Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

KNMI Climate Explorer
A tool for climate analysis
[…and seasonal prediction]

MedCOF Training Workshop
Madrid, 26-30 October 2015

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Royal Netherlands Meteorological Institute (KNMI)

An introduction to Climate Explorer

- Setup in the late 1990s to analyse the teleconnections from the big El Nino event in 1997-98.
- Developed and maintained by Geert Jan van Oldenborgh at KNMI.
- Basically a website for making sense of climate data.
  - Data for easy access to user.
  - Programs for statistical analysis.
  - Visualisation and plotting tools

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- Basically a website for making sense of climate data.
  - Data for easy access to user.
  - Programs for statistical analysis.
  - Visualisation and plotting tools
- Every month:
  - 3000 unique users.
  - 100,000 plots.
  - 10-15 peer-reviewed journal articles.

Some key features

- Access climate data on a wide range of temporal scales.
- Correlation and regression analysis.
- Generate EOFs.
- Calculate and analyse extremes.
- Download data in different formats (inc netCDF) for your own analysis.
- Create and download your own figures (.png, .eps).
- Upload your own time series/fields.

- Email support… also for reporting bugs!

As a tool for seasonal prediction: a hands-on tutorial

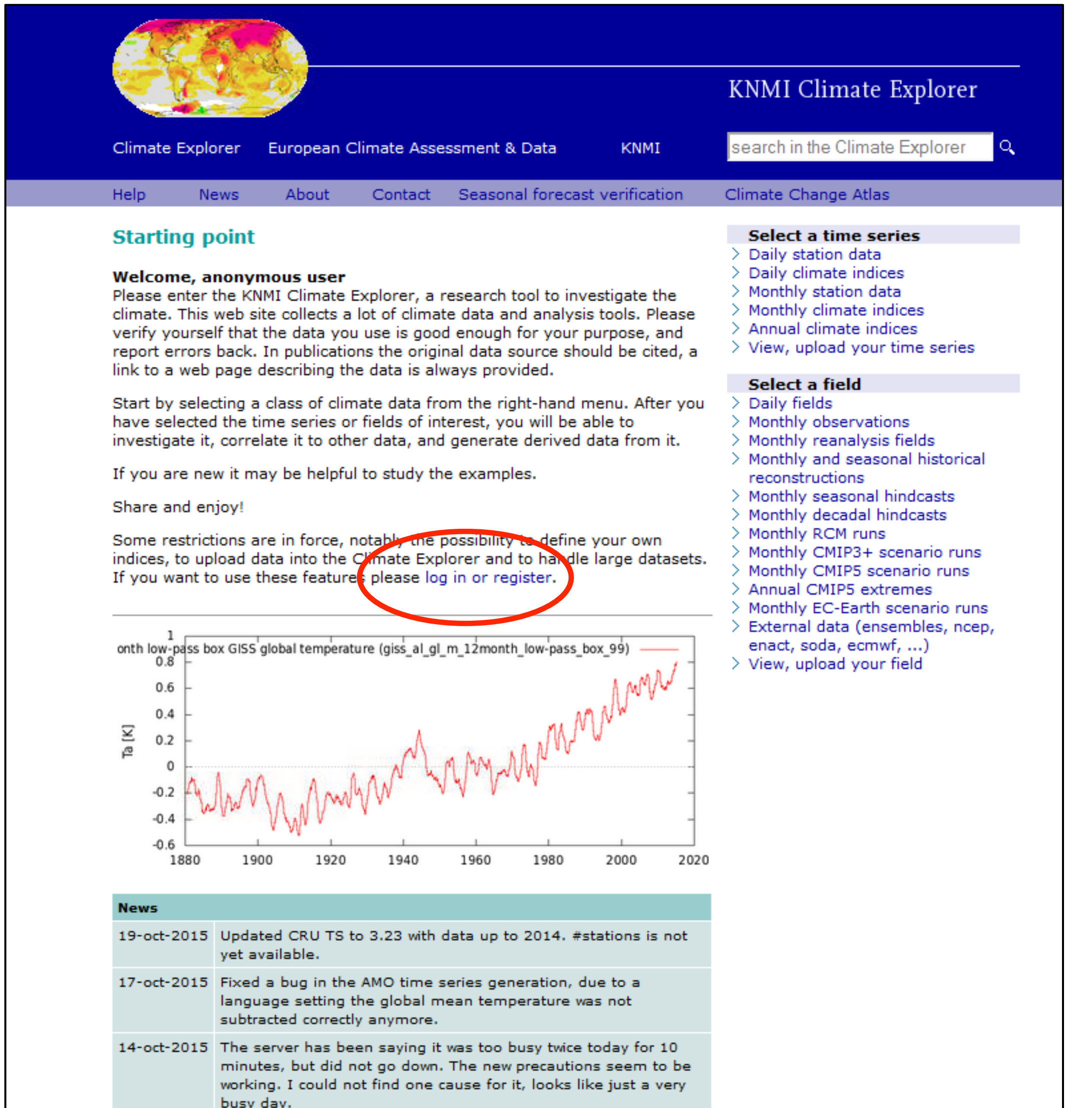
- Quick introduction

- Examples: designed for you to follow on the website itself
  - Analysis of time series.
  - Statistical comparison with other fields.
  - Diagnosing ENSO teleconnections.
  - Seasonal forecast verification tool.

- Climate Change Atlas

Getting started – registration!

climexp.knmi.nl


KNMI Climate Explorer

Climate Explorer | European Climate Assessment & Data | KNMI | search in the Climate Explorer

Help | News | About | Contact | Seasonal forecast verification | Climate Change Atlas

Starting point

Welcome, anonymous user
Please enter the KNMI Climate Explorer, a research tool to investigate the climate. This web site collects a lot of climate data and analysis tools. Please verify yourself that the data you use is good enough for your purpose, and report errors back. In publications the original data source should be cited, a link to a web page describing the data is always provided.

Start by selecting a class of climate data from the right-hand menu. After you have selected the time series or fields of interest, you will be able to investigate it, correlate it to other data, and generate derived data from it.

If you are new it may be helpful to study the examples.

Share and enjoy!

Some restrictions are in force, notably the possibility to define your own indices, to upload data into the Climate Explorer and to handle large datasets. If you want to use these features please log in or register.

News	
19-oct-2015	Updated CRU TS to 3.23 with data up to 2014. #stations is not yet available.
17-oct-2015	Fixed a bug in the AMO time series generation, due to a language setting the global mean temperature was not subtracted correctly anymore.
14-oct-2015	The server has been saying it was too busy twice today for 10 minutes, but did not go down. The new precautions seem to be working. I could not find one cause for it, looks like just a very busy day.

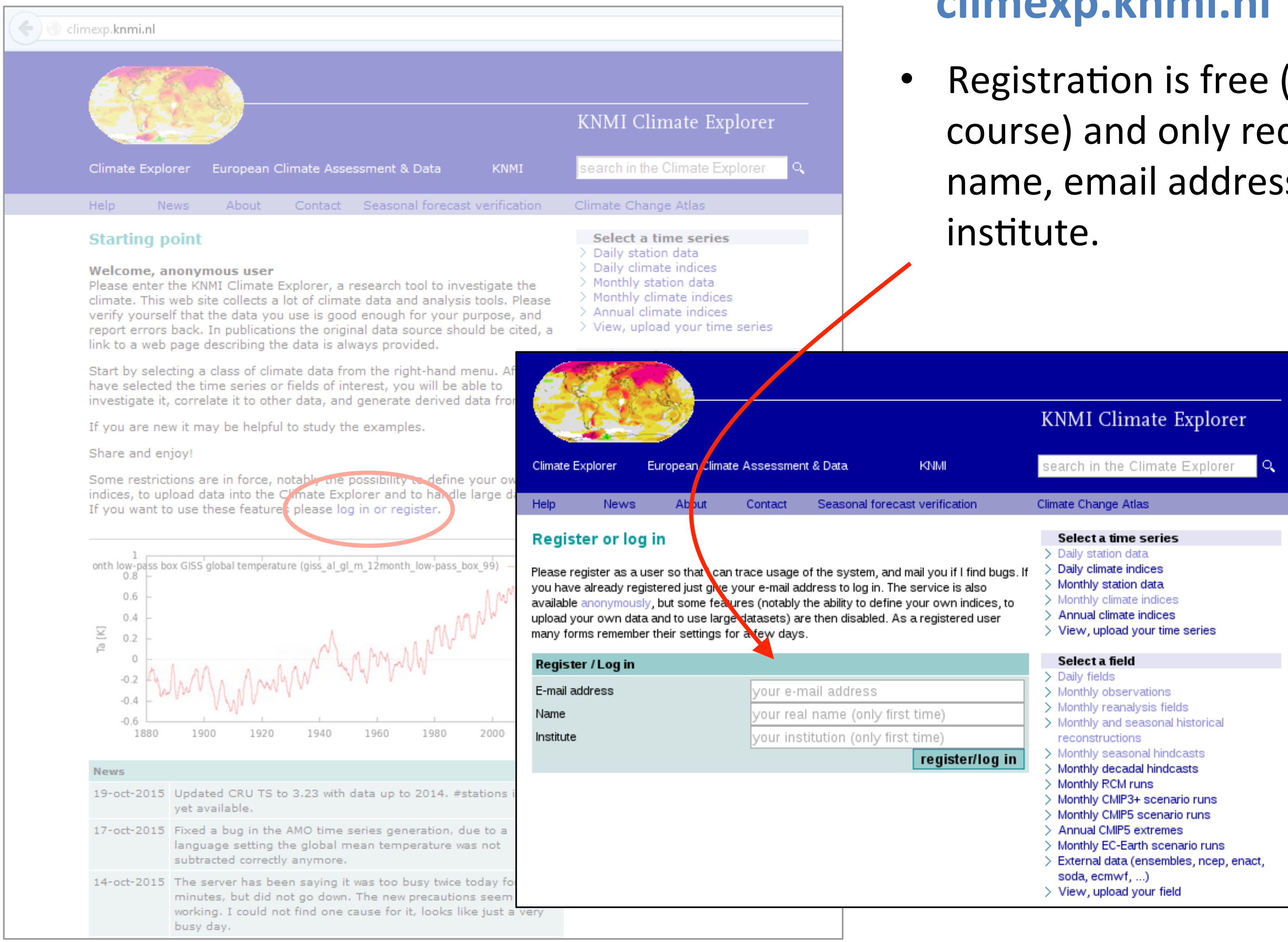
Select a time series
- Daily station data
- Daily climate indices
- Monthly station data
- Monthly climate indices
- Annual climate indices
- View, upload your time series

Select a field
- Daily fields
- Monthly observations
- Monthly reanalysis fields
- Monthly and seasonal historical reconstructions
- Monthly seasonal hindcasts
- Monthly decadal hindcasts
- Monthly RCM runs
- Monthly CMIP3+ scenario runs
- Monthly CMIP5 scenario runs
- Annual CMIP5 extremes
- Monthly EC-Earth scenario runs
- External data (ensembles, ncep, enact, soda, ecmwf, ...)
- View, upload your field

Getting started – registration!

climexp.knmi.nl

- Registration is free (of course) and only requires a name, email address and institute.



What data is available?

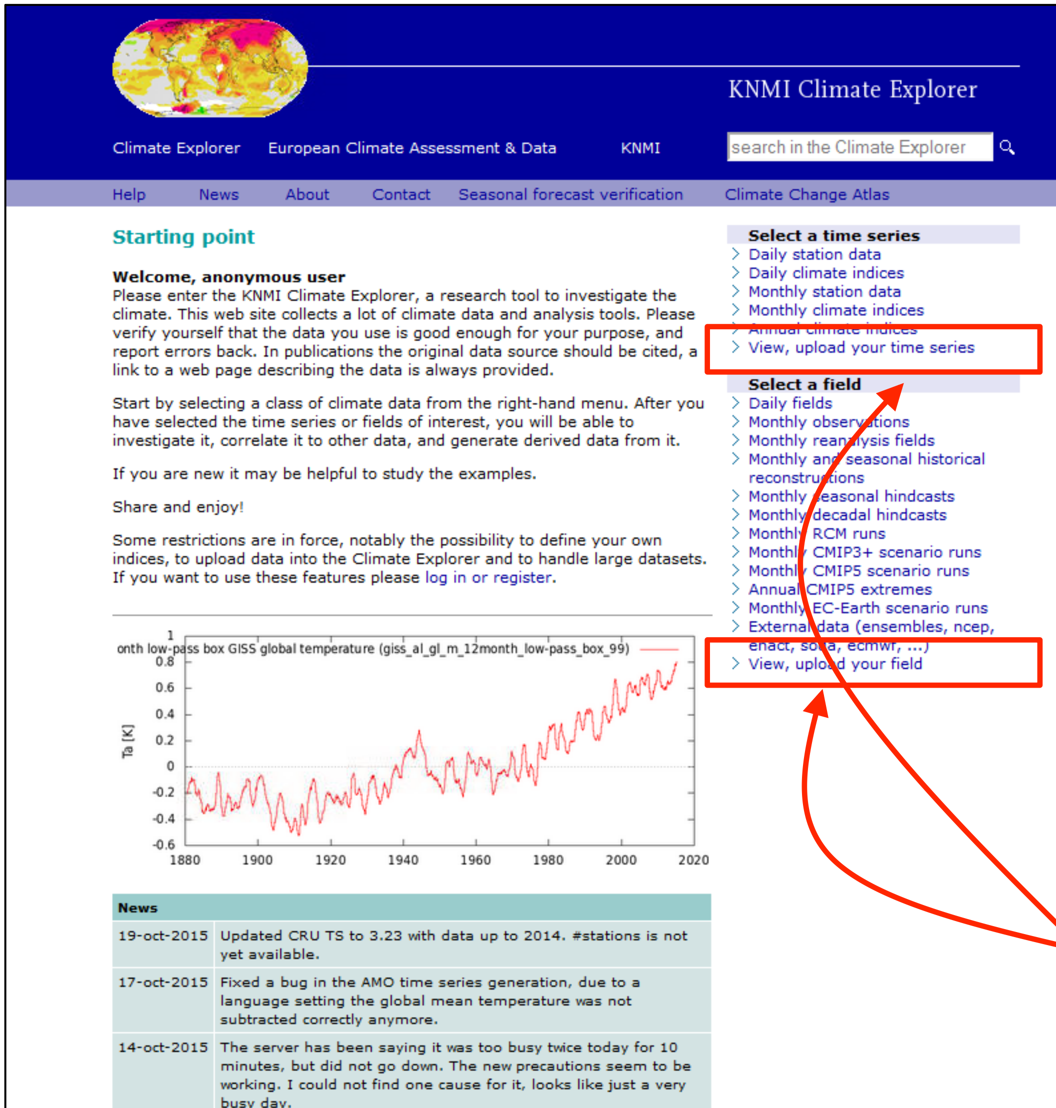
climexp.knmi.nl

- Data generally split between time series (including station data) and spatial fields.

