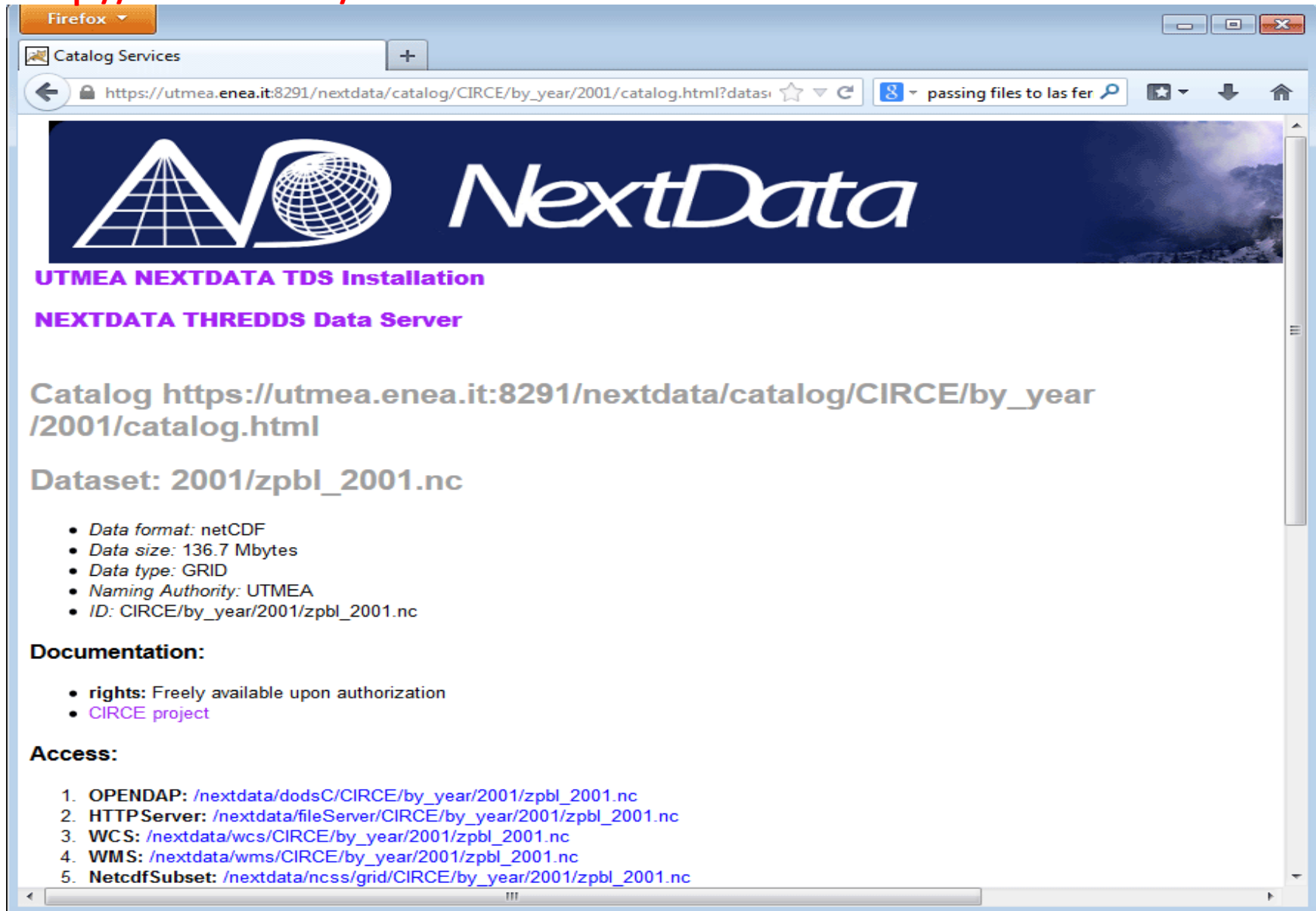
Dataset	Size	Last Modified
 CIRCE		--
 by_year/		--
 by_var/		--

At the bottom of the page, there is a footer section with the text: "UTMEA NEXTDATA TDS Installation at ENEA-UTMEA see [Info](#)" and "NEXTDATA THREDDS Data Server [Version 4.3.21 - 20140311.1646] [Documentation](#)".

ENEA NextData TDS

<http://utmea.enea.it/nextdata>

THREDDS Data Server
[Version 4.3.17 - 20130607.1641]



Firefox

Catalog Services

https://utmea.enea.it:8291/nextdata/catalog/CIRCE/by_year/2001/catalog.html?dataset=2001/zpbl_2001.nc

 **NextData**

UTMEA NEXTDATA TDS Installation

NEXTDATA THREDDS Data Server

Catalog https://utmea.enea.it:8291/nextdata/catalog/CIRCE/by_year/2001/catalog.html

Dataset: 2001/zpbl_2001.nc

- *Data format:* netCDF
- *Data size:* 136.7 Mbytes
- *Data type:* GRID
- *Naming Authority:* UTMEA
- *ID:* CIRCE/by_year/2001/zpbl_2001.nc

Documentation:

- **rights:** Freely available upon authorization
- [CIRCE project](#)

Access:

1. **OPENDAP:** [/nextdata/dodsC/CIRCE/by_year/2001/zpbl_2001.nc](https://utmea.enea.it:8291/nextdata/dodsC/CIRCE/by_year/2001/zpbl_2001.nc)
2. **HTTP Server:** [/nextdata/fileServer/CIRCE/by_year/2001/zpbl_2001.nc](https://utmea.enea.it:8291/nextdata/fileServer/CIRCE/by_year/2001/zpbl_2001.nc)
3. **WCS:** [/nextdata/wcs/CIRCE/by_year/2001/zpbl_2001.nc](https://utmea.enea.it:8291/nextdata/wcs/CIRCE/by_year/2001/zpbl_2001.nc)
4. **WMS:** [/nextdata/wms/CIRCE/by_year/2001/zpbl_2001.nc](https://utmea.enea.it:8291/nextdata/wms/CIRCE/by_year/2001/zpbl_2001.nc)
5. **NetcdfSubset:** [/nextdata/ncss/grid/CIRCE/by_year/2001/zpbl_2001.nc](https://utmea.enea.it:8291/nextdata/ncss/grid/CIRCE/by_year/2001/zpbl_2001.nc)

