The **C**limate-system **H**istorical **F**orecast **P**roject (**CHFP**)

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An introduction to CHFP

Origin

The WCRP Joint Scientific Committee established a limited term Task Force on Seasonal Prediction that drew upon expertise from all the WCRP core projects (CLIVAR, GEWEX, CliC and SPARC), the WCRP Working Group on Numerical Experimentation (WGNE) and the WCRP/CLIVAR Working Group on Coupled Modeling. Since June 2007, the mandate of the TFSP has now been assigned by the JSC to the CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP).

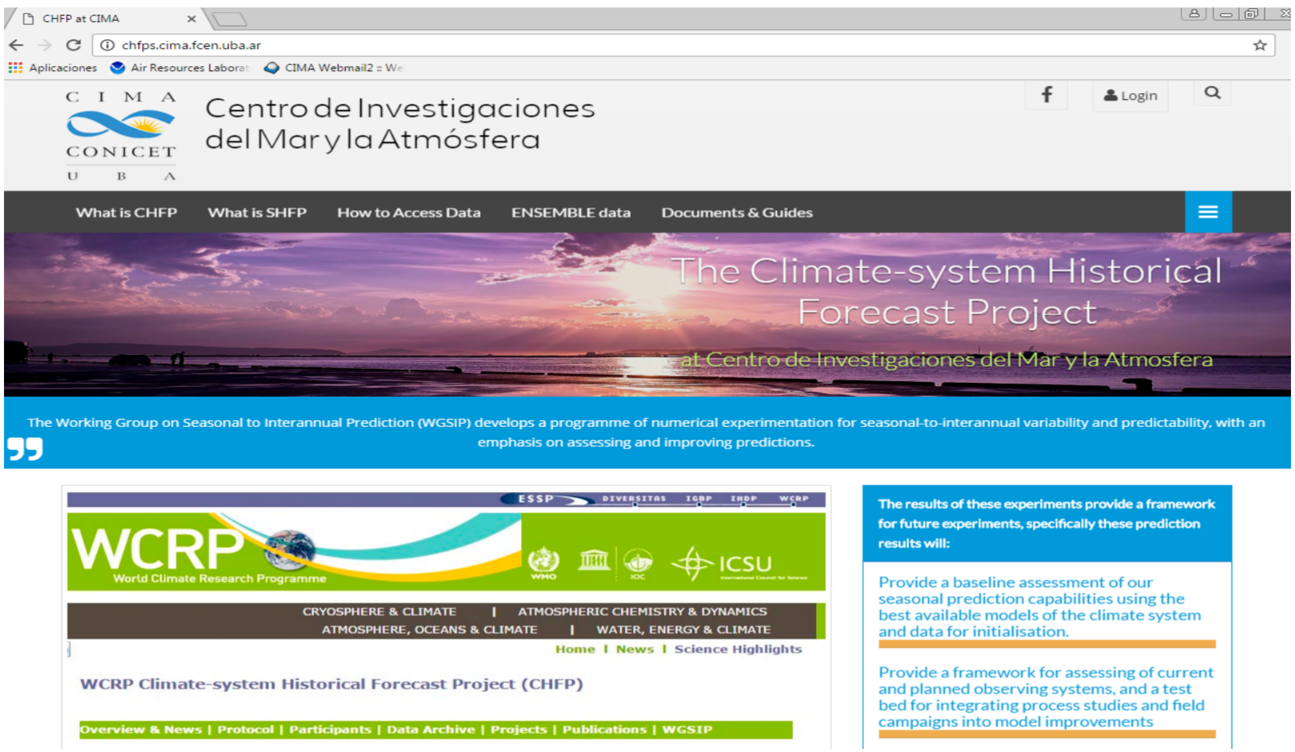
The TFSP proposed the CHFP as a multi-model and multi-institutional experimental framework for sub-seasonal to decadal complete physical climate system prediction. By the complete physical climate system, we mean contributions from the atmosphere, oceans, land surface cryosphere and atmospheric composition in producing regional and sub-seasonal to decadal climate anomalies. This experimental framework is based on advances in climate research during the past decade, which have lead to the understanding that modeling and predicting a given climate anomaly over any region is incomplete without a proper treatment of the effects of SST, sea ice, snow cover, soil wetness, vegetation, stratospheric processes, and atmospheric composition (carbon dioxide, ozone, etc.).