- Station data at daily and monthly time scales.
- Climate indices (NINO indices, AMO, NAO)
- Reanalysis products.
- Climate model output.
- Seasonal forecasts.
- Decadal forecasts.

What data is available?

climexp.knmi.nl



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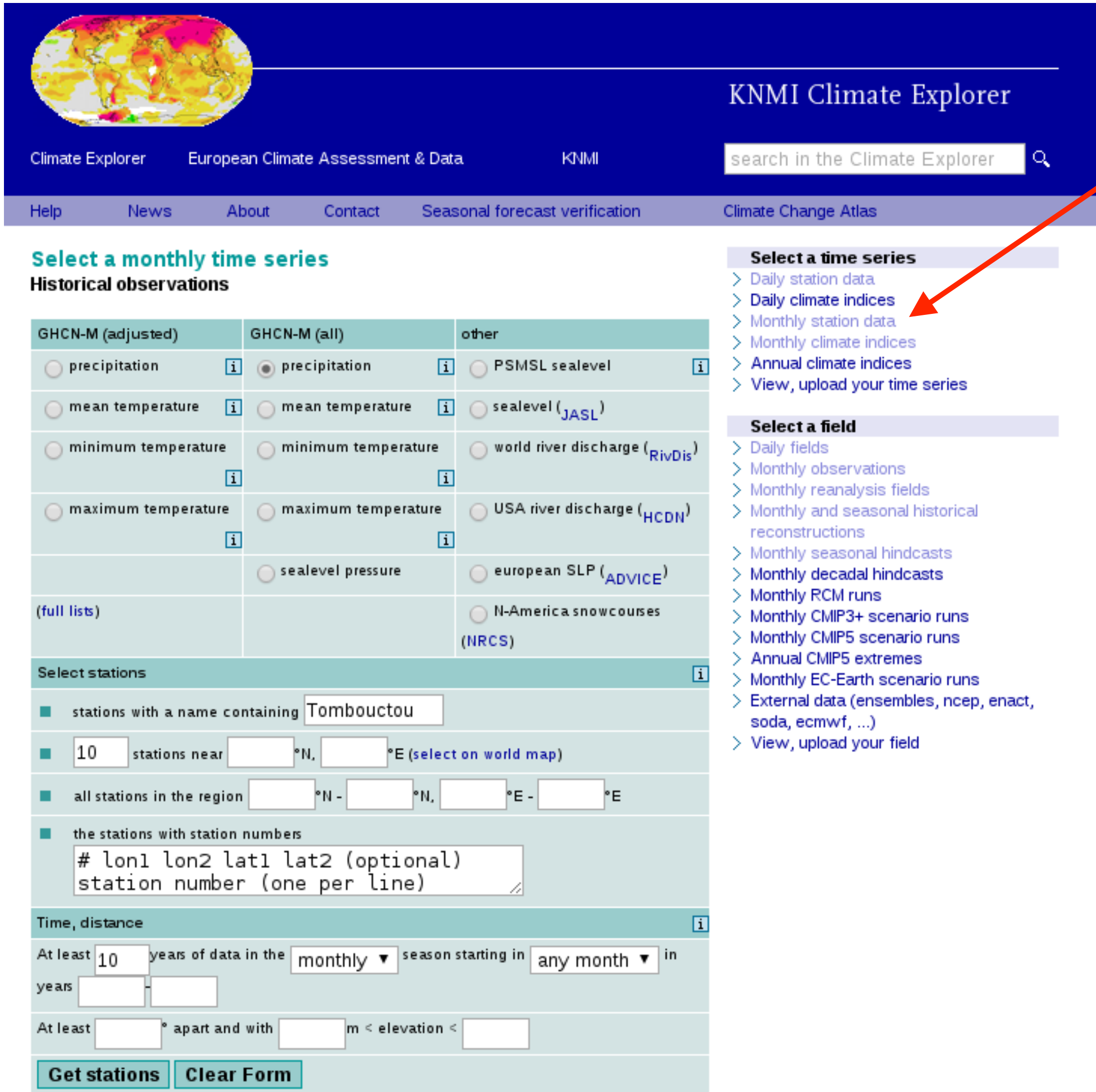
- Station data at daily and monthly time scales.
- Climate indices (NINO indices, AMO, NAO)
- Reanalysis products.
- Climate model output.
- Seasonal forecasts.
- Decadal forecasts.

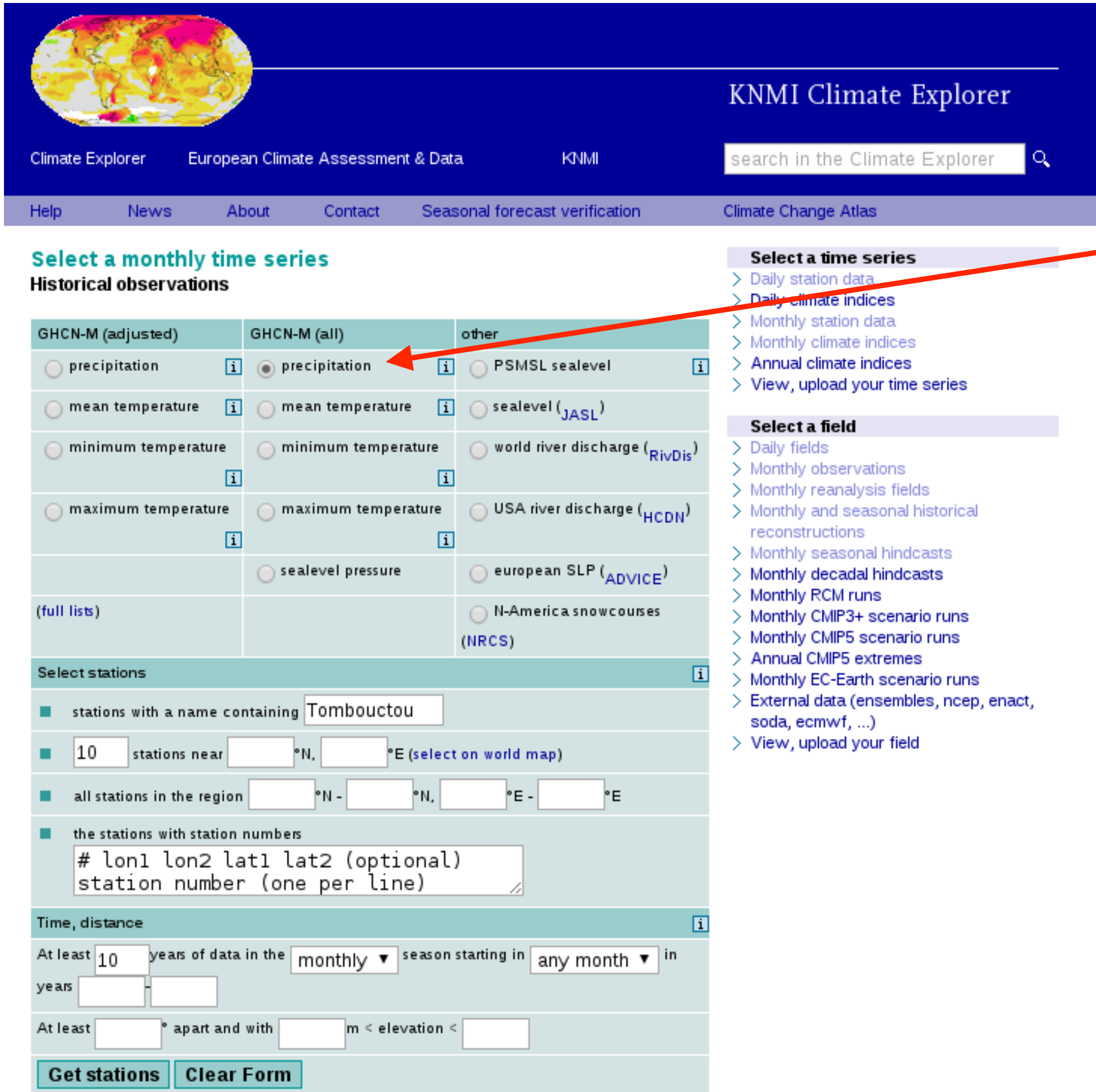
- Possibility to upload and view your own data.

Some examples...



- Click on monthly station data.

Some examples… August rainfall in Tomboctou



- Click on monthly station data.
- The GHCN-M (all) ‘precipitation’ .

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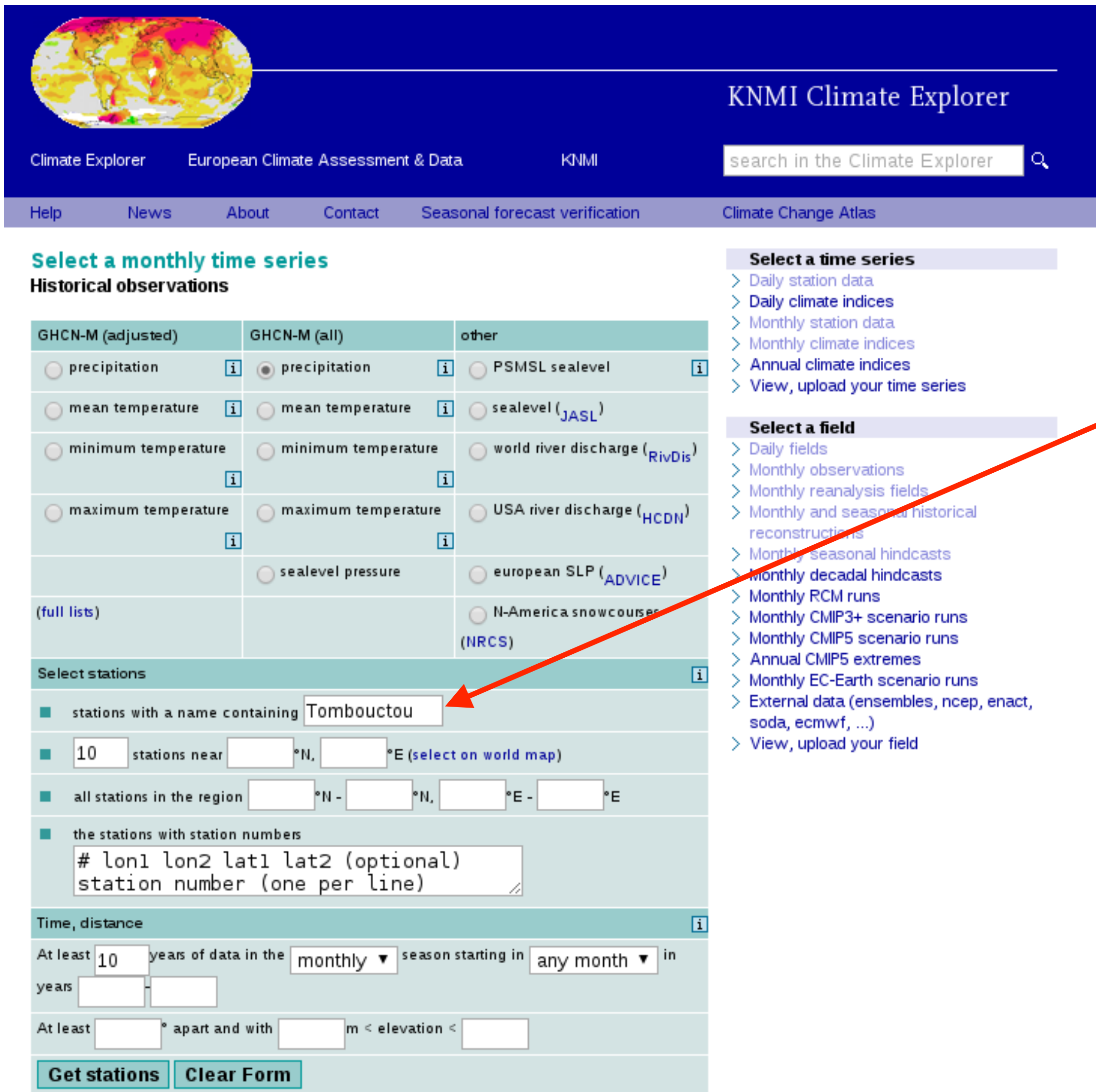

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- Type Tomboctou in station field.