CMCC Thredds server

Osvaldo Marra @ CMCC Lecce



Catalog <http://nextdata.cmcc.it:8080/thredds/catalog.html>

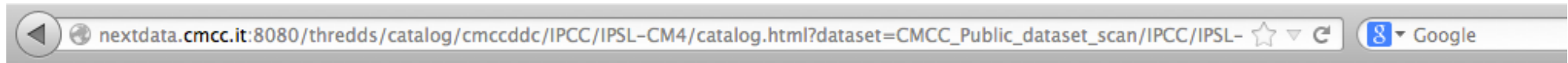
Dataset

 [CMCC Public/](#) [CMCC Private/](#) [CMCC CMIP5 for LAS /](#) [CMCC CMIP5 DATA/](#) [Isac Data/](#) [Cineca Data/](#) [Enea Data/](#)

Initial TDS Installation at My Group see [Info](#)
THREDDS Data Server [Version 4.3.17 - 20130607.1641] [Documentation](#)

<http://nextdata.cmcc.it:8080/thredds>

CMCC Thredds server: services available



Initial TDS Installation

THREDDS Data Server

Catalog <http://nextdata.cmcc.it:8080/thredds/catalog/cmccddc/IPCC/IPSL-CM4/catalog.html>

Dataset: [IPSL-CM4/IPCM4_20C3M_1_pr_1961-1990.nc](#)

- *Data format:* netCDF
- *Data size:* 335.8 Kbytes
- *Data type:* GRID
- *ID:* CMCC_Public_dataset_scan/IPCC/IPSL-CM4/IPCM4_20C3M_1_pr_1961-1990.nc

Access:

1. **OPENDAP:** [/thredds/dodsC/cmccddc/IPCC/IPSL-CM4/IPCM4_20C3M_1_pr_1961-1990.nc](#)
2. **HTTPServer:** [/thredds/fileServer/cmccddc/IPCC/IPSL-CM4/IPCM4_20C3M_1_pr_1961-1990.nc](#)
3. **WCS:** [/thredds/wcs/cmccddc/IPCC/IPSL-CM4/IPCM4_20C3M_1_pr_1961-1990.nc](#)
4. **WMS:** [/thredds/wms/cmccddc/IPCC/IPSL-CM4/IPCM4_20C3M_1_pr_1961-1990.nc](#)
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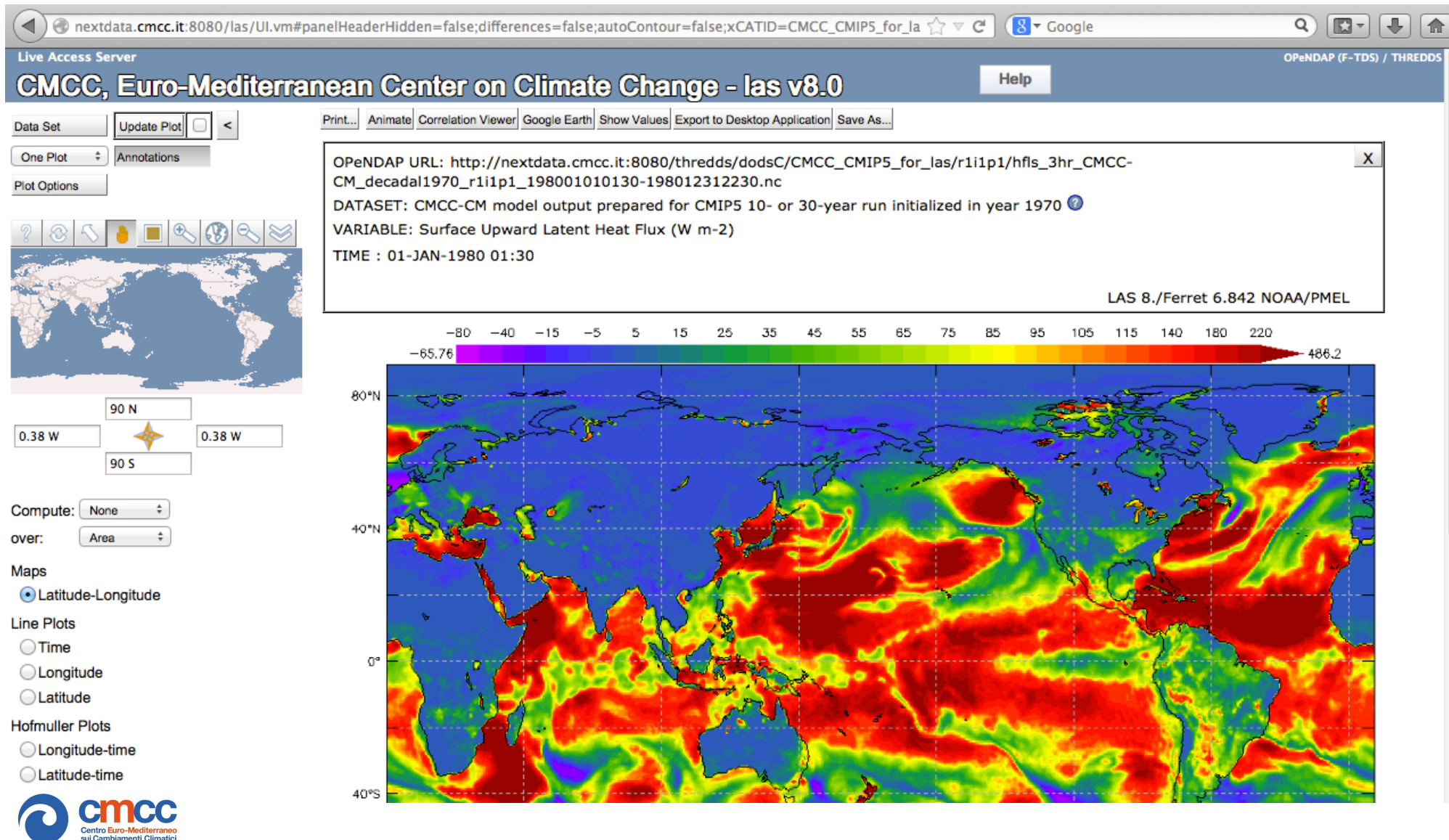
Dates:

- 2007-11-29T16:55:06Z (modified)

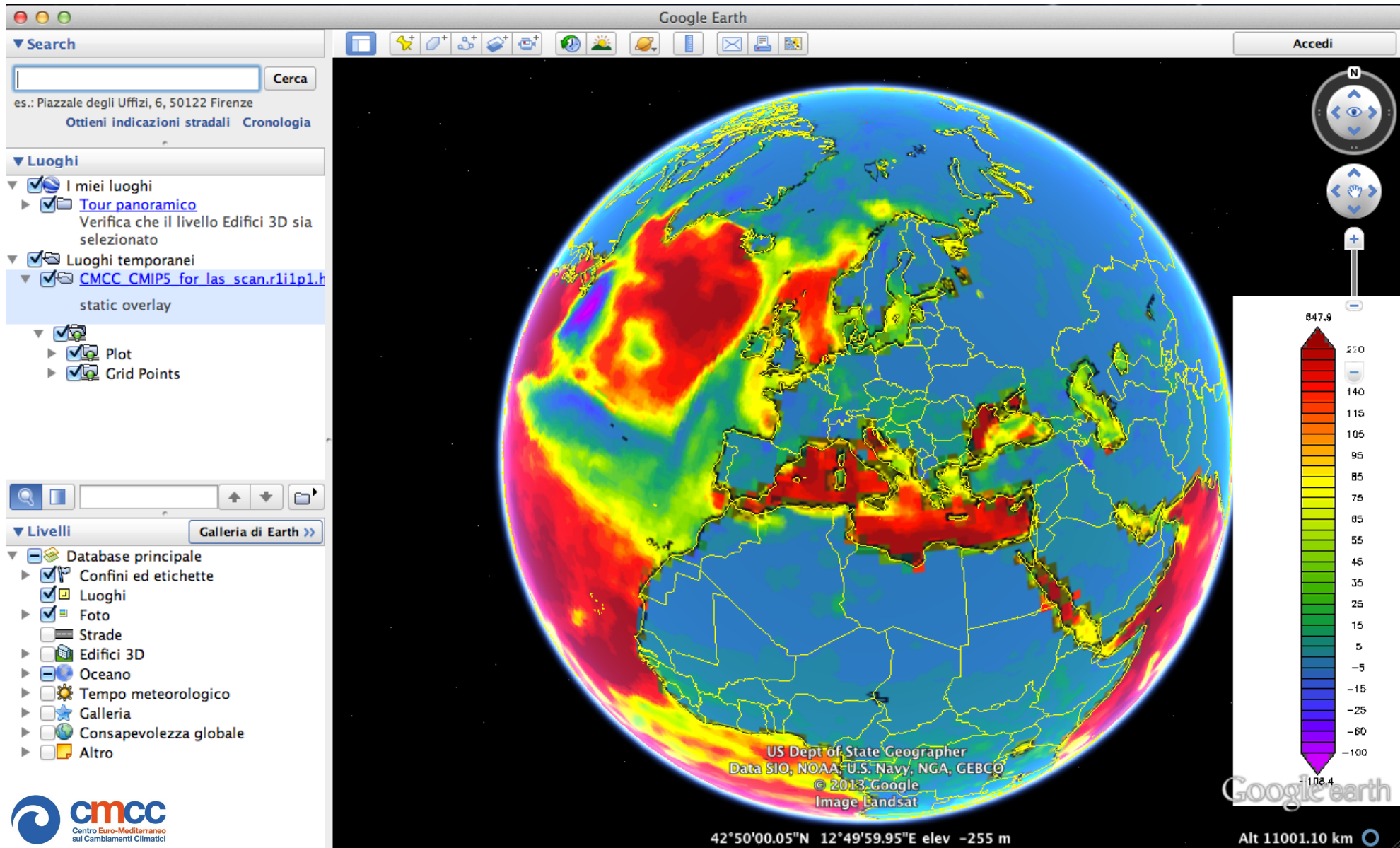
Viewers:

- Godiva2 (browser-based)
- NetCDF-Java ToolsUI (webstart)
- Integrated Data Viewer (IDV) (webstart)

CMCC LAS server: overview



CMCC LAS server: Google Earth plugin

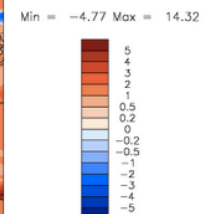
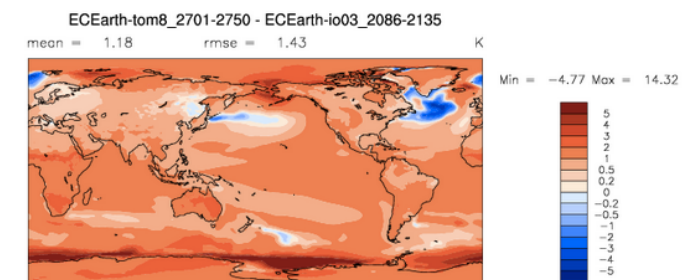
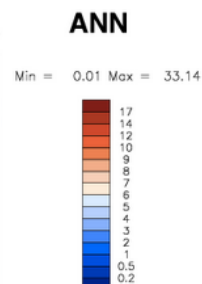
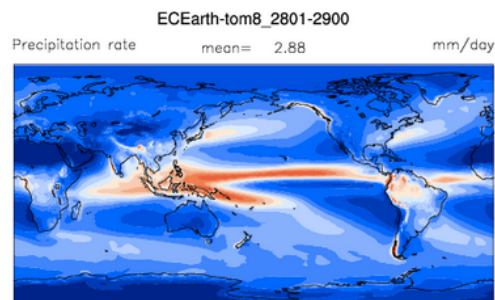