Objectives

- Provide a baseline assessment of our seasonal prediction capabilities using the best available models of the climate system and data for initialisation
- Provide a framework for assessing of current and planned observing systems, and a test bed for integrating process studies and field campaigns into model improvements
- Provide an experimental framework for focused research on how various components of the climate system interact and affect one another
- Provide a test bed for evaluating IPCC class models in seasonal prediction mode

An introduction to CHFP

- The CHFP database consists of data from retrospective predictions of the seasonal global climate from year to year initialized at least twice a year across recent decades, and is freely available for research use.



http://chfps.cima.fcen.uba.ar/

An introduction to CHFP

- The database currently contains data from 16 coupled forecast systems and hosts more than 10 TB of data in NetCDF format. It is continuously growing and will continue to do so over the coming years to serve as a record of progress in global seasonal forecasting capability.

Forecast system	Research Center/ Country
ARPEGE	MétéoFrance (France)
CCCma-CanCM3	CCCma (Canada)
CCCma-CanCM4	CCCma (Canada)
CFS	NCEP (USA)
CMAM	Canada
CMAMlo	Canada
ECMWF-S4	ECMWF (UK)
GloSea5	MetOffice (UK)

Forecast system	Research Center/ Country
JMA/MRI-CGCM1	JMA (Japan)
JMA/MRI-CGCM2	JMA(Japan)
L38GloSea4	MetOffice (UK)
L85GloSea4	MetOffice (UK)
MIROC5	CCSR (Japan)
MPI-ESM-LR	MPI (Germany)
MPI-ESM-MR	MPI (Germany)
POAMA	BoM (Australia)

An introduction to CHFP

- According to CHFP protocols, forecast systems within CHFP **MUST** include seasonal (4-month lead-time) forecasts initialized **AT LEAST** twice a year, in May and November. If available, additional start times are also welcome.
- Data from each forecast system is hosted in its native resolution (i.e. there is not any regridding onto a same grid).
- CHFP hosts both monthly mean and daily data.
- Forecasts start near 1979 and end in 2010.
- Some of the variables included in CHFP are 2m mean, minimum and maximum temperatures, total precipitation, zonal and meridional winds, heat fluxes and soil moisture, among others.

Some studies using CHFP data

Clim Dyn
DOI 10.1007/s00382-015-2710-2

CrossMark

Predictability of the tropospheric circulation in the Southern Hemisphere from CHFP models

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Abstract An assessment of the predictability and prediction skill of the tropospheric circulation in the Southern Hemisphere was done. The analysis is based on seasonal forecasts of geopotential heights at 200, 500 and 850 hPa, for austral summer and winter from 11 models participating in the Climate Historical Forecast Project. It is found that predictability (signal-to-variance ratio) and prediction skill (anomaly correlation) in the tropics is higher than in the extratropics and is also higher in summer than in winter. Both predictability and skill are higher at high than at low altitudes. Modest values of predictability and skill are found at polar latitudes in the Bellinghausen-Amundsen Seas. The analysis of the changes in predictability and prediction skill in ENSO events reveals that both are slightly higher in the El Niño-Southern Oscillation (ENSO) years than in all years, while the spatial patterns of maxima and minima remain unchanged. Changes in signal-to-noise ratio observed are mainly due to signal changes rather than changes in noise. Composites of geopotential heights anomalies for El Niño and La Niña years are in agreement with observations.