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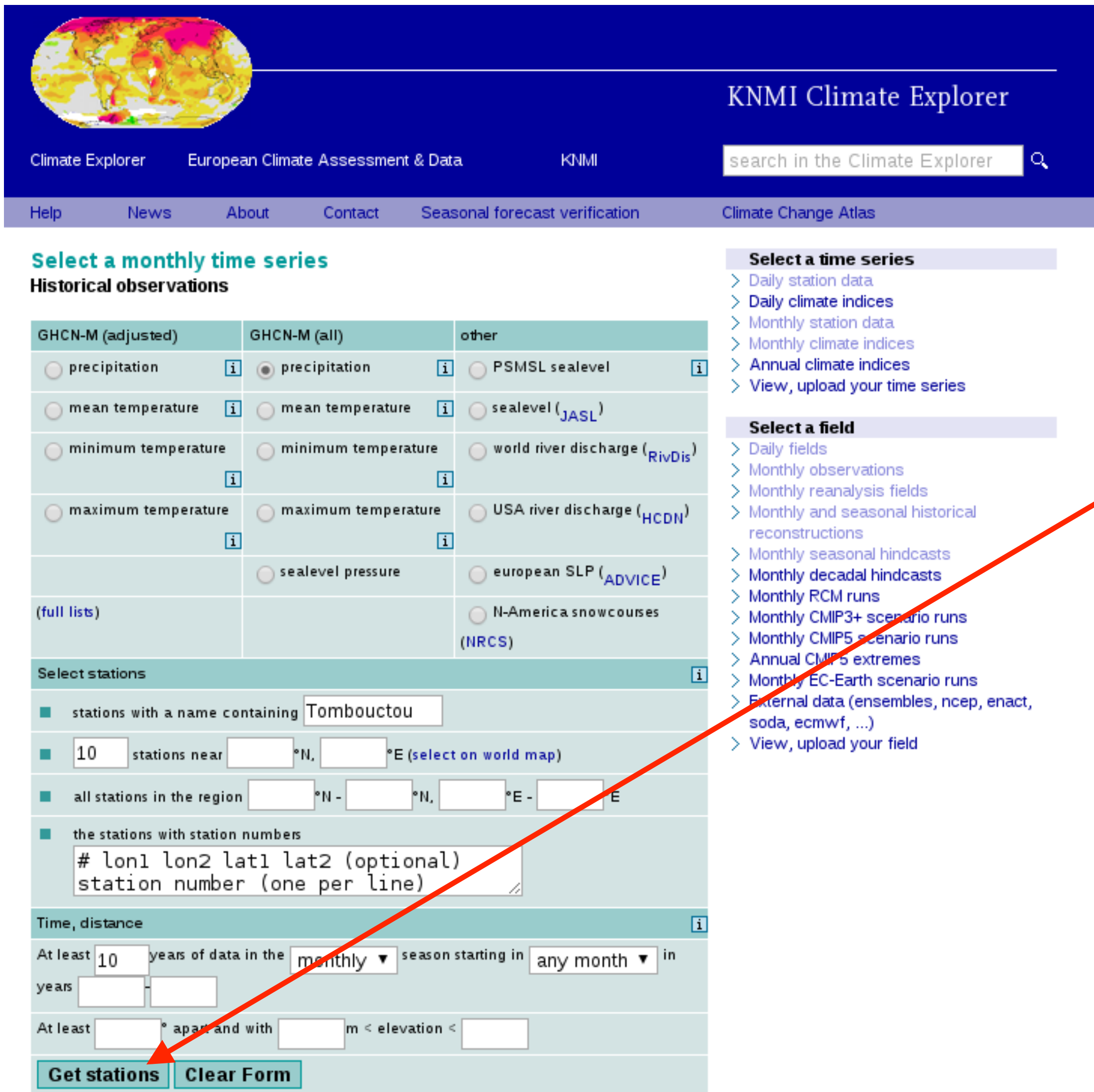

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- Get stations

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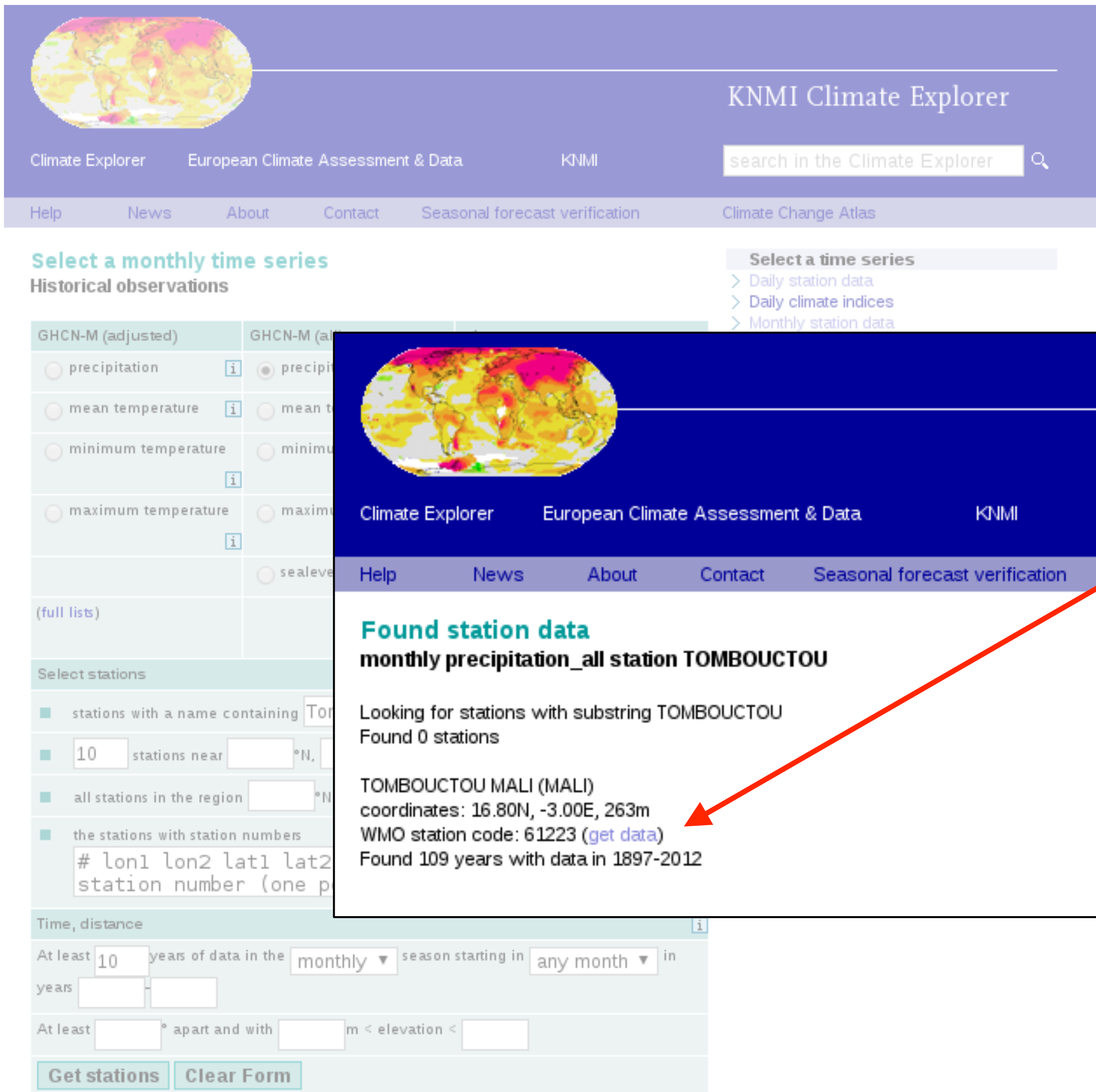

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- Get stations
- ‘get data’

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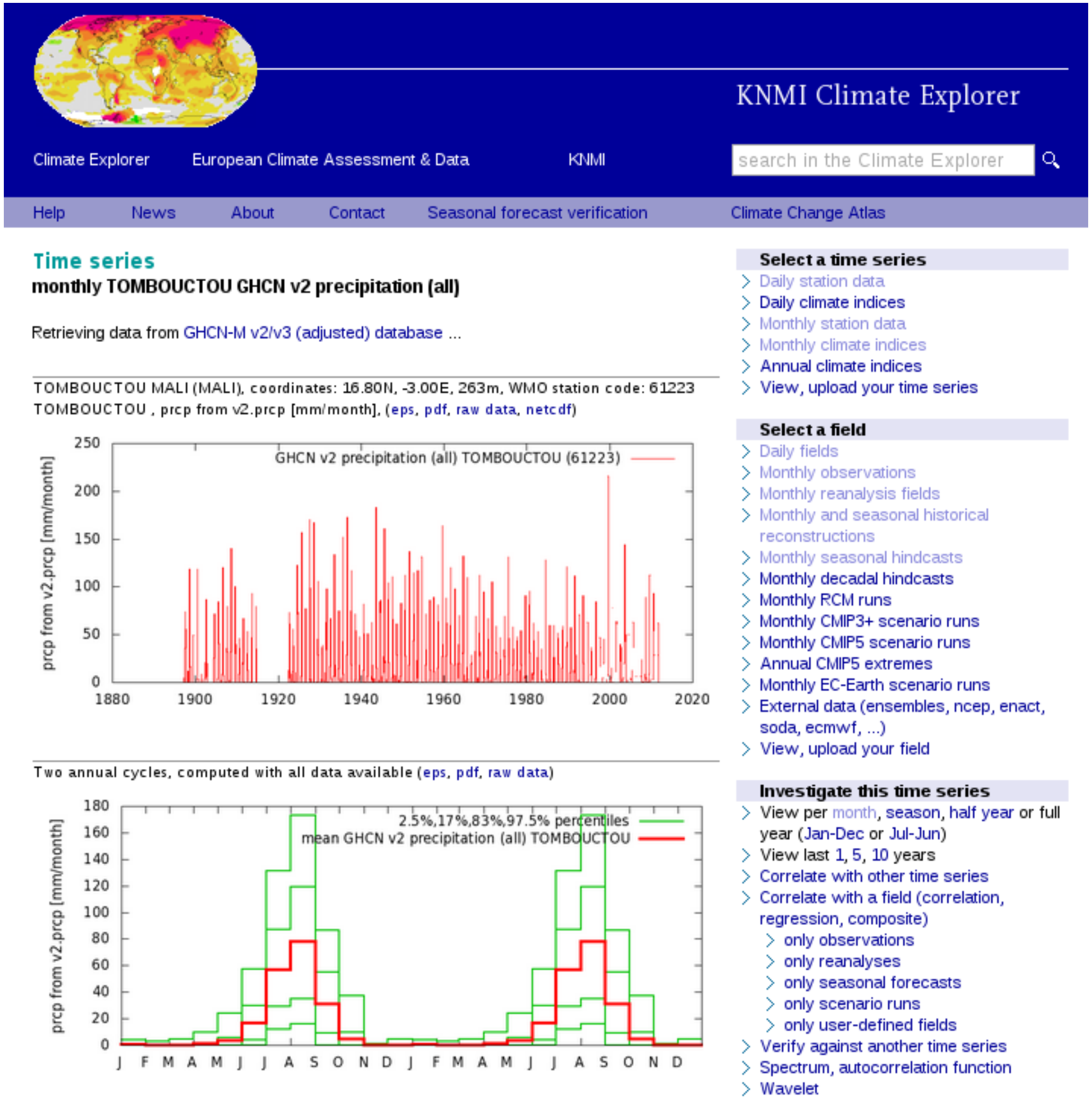
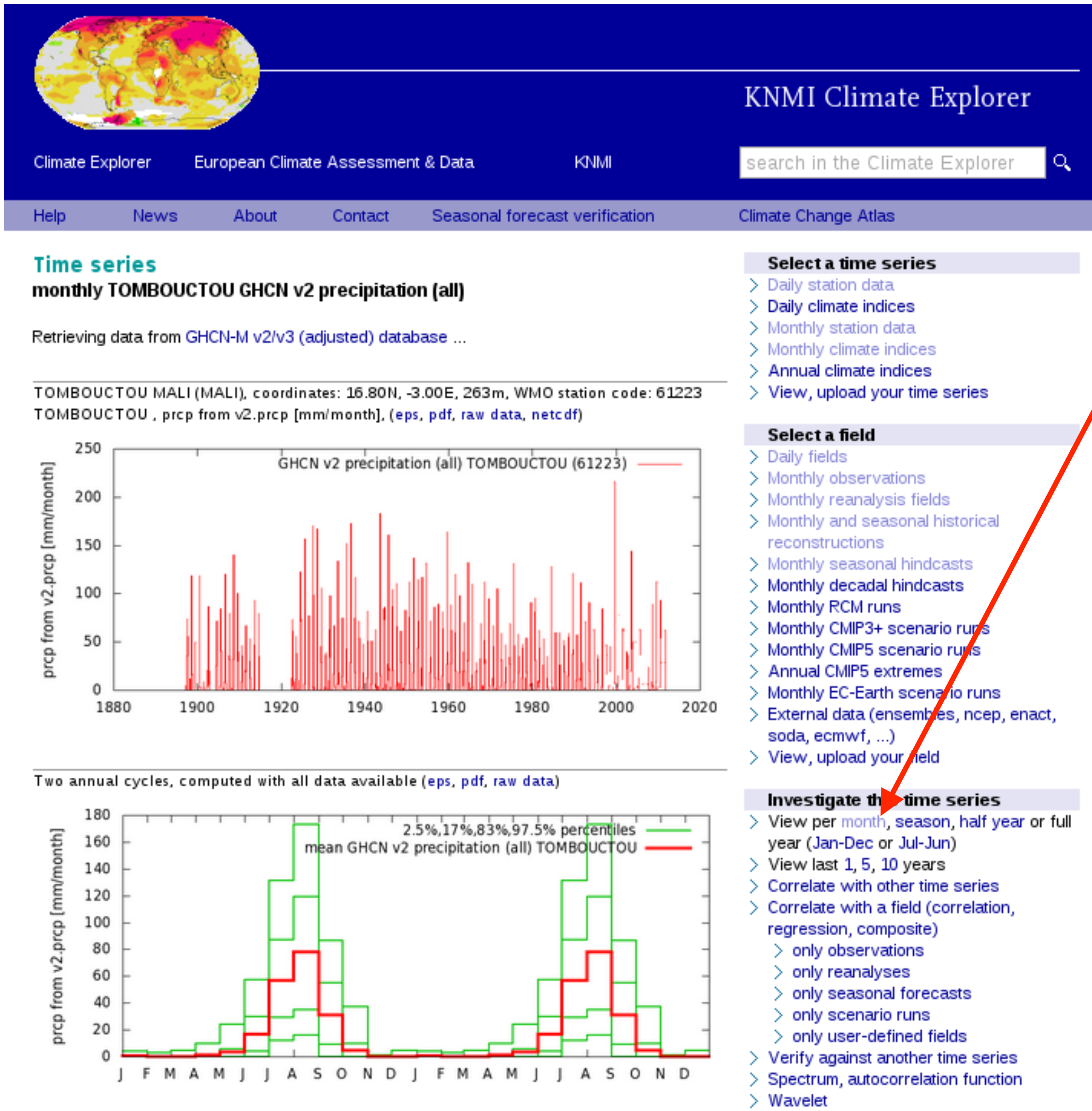


- Time series of monthly precip at Tomboctou.
- Annual cycle of precip, peaking in August.