Model tuning effort



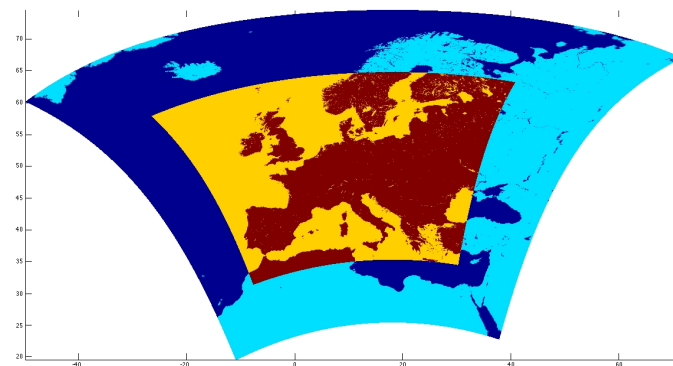
- ISAC-CNR is coordinating a consortium-level tuning effort of the EC-Earth v3 model. The goal is to achieve a tuned and optimized version, suitable for CMIP6.
- In particular ISAC-CNR is concentrating its efforts on analyzing and improving the radiative balance, the hydrological cycle and the precipitation patterns in the model.
- Current activities include coordinated experiments among the different participants in the consortium, based on a common reference baseline (in progress) and on performance metric tools based on Reichler and Kim (2008)
- Several long experiments (> 2000 years of simulation in total) with permanent 2000 conditions in progress/done.
- This effort has led in April 2014 to the release of version 3.1 of the model, which includes significant improvements in terms of global radiative balance and fluxes, significant bug fixes and improved performance indices.
- Implementation of the model at LRZ, CINECA and ECMWF
- Extensive analyses of these experiments are available on ISAC-CNR servers





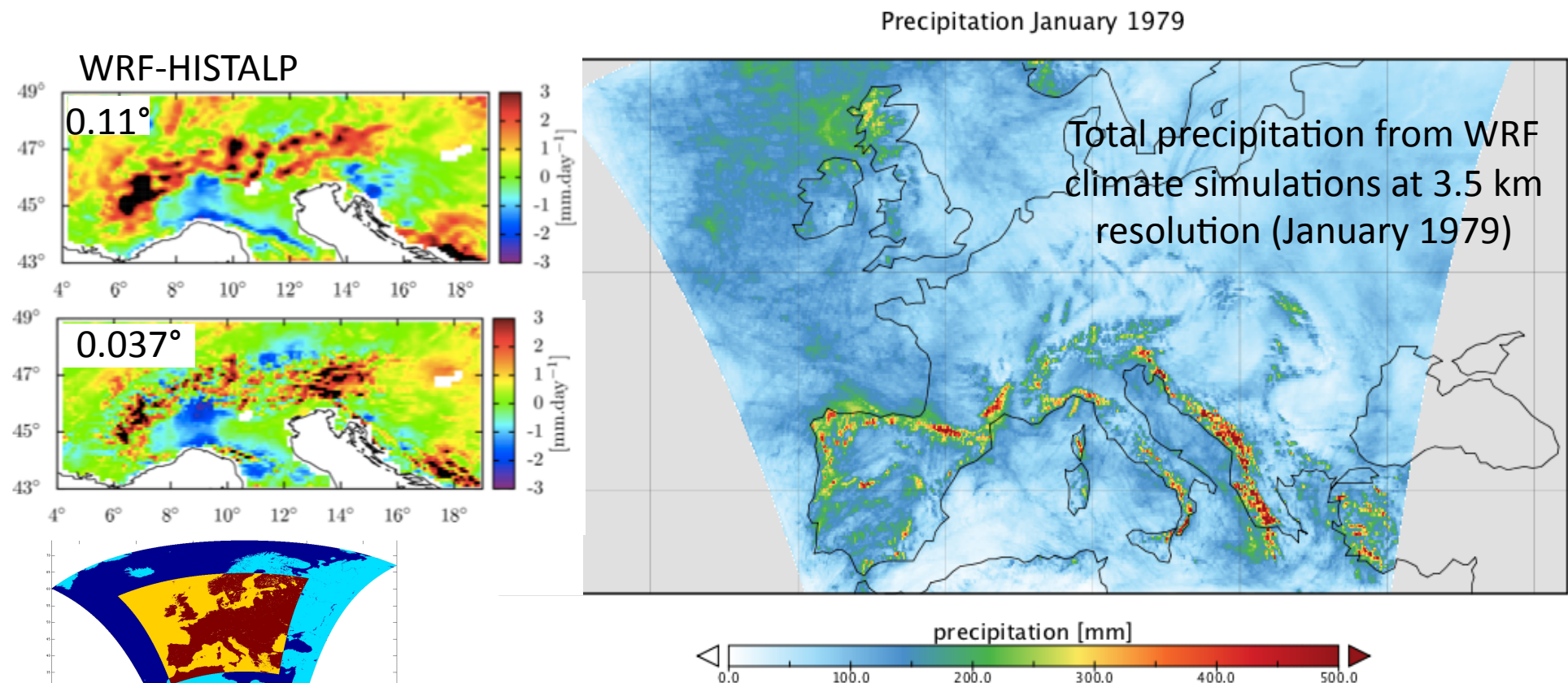
High-resolution dynamical downscaling of global scenarios over Europe

- Climate simulations with the WRF non-hydrostatic regional model for the European domain.
- Resolutions 0.11° and 0.04° .
- 30-yr present (1979-2008), large scale driver ERA-Interim at 0.04° resolution, done.
- Simulations with large scale driver EC-Earth, present-day and future RCP4.5 and RCP8.5 scenarios, at 0.11° , in progress, to be finished by the end of the year.



High-resolution (3.5 km) dynamical downscaling of global scenarios over Europe

- 30-yr present (1979-2008). Large scale drivers EC-Earth and ERA-Interim
- 30-yr projection (2021-2050 RCP 4.5) large scale driver EC-Earth.