Keywords Southern Hemisphere · El niño southern oscillation · Seasonal predictability · Geopotential heights

1 Introduction

During the last decade, the scientific community has made significant progress in the development of Coupled General Circulation Models (CGCMs) that can be used for seasonal prediction. In addition, an increased number of numerical prediction centers in the world have implemented operational seasonal forecast systems using CGCMs (e.g. Kim et al. 2012; MacLachlan et al. 2014; Wang et al. 2009). Accordingly, in the last years, the Working Group on Seasonal to Interannual Prediction (WGSIP) of the World Climate Research Program (WCRP) also implemented the Climate Historical Forecast Project (CHFP) with the main goal of assessing the role of each component of the climate system on the predictability at different timescales, ranging from weeks to decades (Kirtman and Pirani 2009). For this purpose, a database compiling retrospective forecasts made with state-of-the-

RMetS
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The Climate-system Historical Forecast Project: do stratosphere-resolving models make better seasonal climate predictions in boreal winter?

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Using an international, multi-model suite of historical forecasts from the World Climate Research Programme (WCRP) Climate-system Historical Forecast Project (CHFP), we compare the seasonal prediction skill in boreal wintertime between models that resolve the stratosphere and its dynamics ('high-top') and models that do not ('low-top'). We evaluate hindcasts that are initialized in November, and examine the model biases in the stratosphere and how they relate to boreal wintertime (December–March) seasonal forecast skill. We are unable to detect more skill in the high-top ensemble-mean than the low-top ensemble-mean in forecasting the wintertime North Atlantic Oscillation, but model performance varies widely. Increasing the ensemble size clearly increases the skill for a given model. We then examine two major processes involving stratosphere–troposphere interactions (the El Niño/Southern Oscillation (ENSO) and the Quasi-Biennial Oscillation (QBO)) and how they relate to predictive skill on intraseasonal to seasonal time-scales, particularly over the North Atlantic and Eurasia regions. High-top models tend to have a more realistic stratospheric response to El Niño and the QBO compared to low-top models. Enhanced conditional wintertime skill over high latitudes and the North Atlantic region during winters with El Niño conditions suggests a possible role for a stratospheric pathway.