Some examples... August rainfall in Tomboctou



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- Click 'view per month'.

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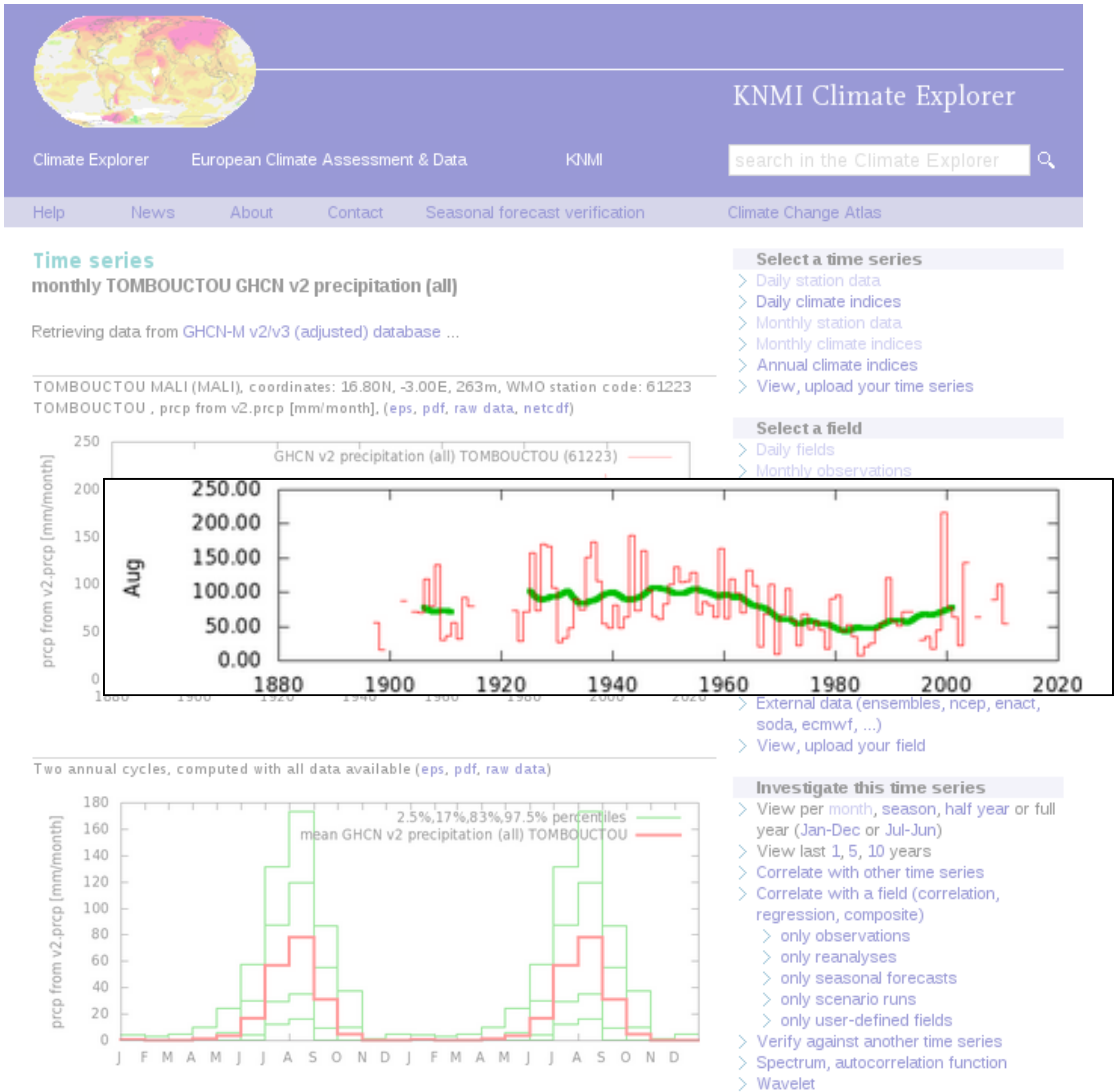

- Time series of monthly precip at Tomboctou.
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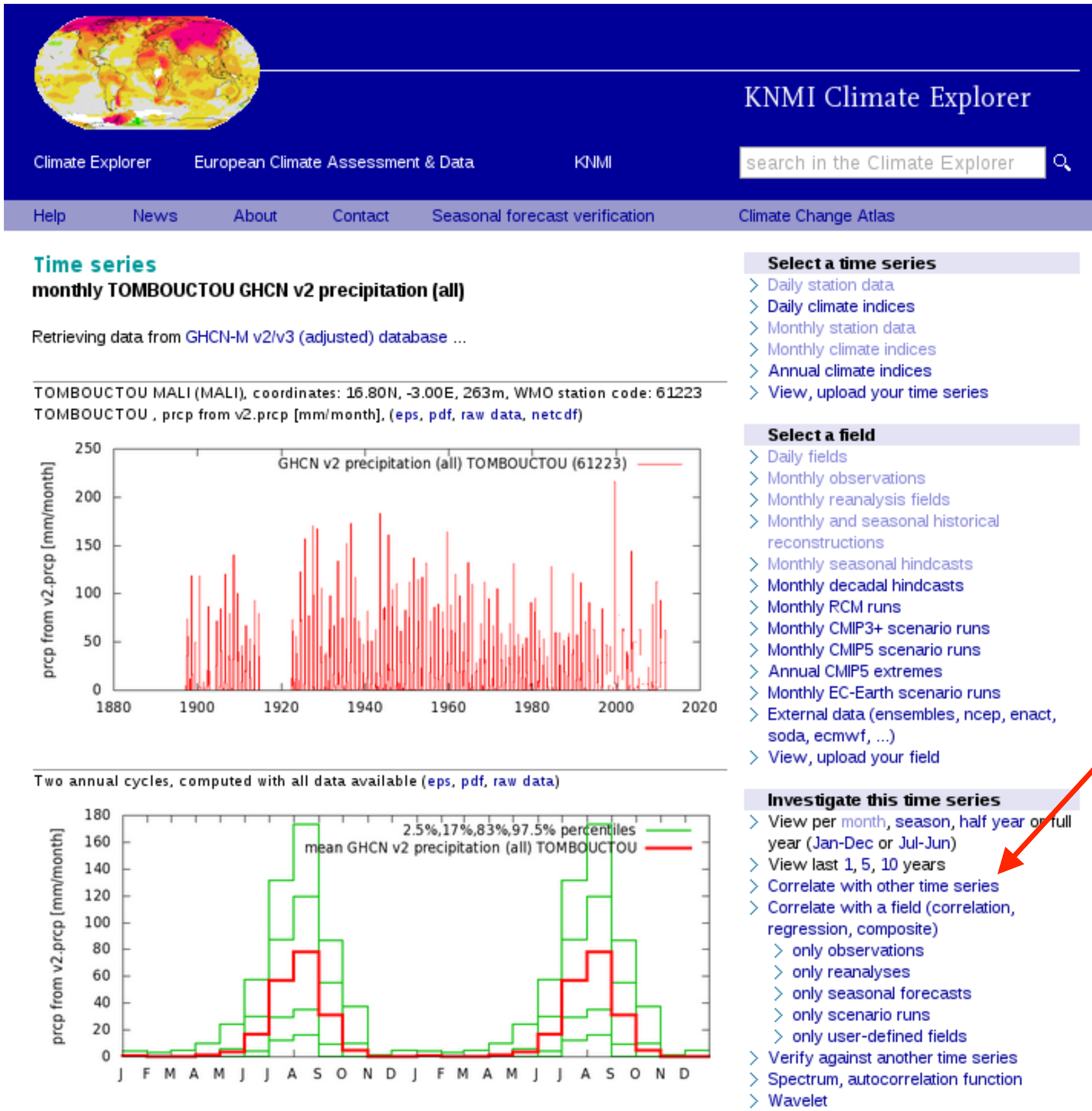
- The August plot reveals decadal variability: drier in the 1970s and 1980s.

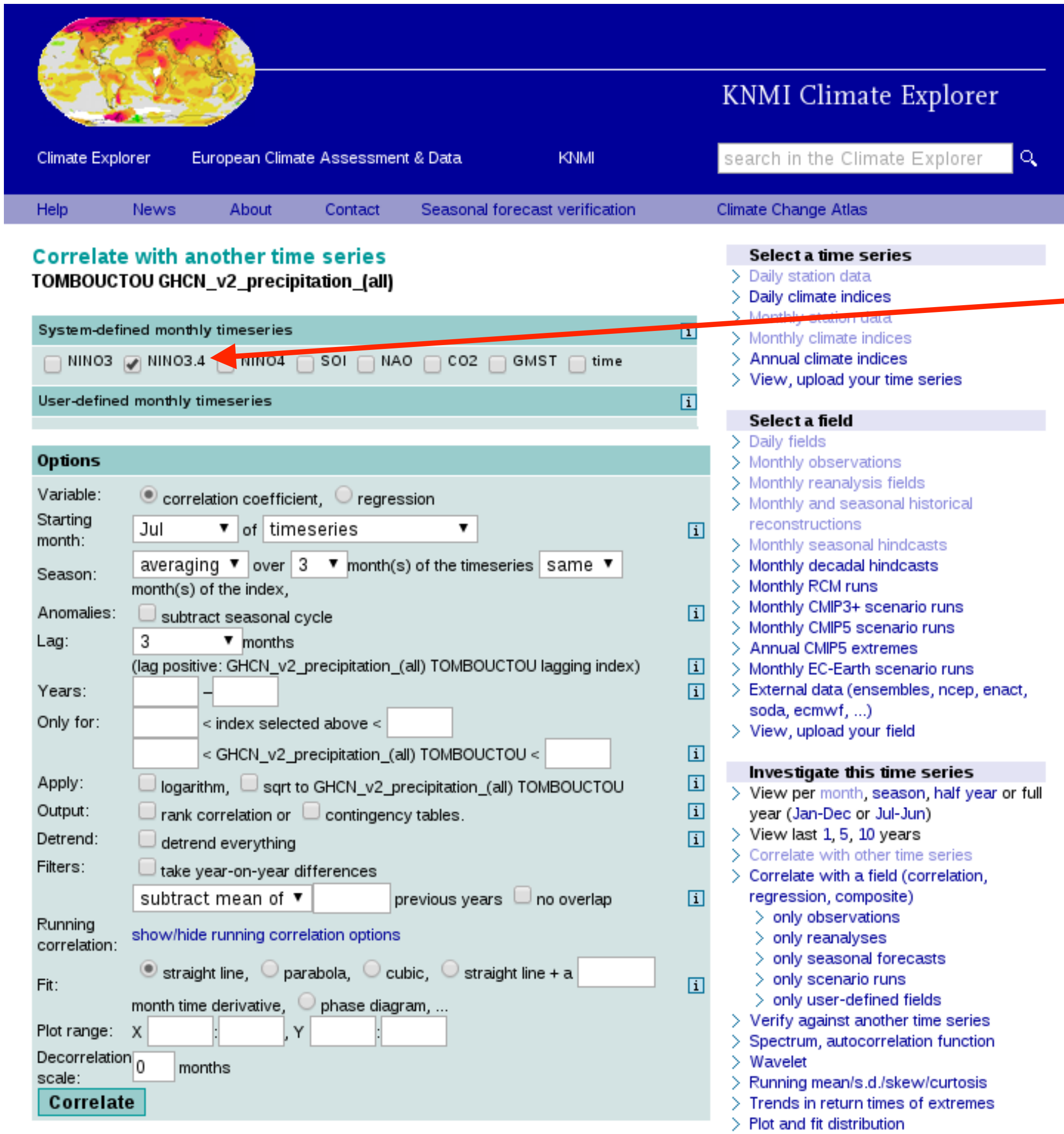
Some examples… August rainfall in Tomboctou



- Time series of monthly precip at Tomboctou.
- Annual cycle of precip, peaking in August.
- Click ‘view per month’.

- The August plot reveals decadal variability: drier in the 1970s and 1980s.
- Click ‘correlate with other time series.