Simulations @ LRZ/SuperMUC, Munich, computing project EXPRESS-Hydro

Downscaling dinamico con WRF

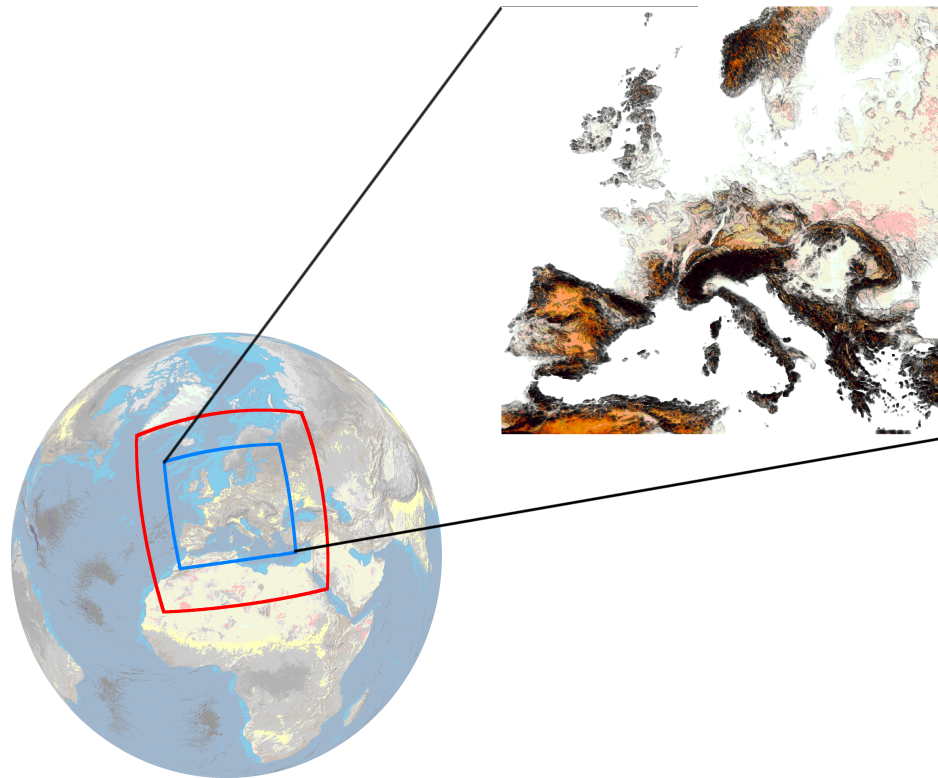


Fig: dominio computazionale.

WRF innestato in rianalisi Era-Interim sul dominio Euro-CORDEX (rosso). Risoluzione di 0.04° (dominio blu).

LRZ Supermuc supercomputer:

- * 901x805 punti in LONxLAT (blu)
- * 56 livelli verticali
- * 528 cores
- * 10 "chunks" da 3 anni
- * 1 mese $\rightarrow$ ~34 ore
- * 1 anno $\rightarrow$ ~17 giorni
- * 1 "chunk" $\rightarrow$ ~51 giorni

Salviamo gli output tri-orari:

- * 1 anno $\rightarrow$ 8,1 TB
- * 30 anni $\rightarrow$ 243 TB

In formato "ridotto" abbiamo a disposizione campi tri-orari ad alta risoluzione (~4km) di precipitazione, temperatura 2m, velocità a 10m, umidità a 2m... (circa 10,3 TB per 30 anni). I dati verranno trasferiti su server Nextdata nel corso dell'anno corrente.

Modellistica accoppiata del Mediterraneo

Cosmo-CLM 4.8

horizontal resolution 50km

deltat=240"

vlevs=40

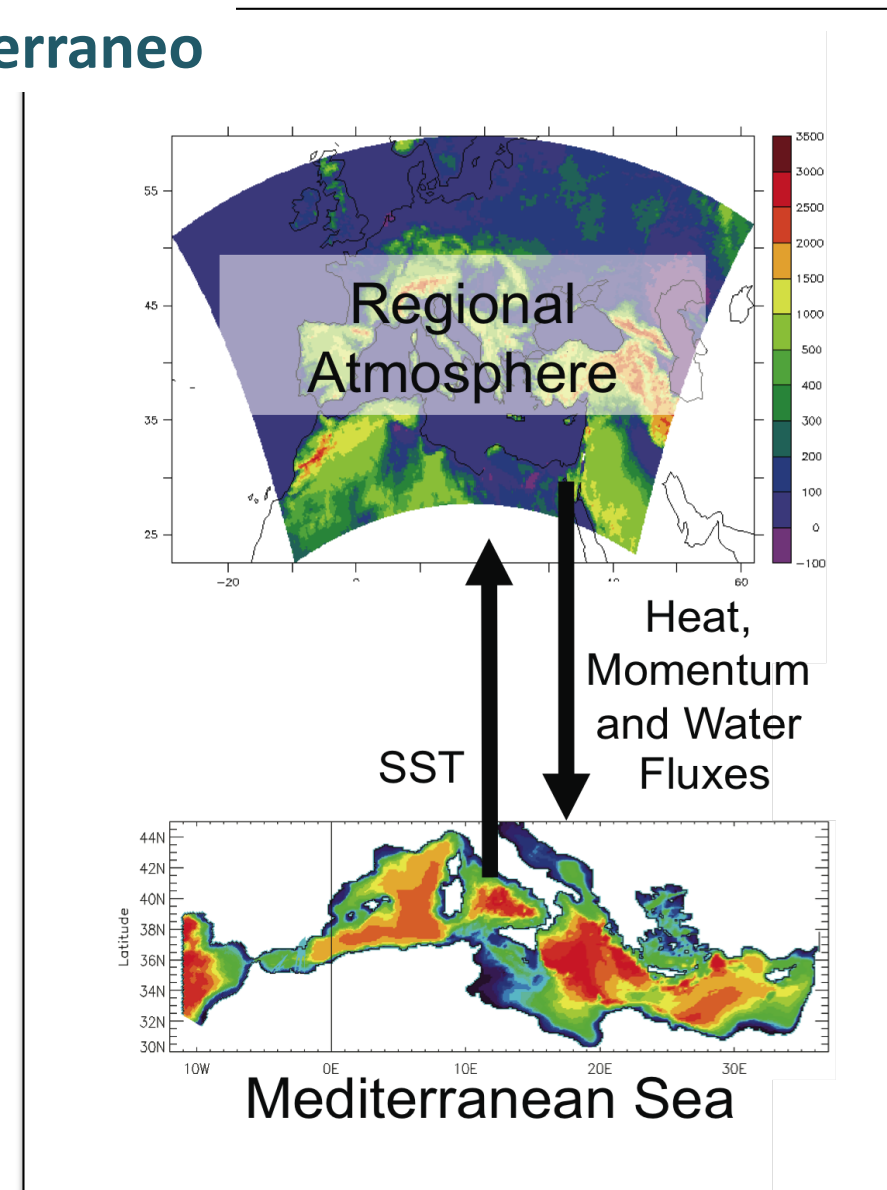
MEDCORDEX domain+atlantic box

Oasis 3 CMCC parallel version
coupling frequency 4800"