How to access the data

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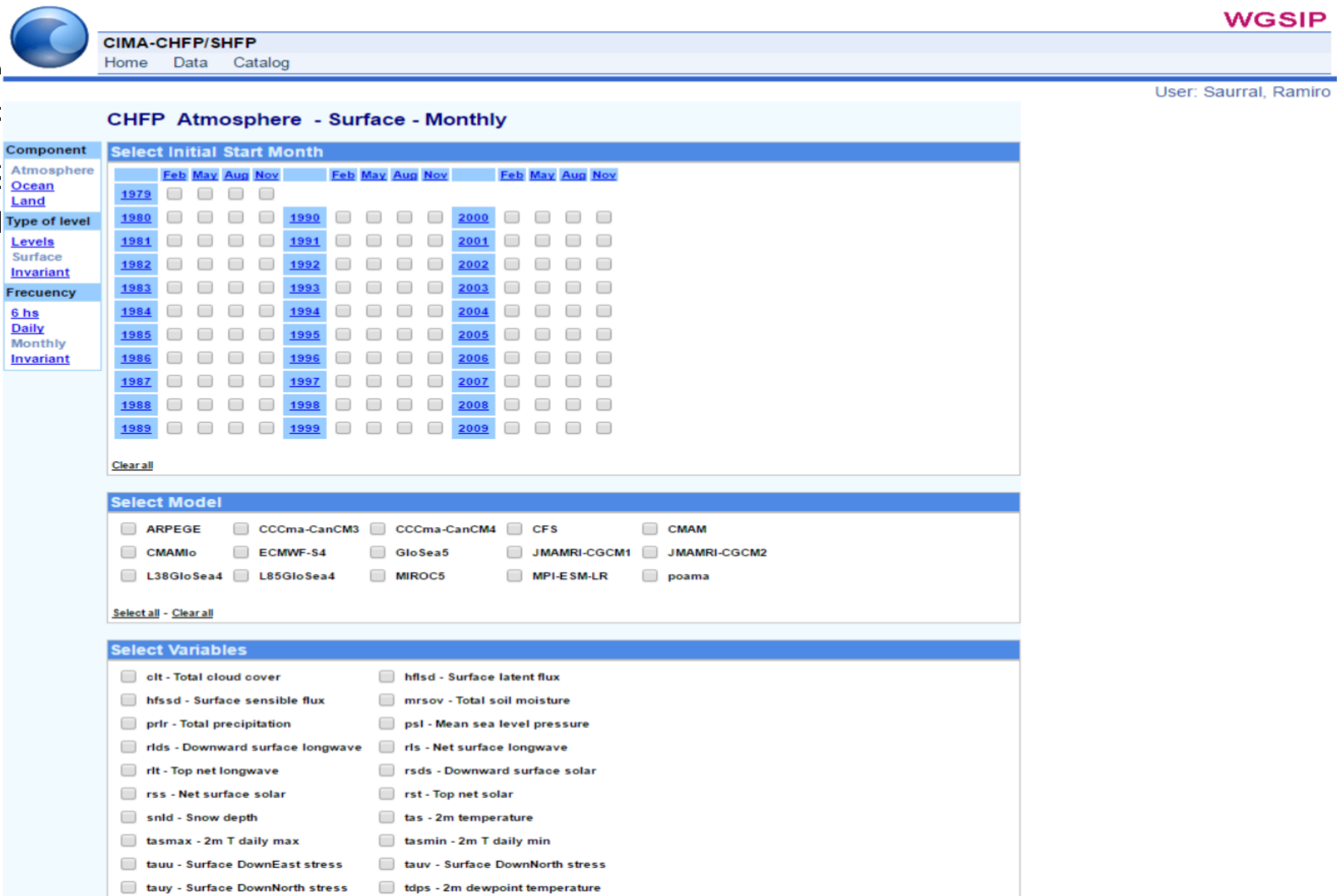
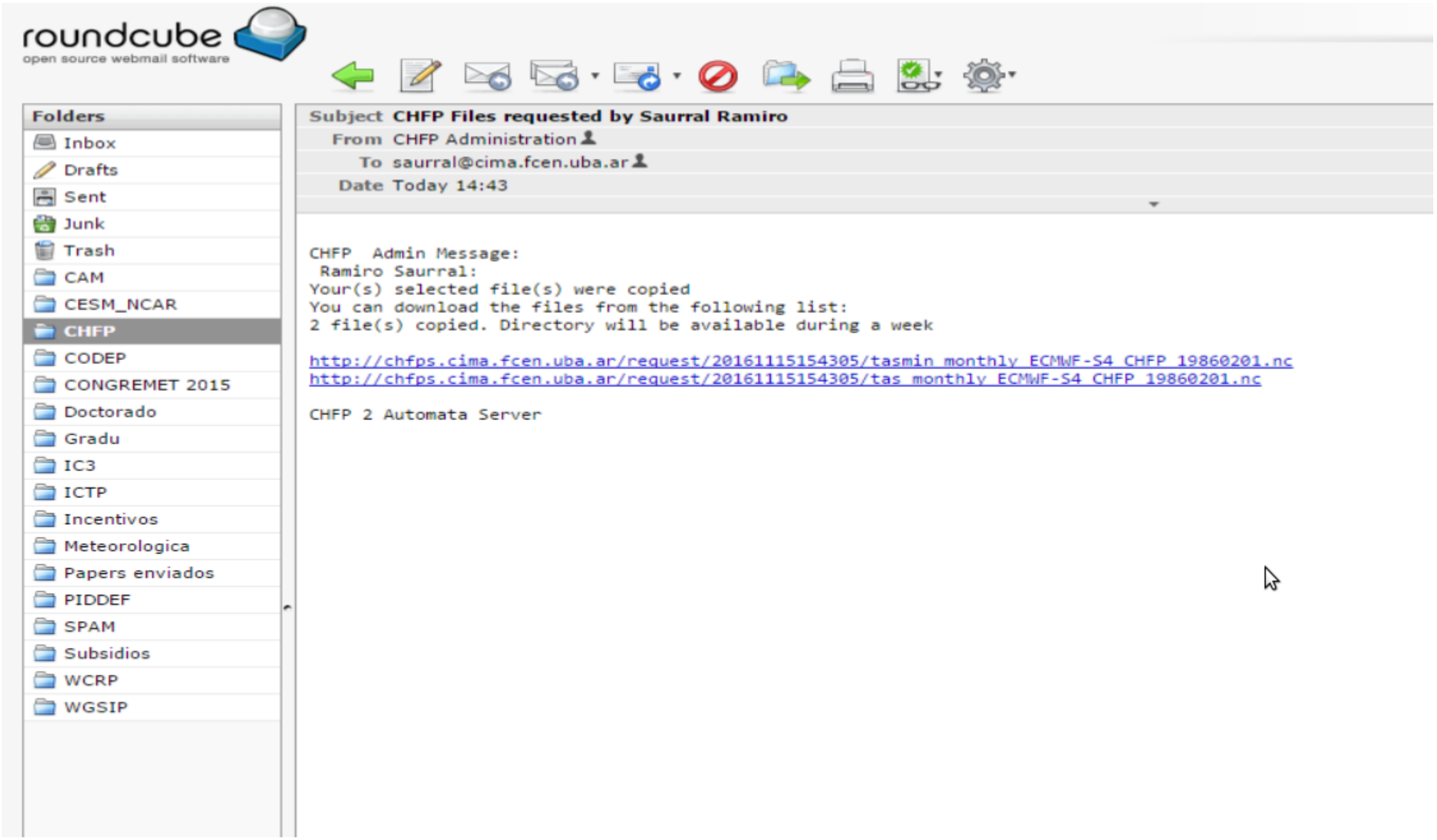