Some examples… August rainfall in Tomboctou



- Is there a relationship between rainfall and ENSO?
- Click 'NINO3.4'

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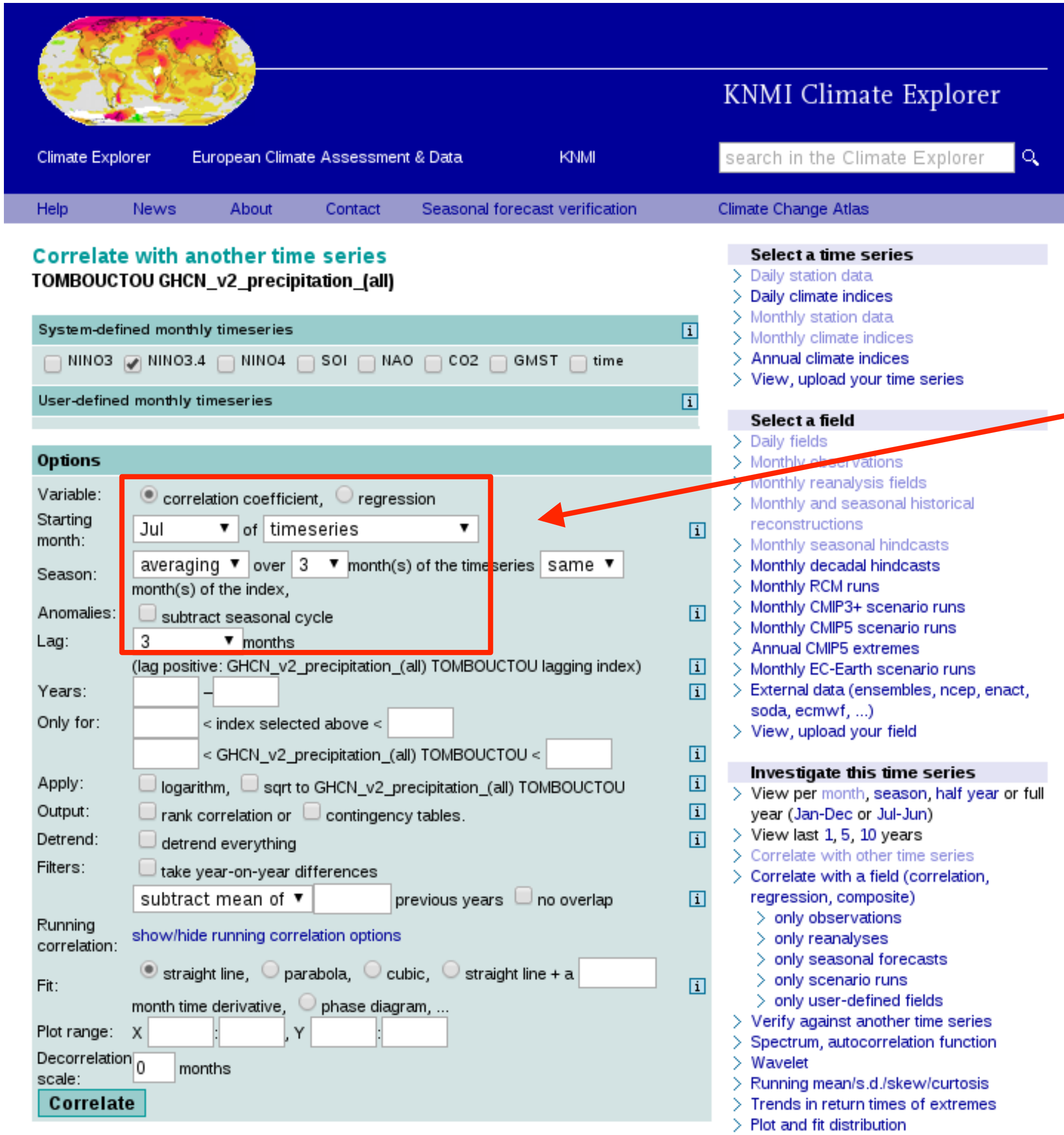

- Is there a relationship between rainfall and ENSO?
- Click ‘NINO3.4’.
- Starting month: Jul; average over 3 months; Lag: 3 months

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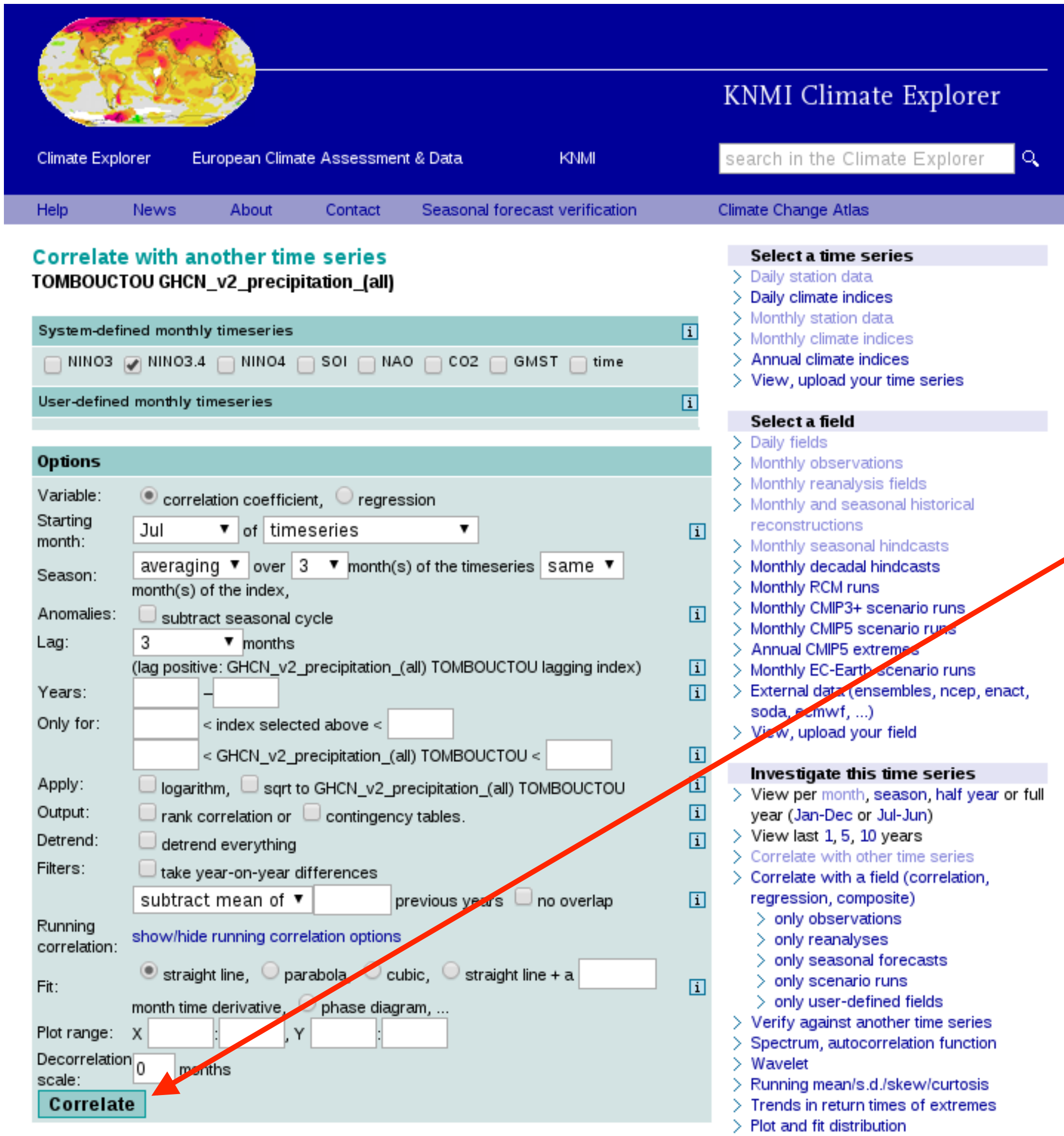

- Is there a relationship between rainfall and ENSO?
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- 'Correlate'.

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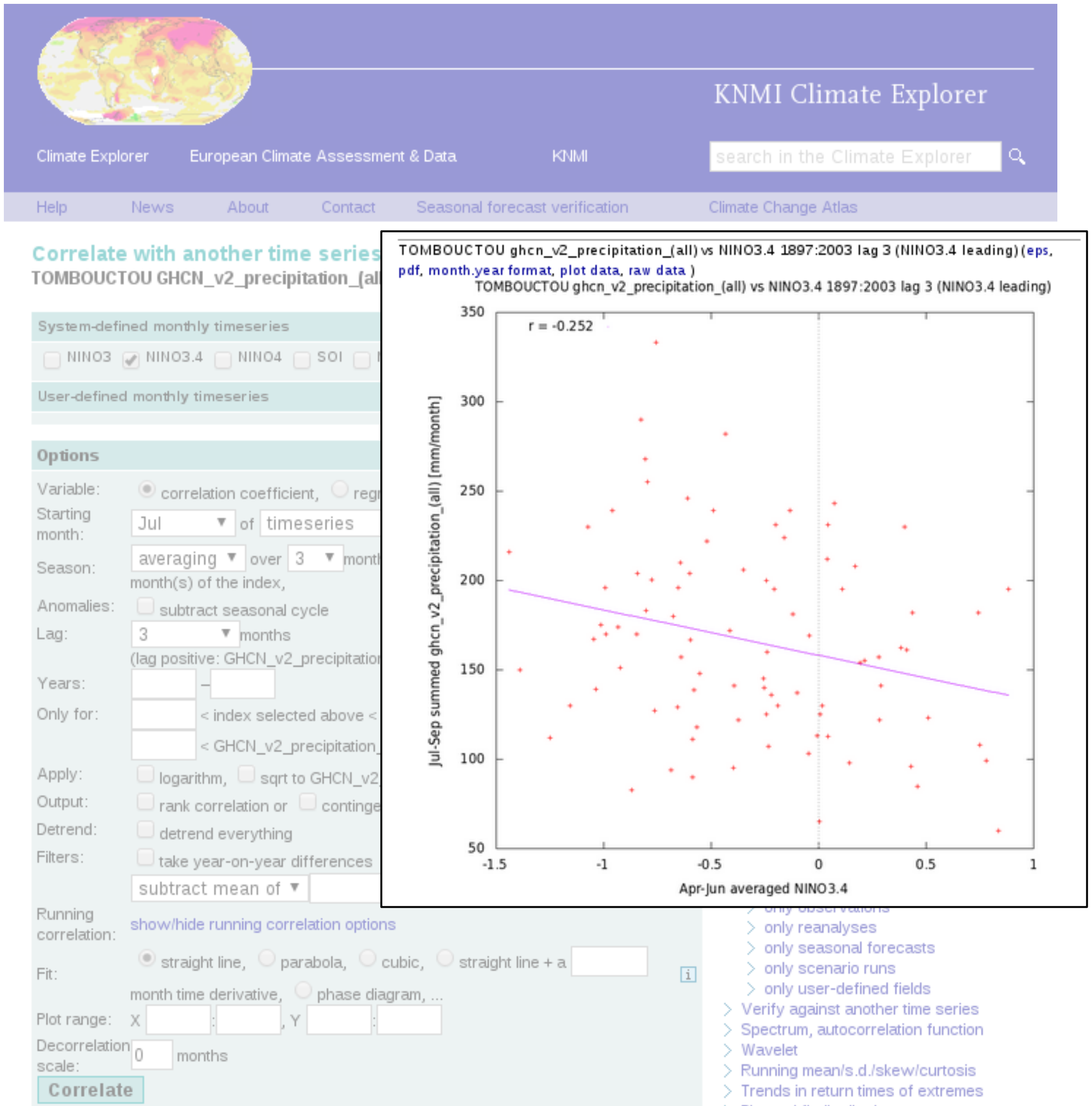

- Is there a relationship between rainfall and ENSO?
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- Starting month: Jul; average over 3 months.
- 'Correlate'.
- Correlate is significant but weak.

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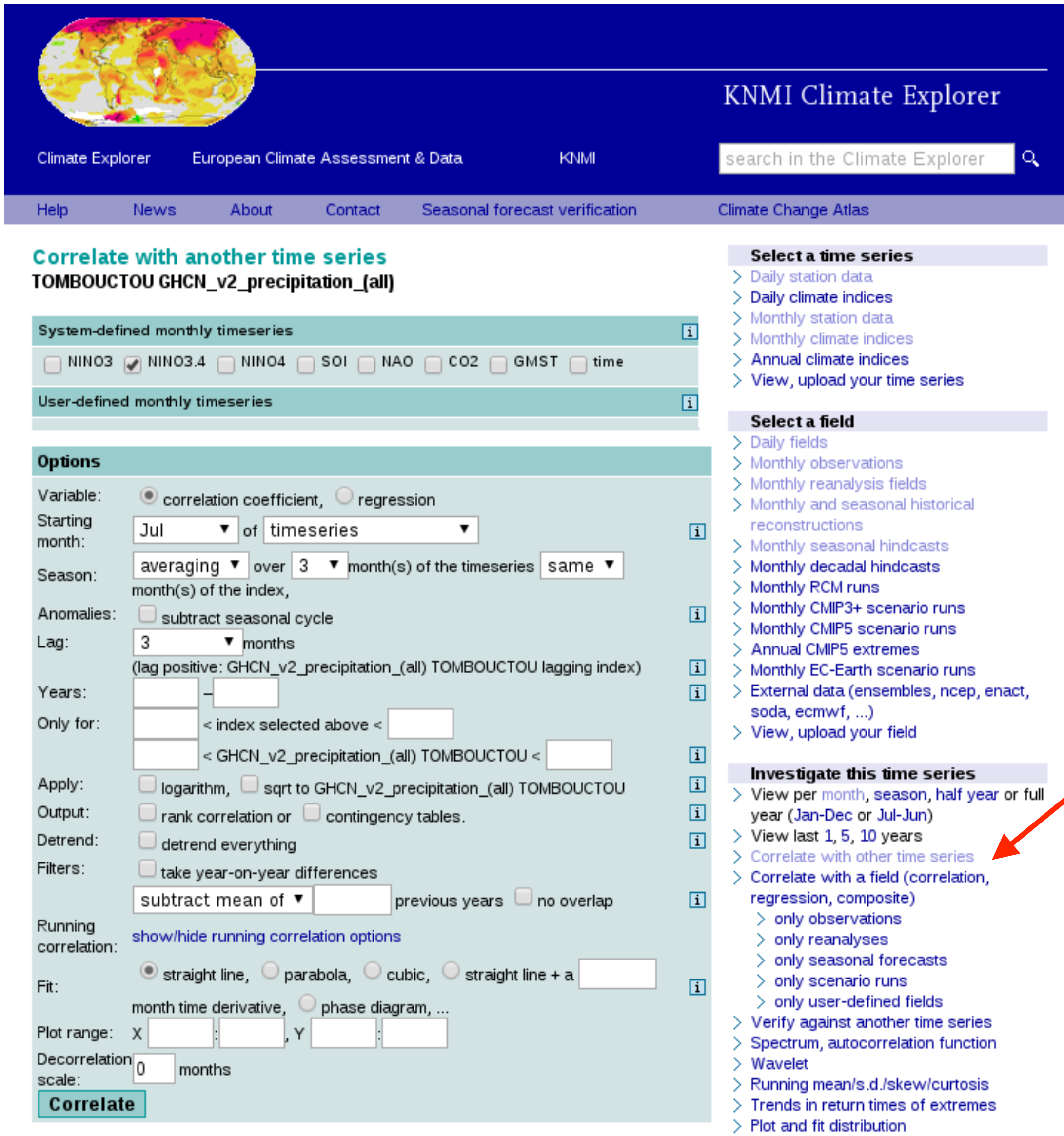