Nemo 3.4 (MFS)

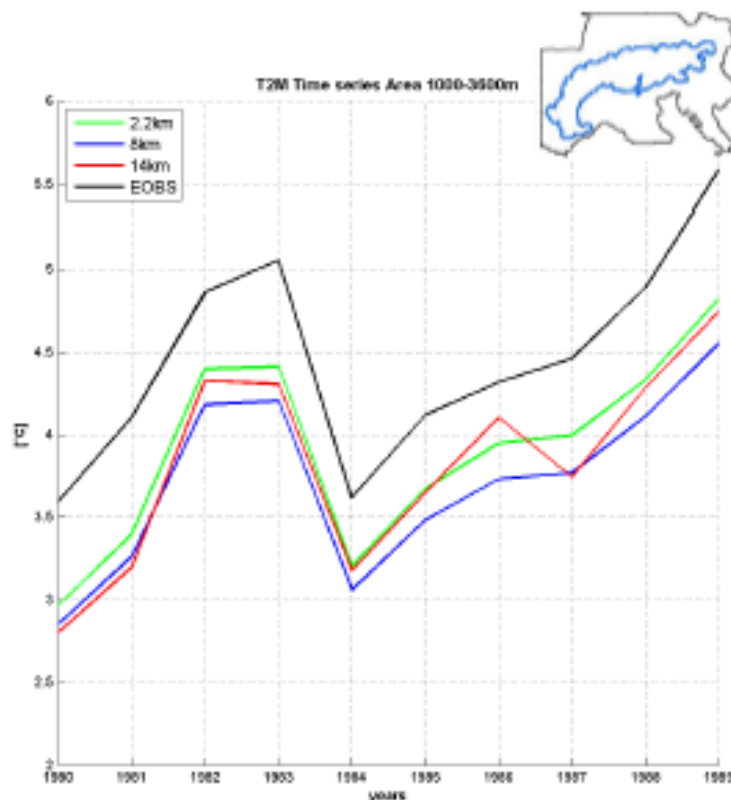
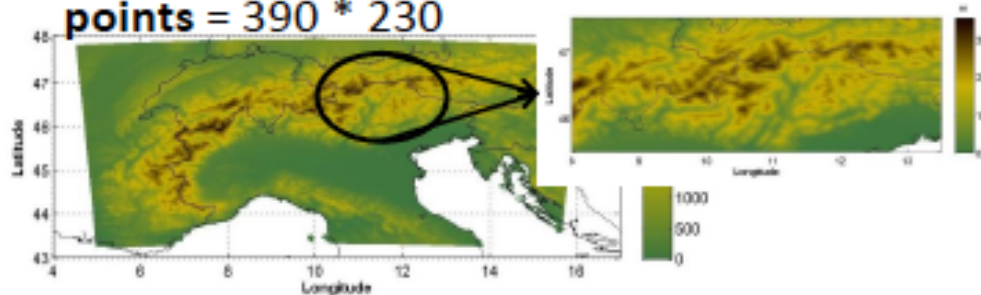
horizontal resolution 1/16

deltat=600"



Very high resolution simulation over Alpine region

**Resolution = 0.02° ($\sim 2.2\text{km}$) Grid
points = $390 * 230$**



A preliminary simulation at very high horizontal resolution of 0.02° (about 2.2km) has been performed over the Alpine region for the period 1979-1990 with the regional climate model COSMO-CLM.

Different observational datasets have been used for the bias assessment: E-OBS for 2-meter temperature, whereas for precipitation EURO4M-APGD and high resolution observed data provided by ARPAs of Veneto and Emilia-Romagna region.

The 0.02° simulation has been compared to previous ones at 0.0715° (about 8km) and 0.125° (about 14km) respectively, in order to assess the added value of using a so high horizontal resolution.

Figure on the left shows the 2-meter temperature time series computed over an area characterized by orography higher than 1000m: it shows that the 0.02° simulation has the best agreement with the observations.