How to access the data



How to access the data

Files can be downloaded individually or (more efficiently) using scripts.

An easy way to go in Linux is to download the list of files and use wget…

- Save the list of files (received by email) in a .txt file (e.g. file_list.txt)

  http://chfps.cima.fcen.uba.ar/request/20140128131722/tasmin_monthly_ECMWF-S4_CHFP_19810201.nc
  http://chfps.cima.fcen.uba.ar/request/20140128131722/tasmin_monthly_ECMWF-S4_CHFP_19820201.nc
  http://chfps.cima.fcen.uba.ar/request/20140128131722/tasmin_monthly_ECMWF-S4_CHFP_19830201.nc

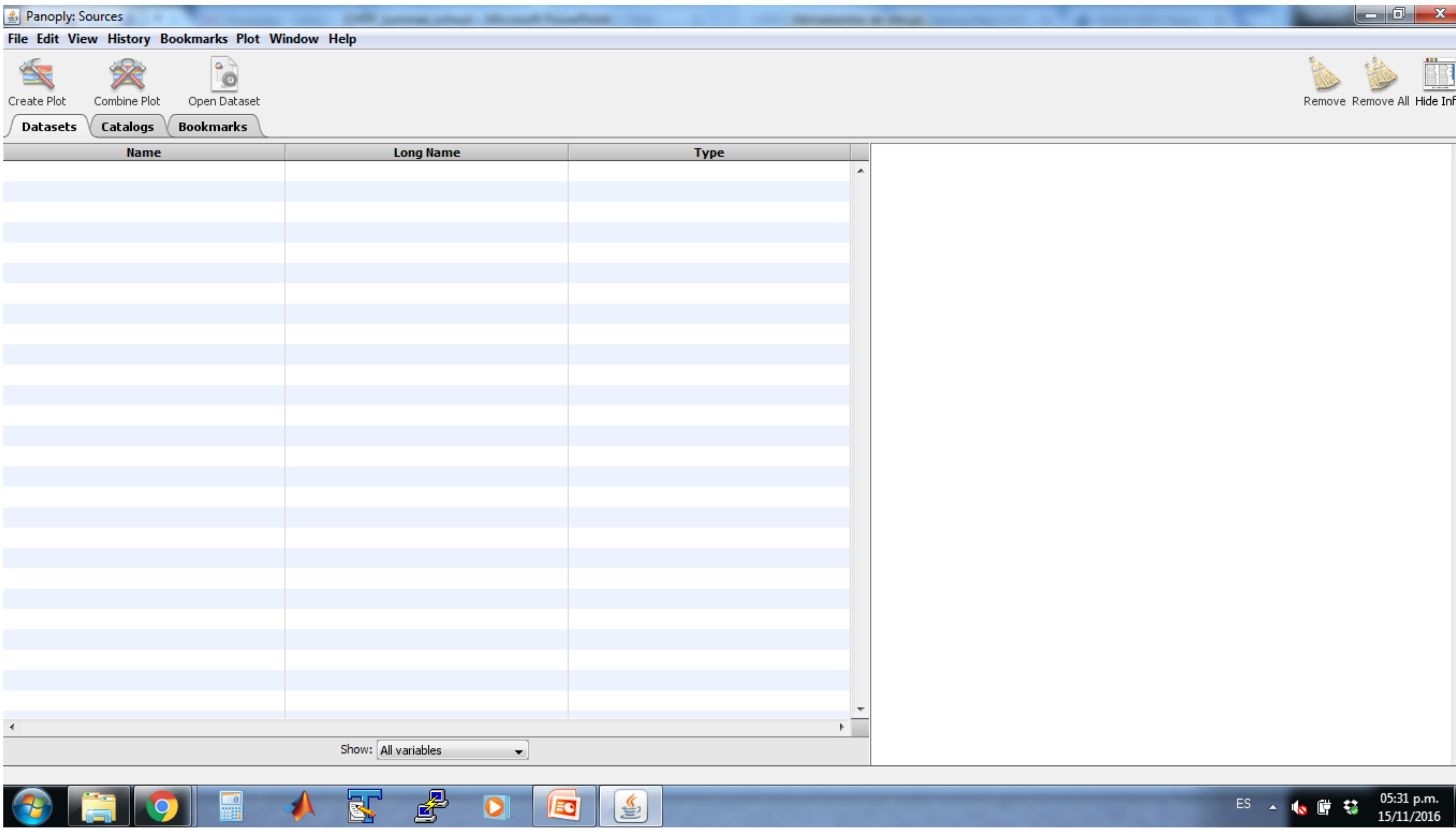
- Use wget:

  $ wget -b -c -nd t=0 -i file_list.txt -o log_01

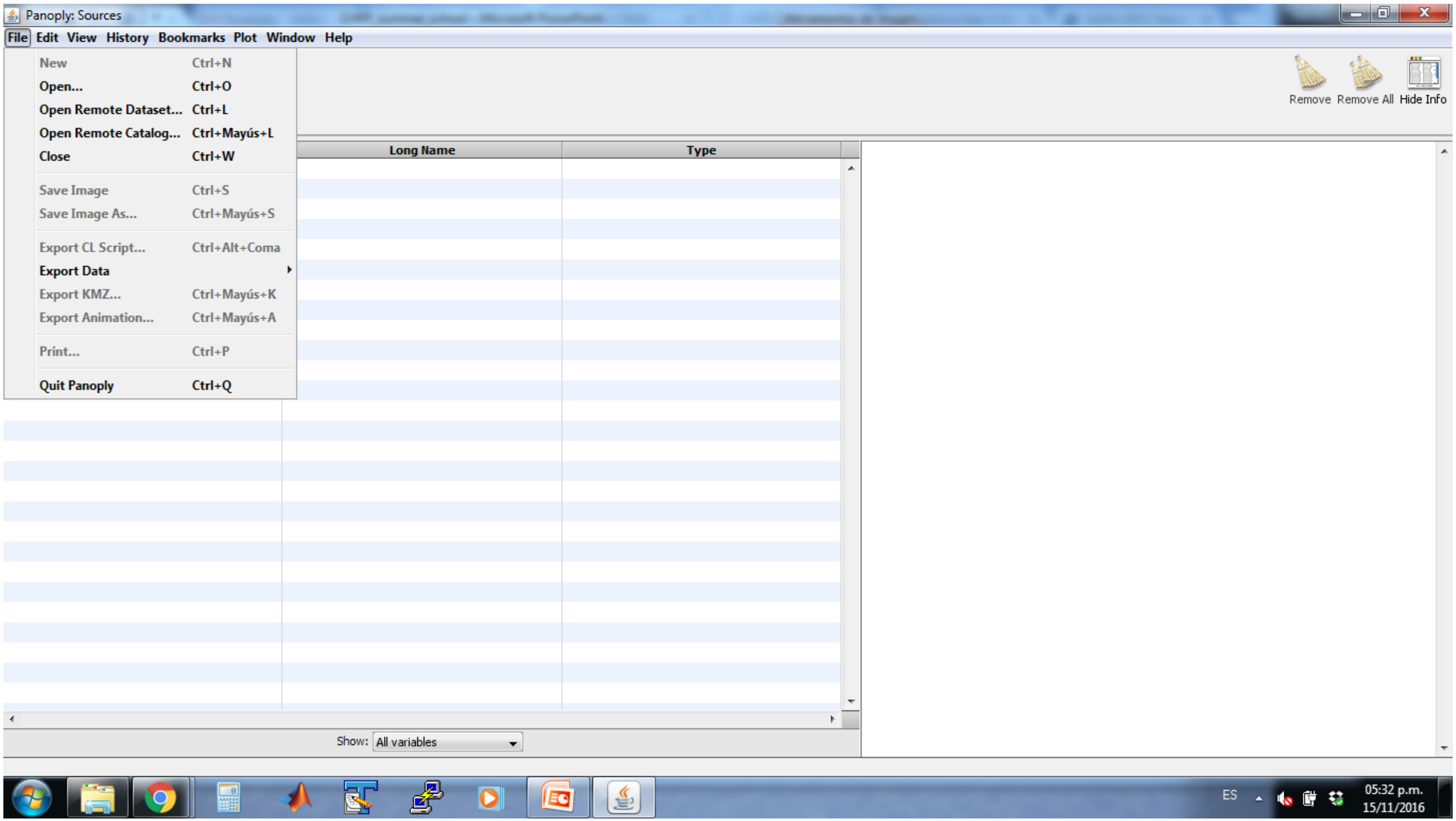
In the example above, file "log_01" will contain all the information regarding the download speed and status.