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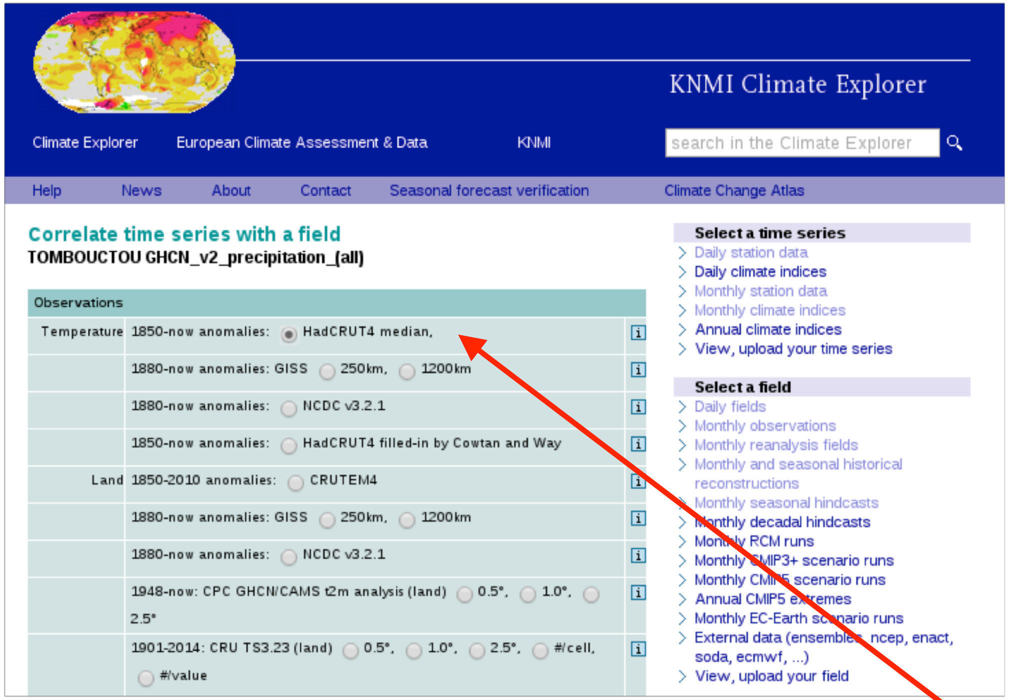

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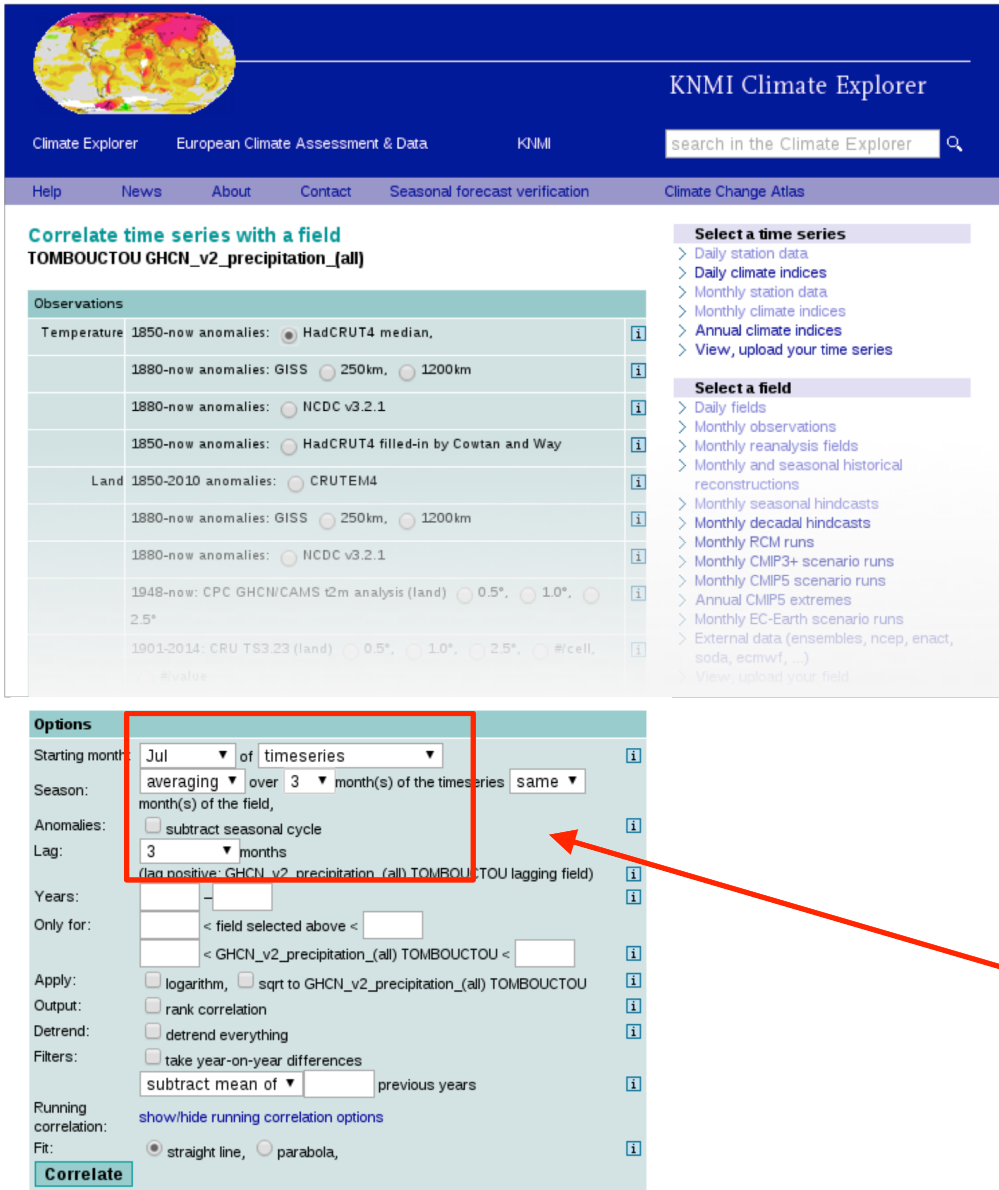

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- Select HadCRU4 temperature.
- Again, select JAS and a lag of 3 months.

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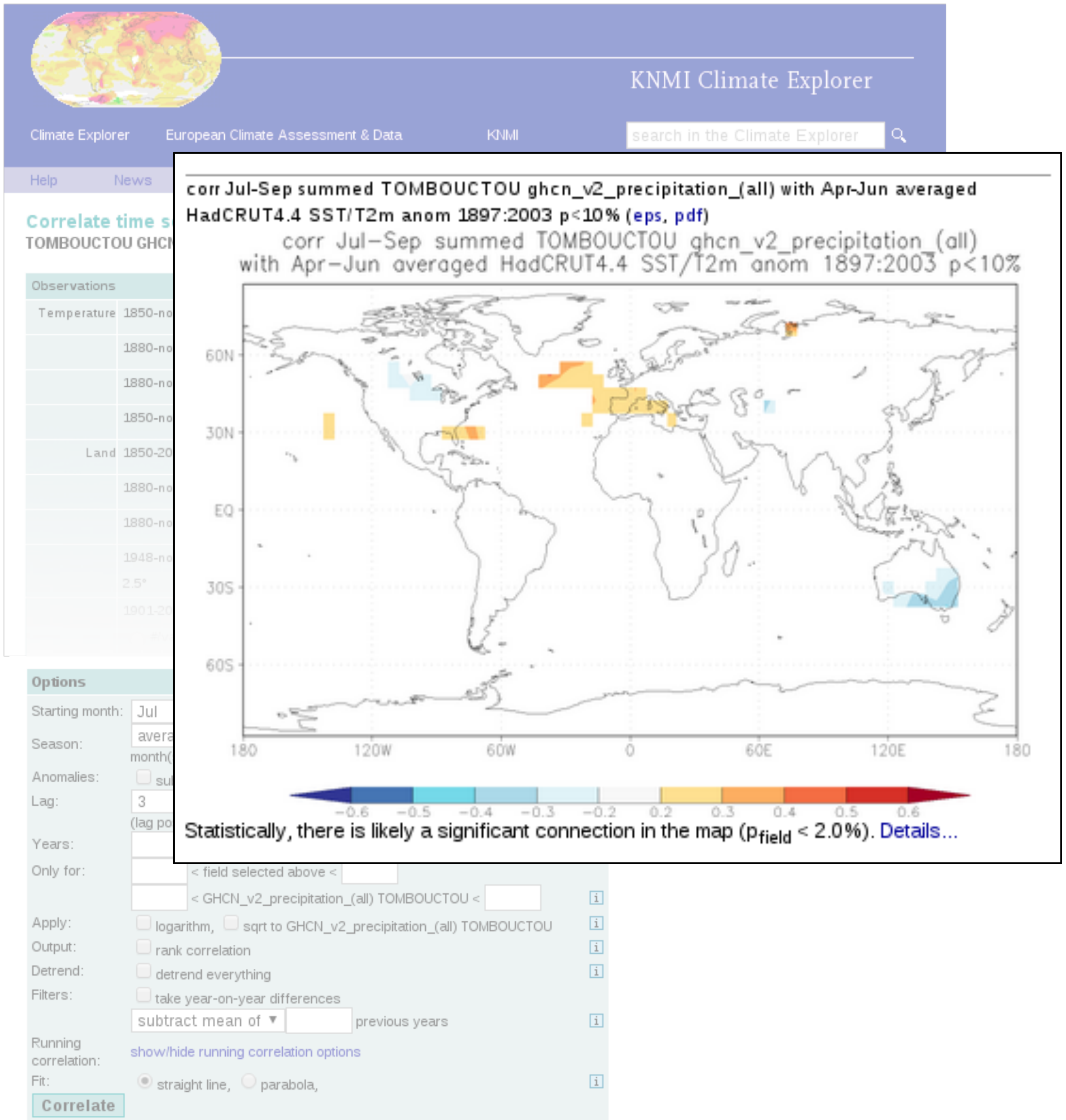

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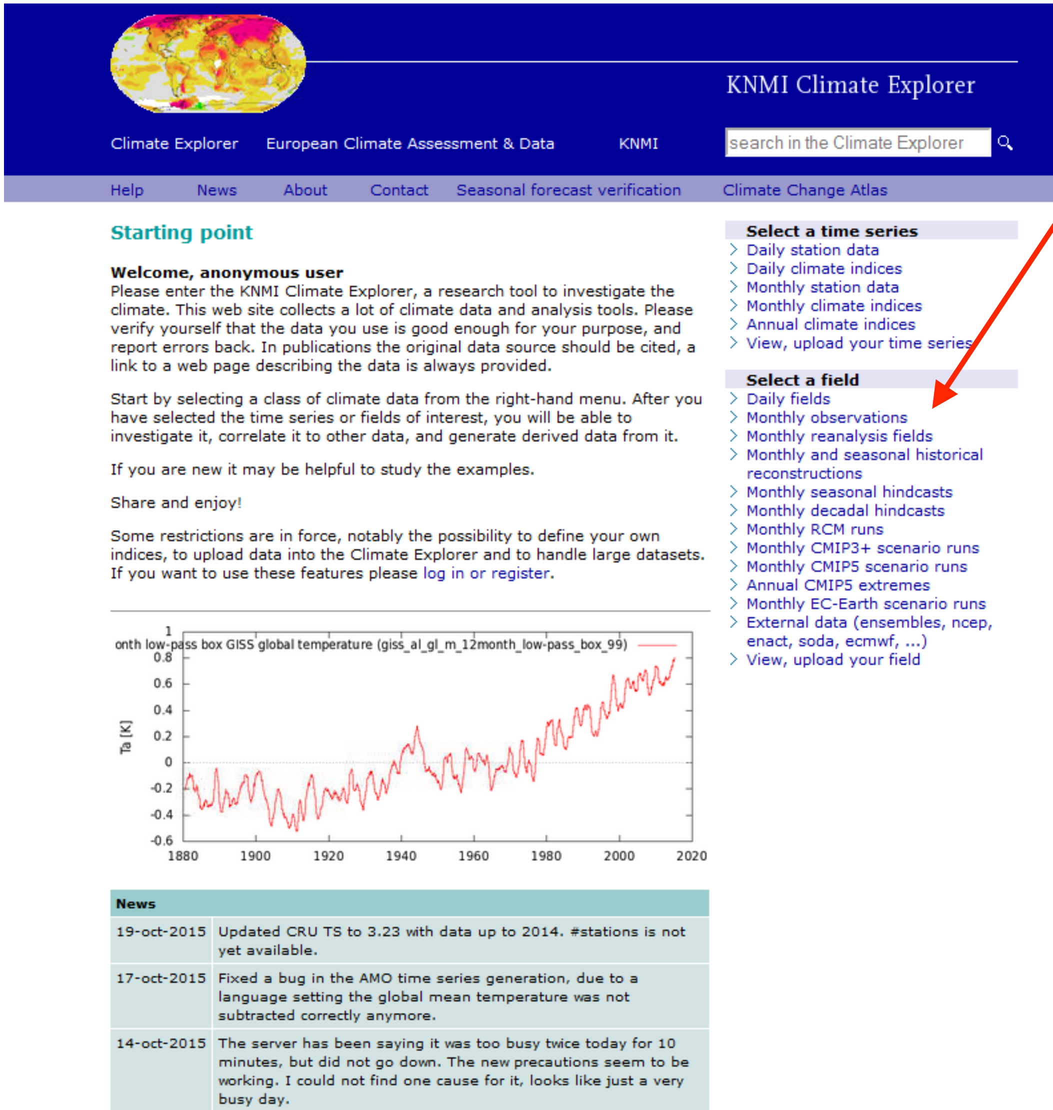
Computing ENSO teleconnections



- Select ‘monthly observations.’