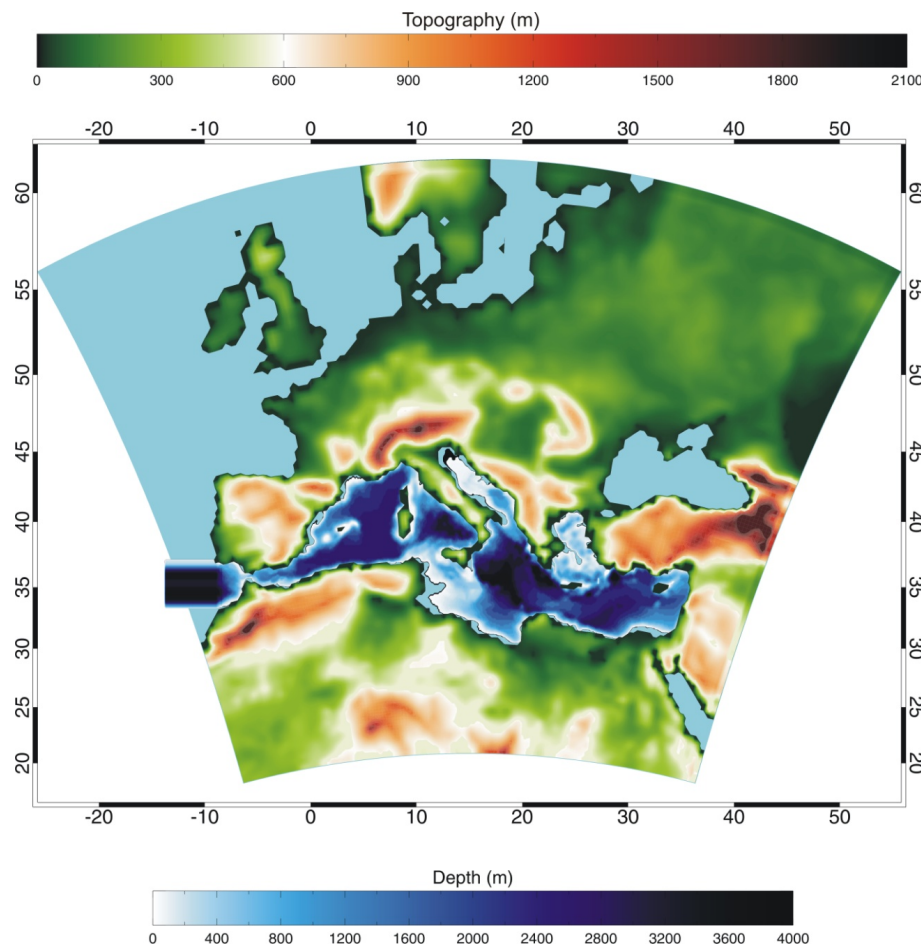
Future step

A sensitivity activity is in progress, in order to improve the results of the 0.02° simulation and to find the best configuration of COSMO-CLM at this very high resolution.



Modellistica accoppiata del Mediterraneo

ENEA-PROTHEUS 1.0



Model components

RegCM3

18 sigma vertical levels
30 Km horizontal resolution

BATS + IRIS

BATS: Biosph.-Atmosph. Transfer Scheme
IRIS: interactive Rivers Scheme



SST

OASIS 3
Freq. 6h

HF-WF-Wind



MedMIT

42 zeta vertical levels (partial cell)
1/8° x 1/8° horizontal resolution

Le Scientific Questions (D2.5.2)

L'archivio rende disponibili i risultati di **simulazioni ad alta risoluzione a scala regionale e locale** per aree di interesse strategico per il progetto (Italia, bacino del Mediterraneo, Hindu-Kush–Karakorum–Himalaya, regione del Rwenzori), includendo sia i risultati di simulazioni puramente atmosferiche che simulazioni accoppiate mare-atmosfera per il bacino del Mediterraneo.

- What are the **advantages and disadvantages of the different downscaling techniques** commonly used to produce high quality data in areas with a complex orography?
- What is the **low-frequency component of the climate variability** that characterizes the **Mediterranean** area?
- What is the role of low-frequency natural variability in modulating the long-term trend observed and projected for the **hydrologic cycle in the Alpine region**?
- How can we improve models of **severe hydro-meteorological events in areas with complex topography**?

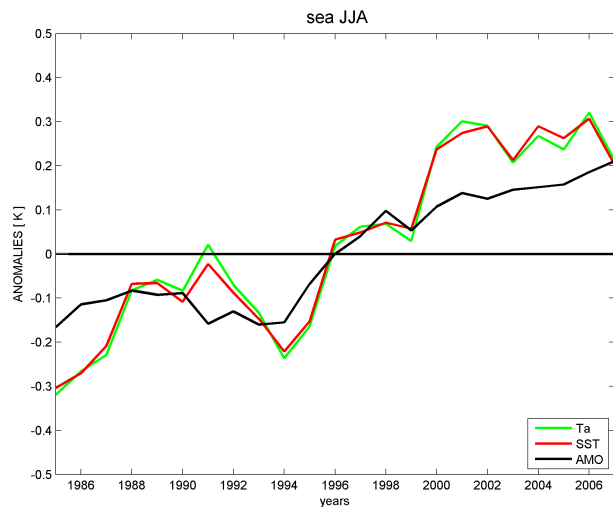
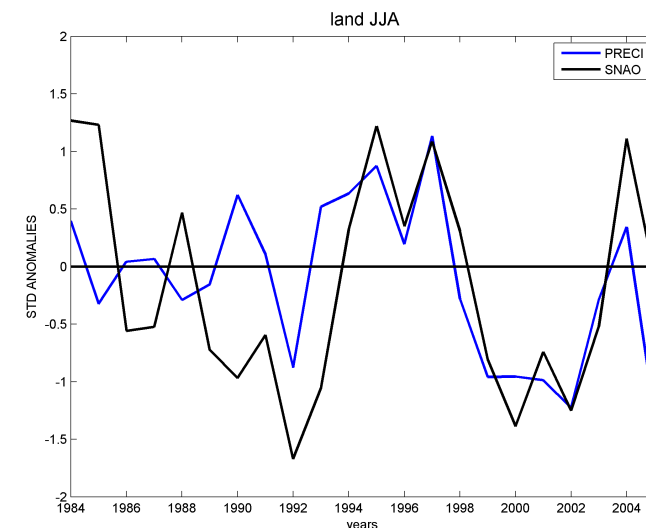
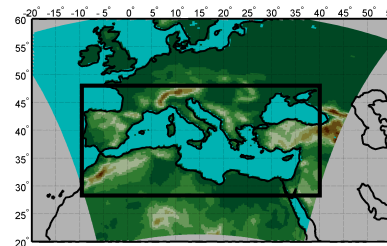
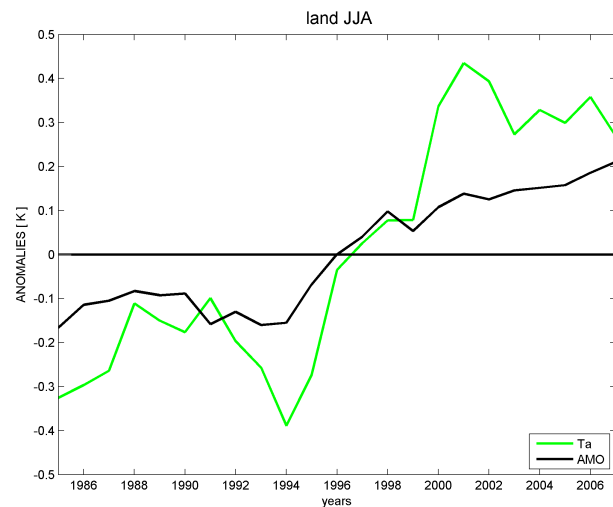
Queste *Scientific Questions* sono emerse dalla discussione (svolta nel WP) su un set di problemi scientifici più generali e rilevanti per il progetto:

- Downscaling of climate simulations for the Alpine region
- Climate variability of the Mediterranean region with particular focus on the long (multi-annual and decadal) time-scales
- Simulation and reproduction of the main climatic features of regions with complex orography, such as Hindu-Kush-Karakorum–Himalaya, Andes, Alps:

E rappresentano il contributo che WP2.5 dà alle Grand Challenges

Capability of RCM runs in reproducing the influence of large-scale decadal climate modes on Mediterranean Region (*Mariotti and Dell'Aquila 2011*)

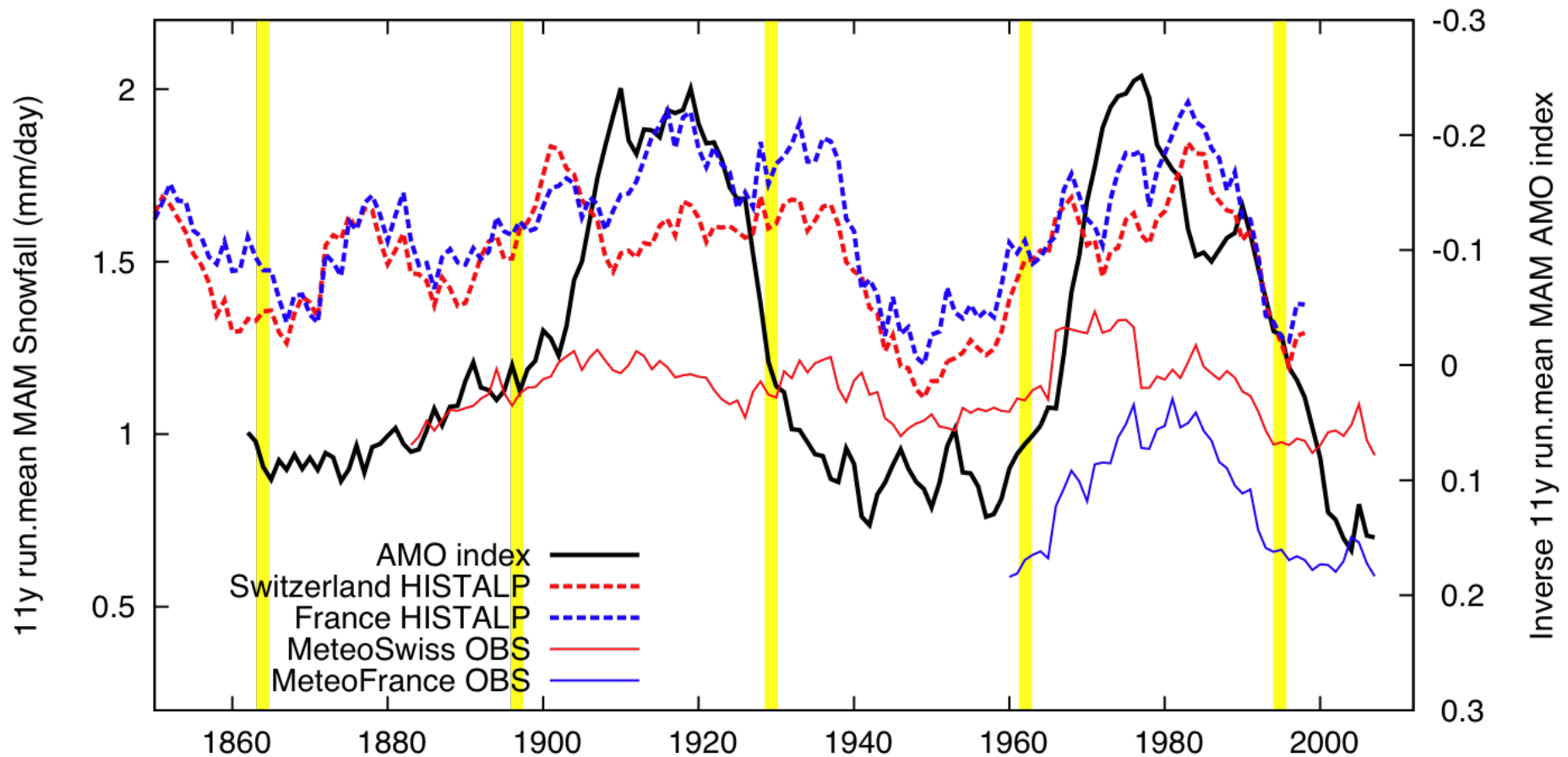
ENEA-PROTHEUS ERA-INTERIM evaluation simulation 1982-2010



ENEA-PROTHEUS simulated decadal JJA anomalies in the Mediterranean region over the period 1982–2010. Land-only (top panels) and Mediterranean Sea-only means (bottom panel) are displayed. Left column surface air temperature (Ta) anomaly + SST + AMO index. Right column Precipitation anomaly + Summer NAO index



HISTALP vs. Observations low-frequency



correlations
About 0.5

Zampieri et al. (2013)



RECCO: REgional Climate in Complex Orography

Development of ensembles of regional climate change scenarios, with focus on variability, extremes and uncertainties in areas of complex orography



Unit1 (ISAC-CNR, coordinator): [Silvia Trini Castelli](#) and Antonio Parodi

Unit2 (ICTP): Laura Mariotti, Filippo Giorgi

Unit3 (Cineca): Giovanni Erbacci

Unit4 (IMAA-CNR) Fabio Madonna

Aim: improving the physical understanding of the changes in climatological regimes in the NextData regions, with the support of their meteorological characterization

Rationale: the variability and uncertainties of climate and meteorology in the areas of interest (H.-K. K., Alpine and Mediterranean regions will be studied with a suite of regional models integrated with mesoscale meteorological models. Each modelling system will be used at different spatial scales, from regional to local, yielding a unique multi-scale framework

grazie