How to access the data

If in doubt of what a file contains, a good way to go is to use **Panoply**



How to access the data



How to access the data

Another good option is to use OpenDAP, which allows to use NCO tools to subset, split and merge files <u>before</u> download.

Let's see an example on how it works…

Atmosphere

	Surface																								
Frecuency	Monthly																								
Model/Vble	Period	clt	hflsd	hfssd	mrsov	prlr	psl	rlds	rls	rlt	rsds	rss	rst	snld	tas	tasmax	tasmin	tauu	tauv	tauy	tdps	ts	uas	vas	
ARPEGE	1979 2007					174	174															174			522
CCCma-CanCM3	1979 2010	120	120	120	120	120	122	120	120	120	120	120	120	120	120	120	120					120	120	120	2282
CCCma-CanCM4	1979 2010	120	120	120	120	120	122	120	120	120	120	120	120	120	120	120	120					120	120	120	2282
CFS	1981 2007					53	53								53							53			212
CMAM	1979 2008					60	60								60							60			240
CMAMlo	1979 2008					60	60								60							60			240
ECMWF-S4	1981 2010	120			120	120	120	120	120	120	120	120	120	120	120	120	120	120	120		120	120	120	120	2400
GloSea5	1996 2009					56	56							56	56							56			280
JMAMRI-CGCM1	1979 2010	128	128	128		128	128	128	128	128	128	128	128	116	128	128	128					128	128	128	2292
JMAMRI-CGCM2	1981 2010	120	120	120		120	120	120	120	120	120	120	120		120	120	120	120	120				120	120	2160
L38GloSea4	1989 2002					56	56							56	56							56			280
L85GloSea4	1989 2009					84	84							84	84							84			420
MIROC5	1979 2011	132	132	132		132	132		132	132	132	132	132	132	132	132	132	132	132			132			2244
MPI-ESM-LR	1982 2011	60	60	60		60	60	60	60	60	60	60	60	60	60	60	60	60	60		60	60	60	60	1260
poama	1980 2009		120	360		360	360	360		360			360	360	360			360		360		360			4080
Total Files:		800	800	1040	360	1703	1707	1028	800	1160	800	800	1160	1224	1529	800	800	792	432	360	180	1583	668	668	21194