Computing ENSO teleconnections

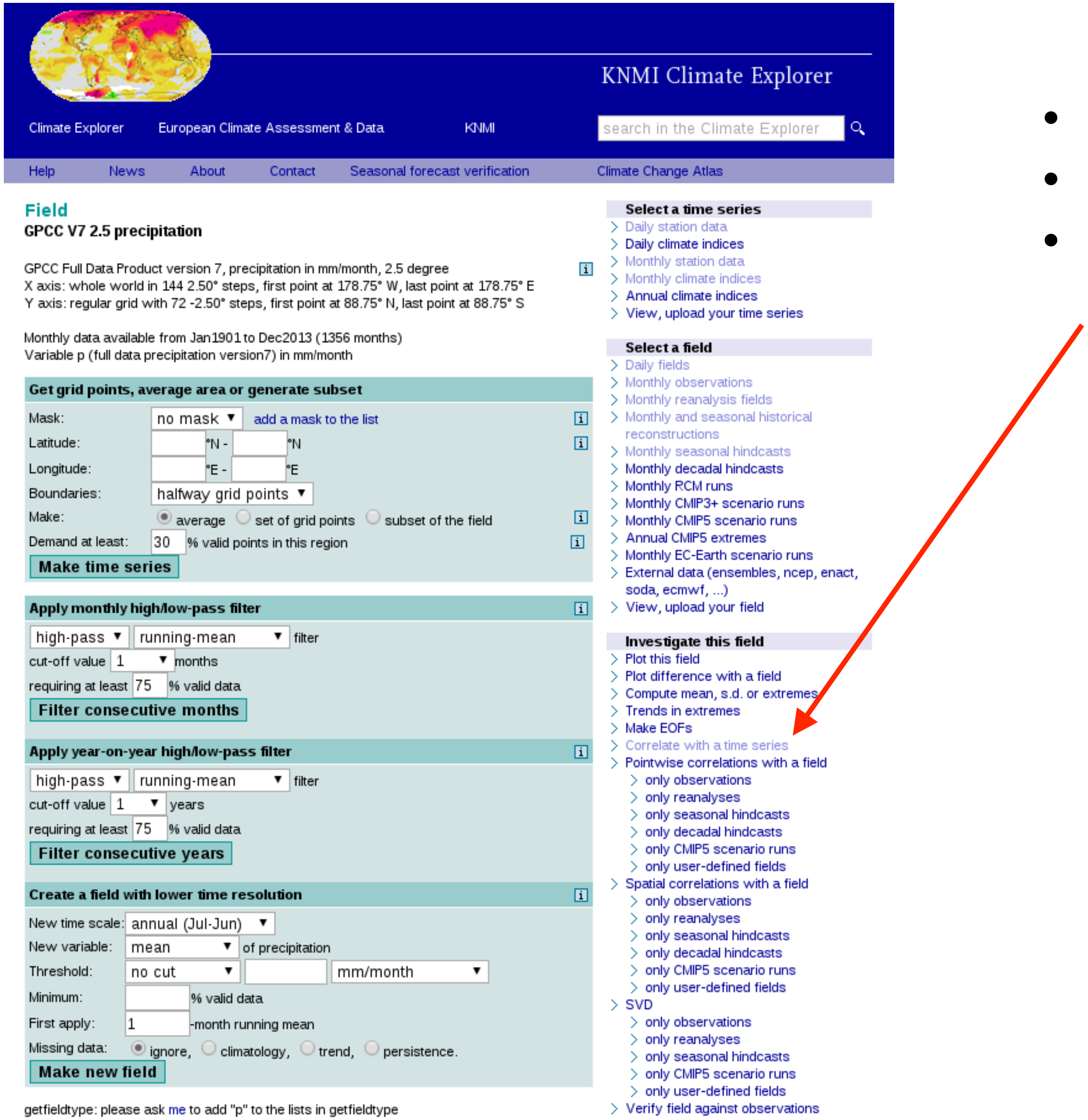
Select a monthly field

Observations

Select a field by following its link (old list)	
Temperature	1850-now anomalies: HadCRUT4 median,
	1880-now anomalies: GISS 250km, 1200km
	1880-now anomalies: NCDC v3.2.1
	1850-now anomalies: HadCRUT4 filled-in by Cowtan and Way
Land	1850-2010 anomalies: CRUTEM4
	1880-now anomalies: GISS 250km, 1200km
	1880-now anomalies: NCDC v3.2.1
	1948-now: CPC GHCN/CAMS t2m analysis (land) 0.5°, 1.0°, 2.5°
	1901-2014: CRU TS3.23 (land) 0.5°, 1.0°, 2.5°, #/cell, #/value
	1750-now: Berkeley 1°
	0.25° 1950-now: E-OBS v11.0 Tg, 0.5° 1901-now with CRU TS (Europe)
Tmax	1901-2014: CRU TS3.23 (land) 0.5°, 1.0°, 2.5°, #/cell, #/value
	1833-now: Berkeley 1°
	0.25° 1950-now: E-OBS v11.0 Tx, 0.5° 1901-now with CRU TS (Europe)
Tmin	1901-2014: CRU TS3.23 (land) 0.5°, 1.0°, 2.5°, #/cell, #/value
	1833-now: Berkeley 1°
	0.25° 1950-now: E-OBS v11.0 Tn, 0.5° 1901-now with CRU TS (Europe)
Tmax-Tmin (DTR)	1901-2014: CRU TS3.23 (land) 0.5°, 1.0°, 2.5°
SST	1870-now: HadISST1 1° reconstruction
	1854-now: NCDC v4 ERSST reconstruction, (v3b)
	1850-2006: Hadley Centre HadSST3.1.1.0 5°
	1800-2007: 2° ICOADS v2.5 SST, number of obs
	1982-now: 1° Reynolds OI v2 SST, v1
	1980-now: TAO buoys SST, Air Temperature
Air Temperature	1880-2010: HadNMAT2, anomalies, large-scale uncertainties, (1856-2002 HadMAT1)
	1800-2007: 2° ICOADS v2.5 Tair, number of obs
Lower Troposphere	1979-now: Spencer & Christy MSU anomalies v5.6 (v6.0beta3)
	1978-now: RSS MSU 3.3 TLT, anomalies (3.2, anomalies)
Precipitation	1901-2014: CRU TS3.23 (land) 0.5°, 1.0°, 2.5°
	0.25° 1950-now: E-OBS v11.0 precip, 0.5° 1901-now with CRU TS (Europe)
	1900-now anomalies: NCDC analysis (land)
	1901-2013: GPCC V7 analysis (land) 2.5°, 1.0°, 0.5°, only observations: 2.5°, 1.0°, 0.5°, number of gauges 0.5°, 1.0°, 2.5°
	1986-now: 1° GPCC monitoring product + first guess (land); only observations, number of gauges
	1900-now: home-merged 1° GPCC V7 + monitoring product + first guess (land); 1°, 2.5°, only observations: 1°, 2.5°

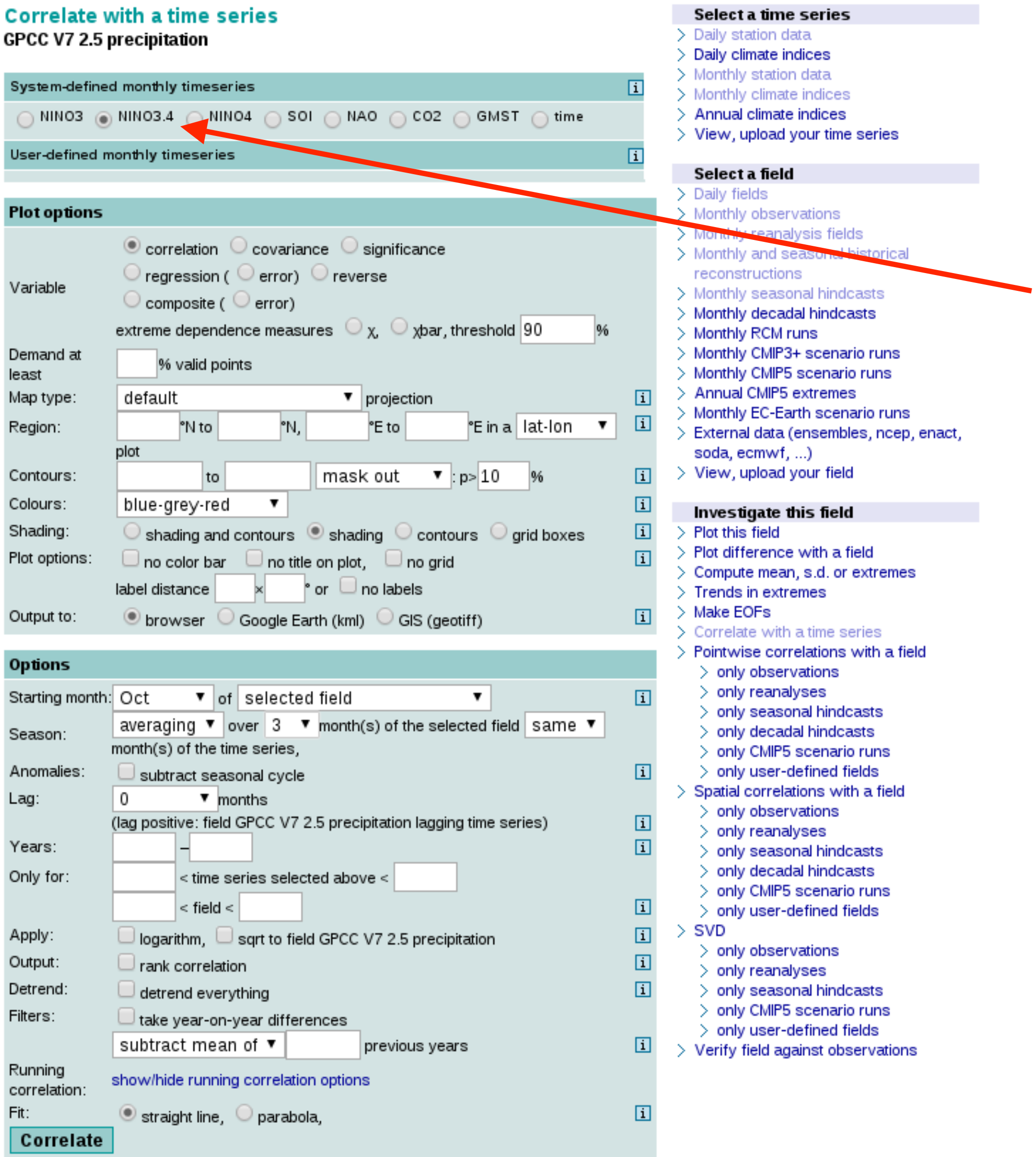
- Select 'monthly observations.'
- 'GPCC 2.5 deg'.

Computing ENSO teleconnections



- Select 'monthly observations.'
- 'GPCC 2.5 deg'
- 'Correlate with time series'

Computing ENSO teleconnections



- Select ‘monthly observations.’
- ‘GPCC 2.5 deg’.
- ‘Correlate with time series’
- Select ‘NINO3.4’.