	Levels						
Frecuency	Monthly						
Model/Vble	Period	g	hus	ta	ua	va	
ARPEGE	1979 2007	174	174	174	174	174	870
CCCma-CanCM3	1979 2010	122	120	120	122	120	604
CCCma-CanCM4	1979 2010	122	120	120	122	120	604
CFS	1981 2007	53	53	53	53	53	265
CMAM	1979 2008	60		60	60	60	240
CMAMlo	1979 2008	60		60	60	60	240
ECMWF-S4	1981 2010	120	120	120	120	120	600
GloSea5	1996 2009	56		56	56	56	224
JMAMRI-CGCM1	1979 2010	128	128	128	128	128	640
JMAMRI-CGCM2	1981 2010	120	120	120	120	120	600
L38GloSea4	1989 2002	56		56	56	56	224
L85GloSea4	1989 2009	84		84	84	84	336
MIROC5	1979 2011	132	132	132	132	132	660
MPI-ESM-LR	1982 2011	60	60	60	60	60	300
MPI-ESM-MR	1981 2011	62	62	62	62	62	310
poama	1980 2009		360	360	360	360	1440
Total Files:		1409	1449	1765	1769	1765	8157

	Surface																								
Frecuency	Daily																								
Model/Vble	Period	clt	hflsd	hfssd	mrsov	prlr	psl	rlds	rls	rlt	rsds	rss	rst	snld	tas	tasmax	tasmin	tauu	tauv	tauy	tdps	ts	uas	vas	
CCCma-CanCM3	1979 2008	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120					120	120	120	2280
CCCma-CanCM4	1979 2008	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120					120	120	120	2280
CFS	1981 2007					53	53								53										159
CMAM	1979 2008					60	60								60										180
CMAMlo	1979 2008					60	60								60										180
JMAMRI-CGCM1	1979 2006		112	112		112	112	112	112	112	112	112	112	112		112	112					112			1568
MIROC5	1979 2011		132	132	132	132	132	132	132	132	132	132	132	132		132	132	132	132			132			2244
Total Files:		240	484	484	372	657	657	484	484	484	484	484	484	484	413	484	484	132	132	0	0	484	240	240	8891

	Levels					
Frecuency	Daily					
Model/Vble	Period	g	hus	ta	ua	va	
CCCma-CanCM3	1979 2008	120	120	120	120	120	600
CCCma-CanCM4	1979 2008	120	120	120	120	120	600
CMAM	1979 2008	60		60	60		180
CMAMlo	1979 2008	60		60	60		180
GloSea5	1996 2009				56		56
JMAMRI-CGCM1	1979 2006	112	112	112	112	112	560
L85GloSea4	1989 2009				83		83
MIROC5	1979 2011	132	132	132	132	132	660
Total Files:		604	484	604	743	484	2919

Ocean

	Surface									
Frecuency	Monthly										
Model/Vble	Period	hfns	rss	shfo	swhfo	tauxo	tauyo	wo	zoh	zmlo	
CCCma-CanCM3	1979 2008								120	120	240
CCCma-CanCM4	1979 2008								120	120	240
JMAMRI-CGCM1	1979 2010								128	128	256
JMAMRI-CGCM2	1981 2010	120	120						120		360
MIROC5	1979 2011	132	131						132	132	527
Total Files:		252	251	0	0	0	0	0	620	500	1623

	Levels					
Frecuency	Monthly						
Model/Vble	Period	thetao	saltfo	so	uo	vo	
CCCma-CanCM3	1979 2008	120		120	120	120	480

Let's download some data

- Username: user.chfp@gmail.com
  Password: hindcast

Some useful links

CHFP:

chfps.cima.fcen.uba.ar

Panoply:

www.giss.nasa.gov/tools/panoply/

NCO tools:

nco.sourceforge.net

Quick introduction to NCO tools

Cut files (along the dimension of a variable): ncks

Example: Want to keep only latitudes from 0 to 20N

$ ncks –d latitude,0.,20. [input file] [output file]

Merge files: ncrcat

$ ncrcat precip* precip_merged.nc