Computing ENSO teleconnections

- Select ‘monthly observations.’
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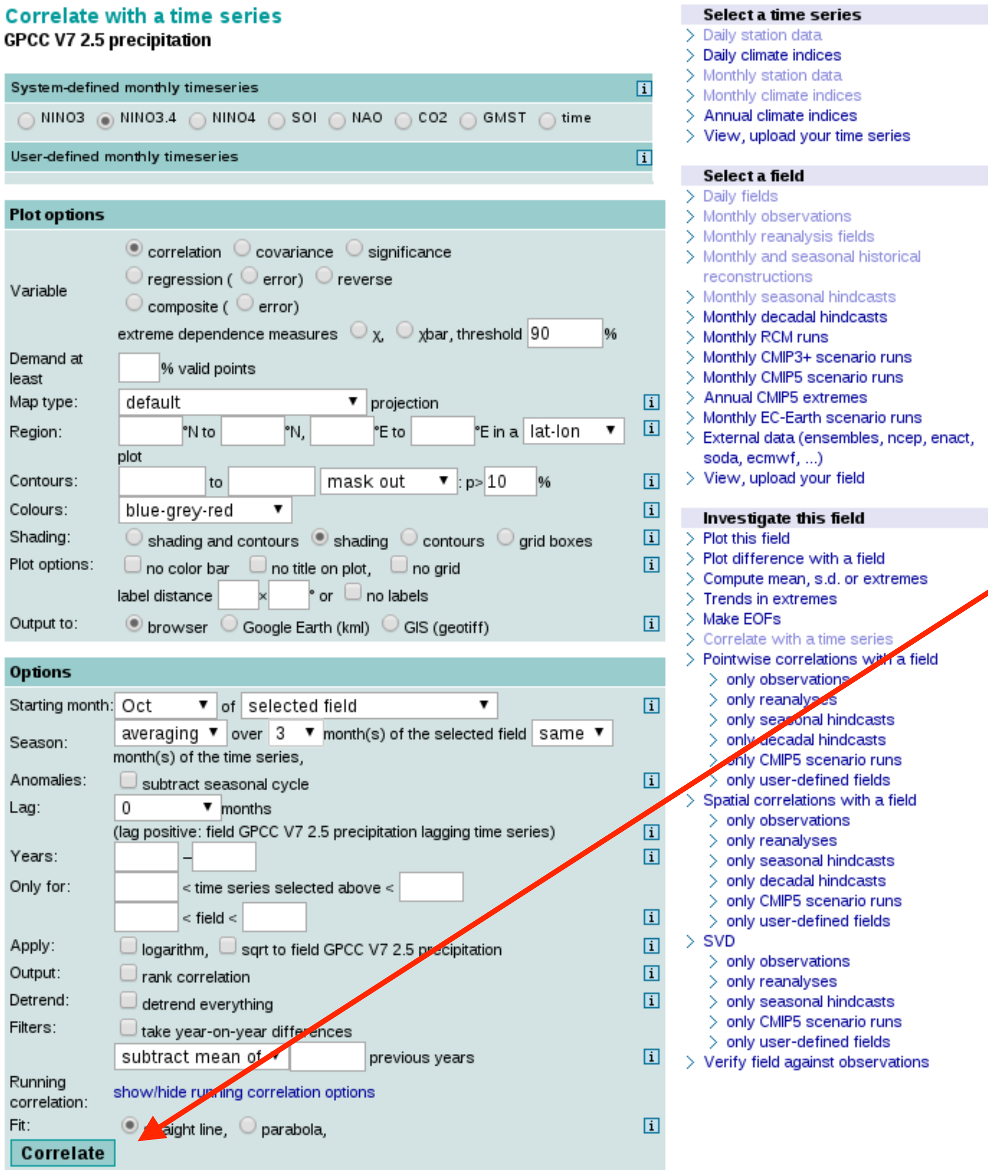
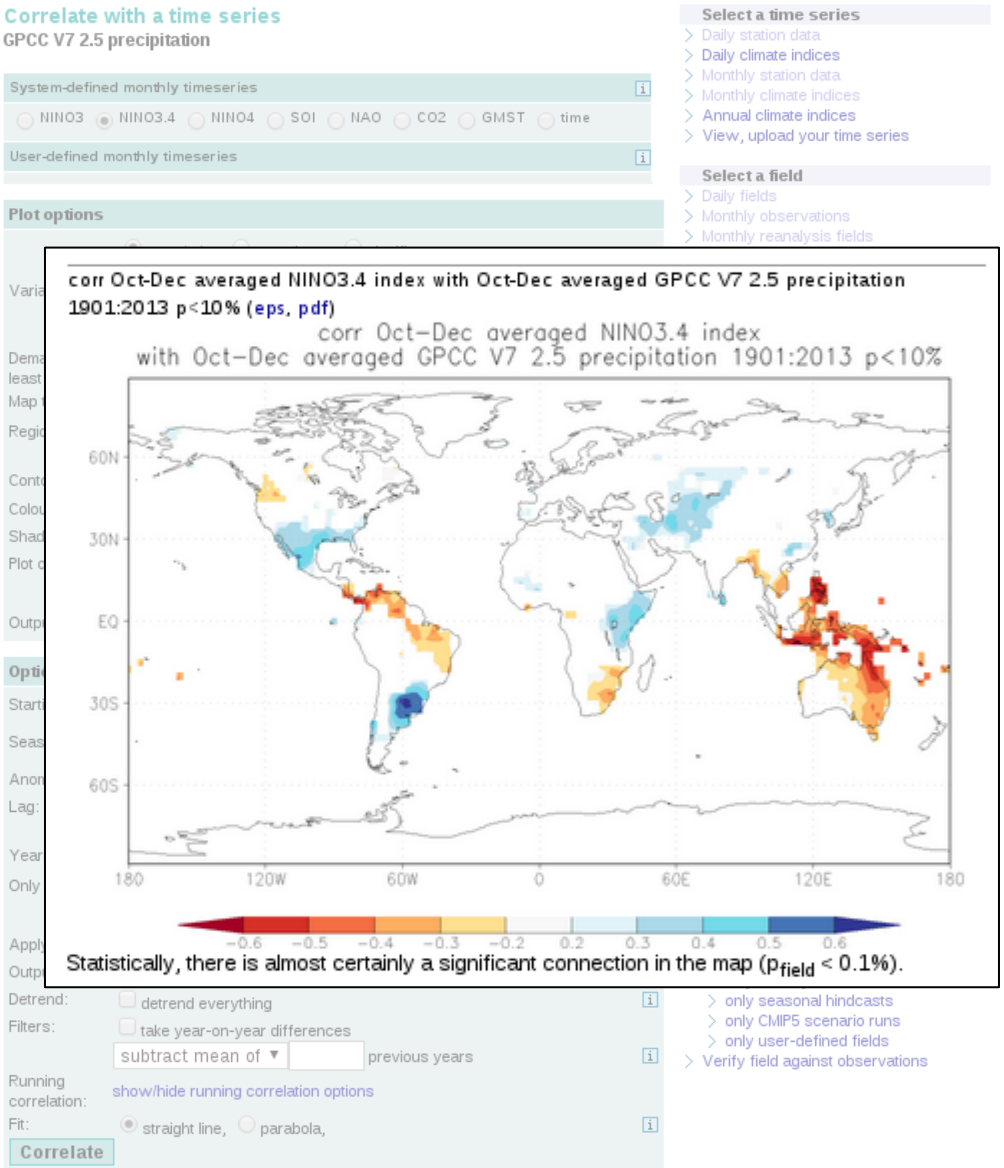
- Select ‘NINO3.4’.
- Starting month: Oct; averaged over 3 months

Computing ENSO teleconnections



- Select 'monthly observations.'
- 'GPCC 2.5 deg'.
- 'Correlate with time series'
- Select 'NINO3.4'.
- Starting month: Oct; averaged over 3 months.
- 'Correlate'.

Computing ENSO teleconnections



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- ‘GPCC 2.5 deg’.
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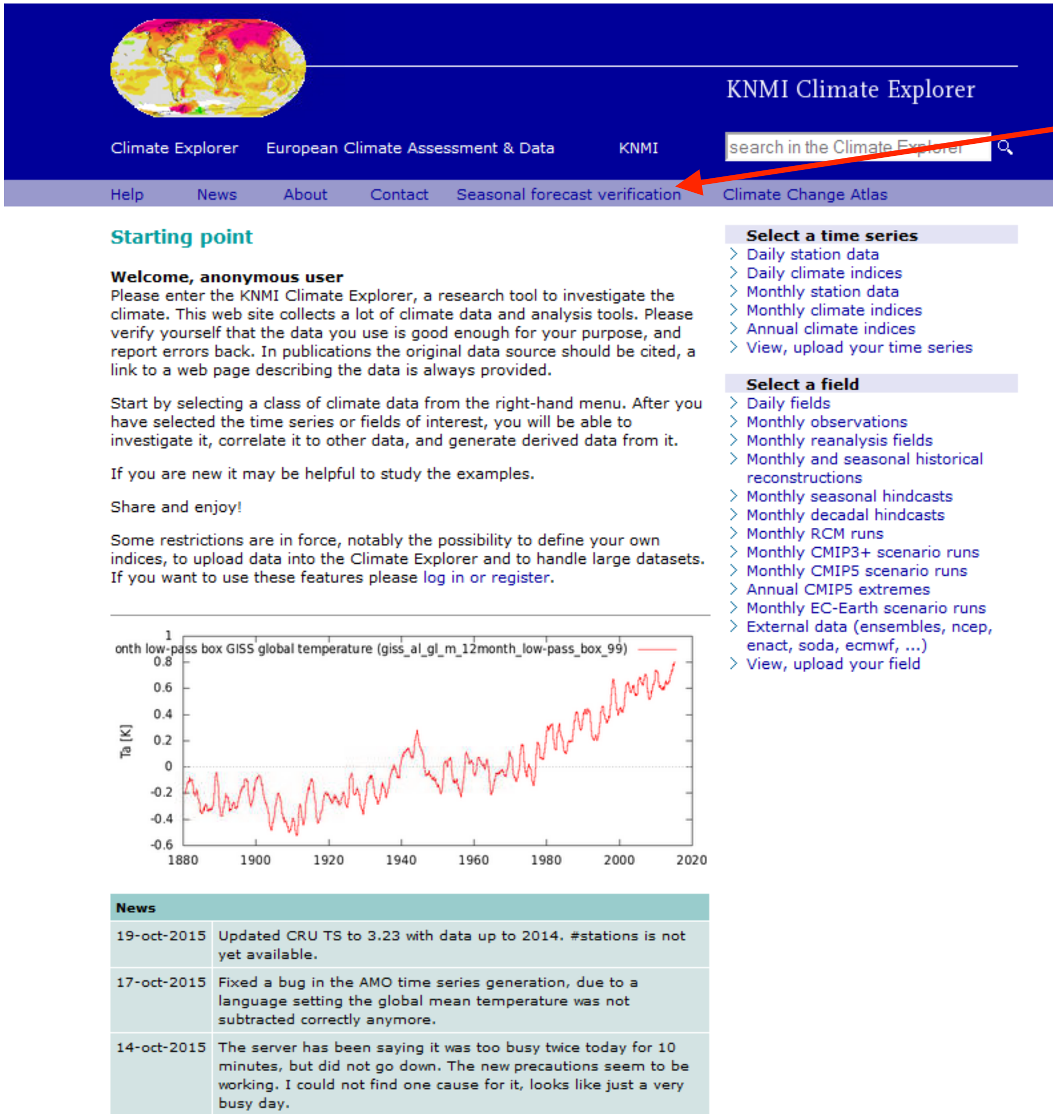
- Select ‘NINO3.4’.
- Starting month: Oct; averaged over 3 months.
- ‘Correlate’.

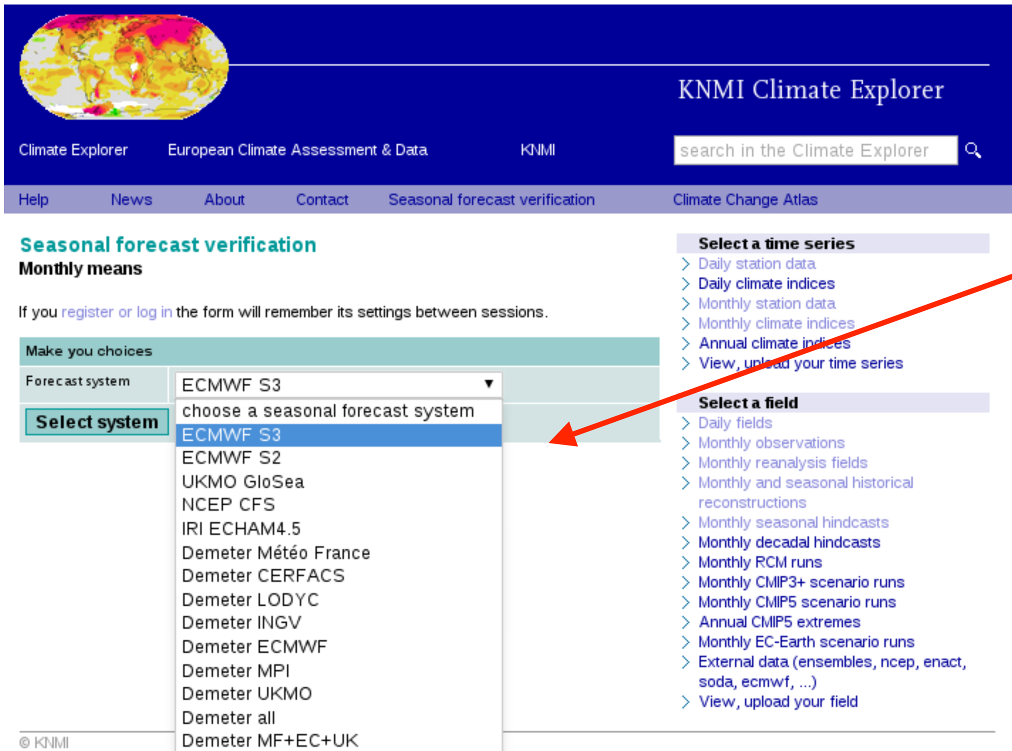
- Reveals well-known teleconnections…
- Climate Explorer allows you to focus on specific regions, seasons.
- Analysis extends to regression, composites etc.

Seasonal forecast verification tool



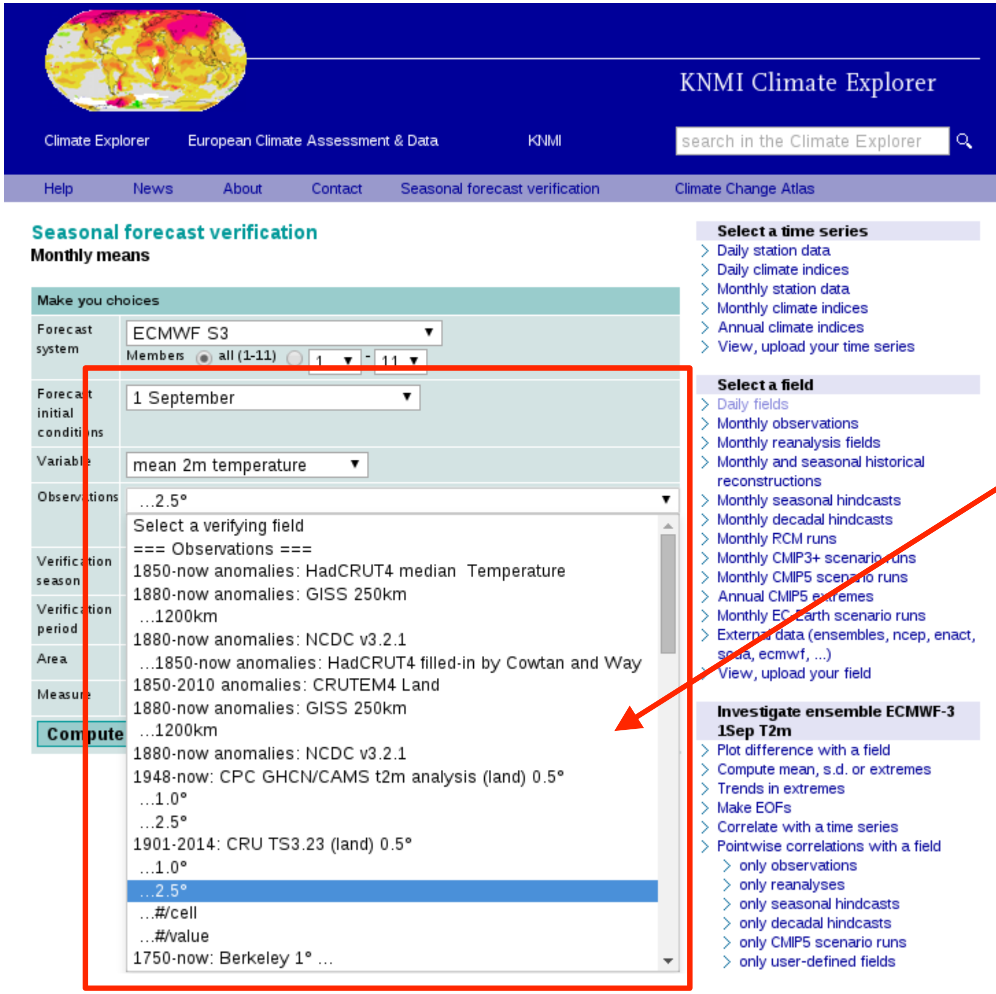
- Click ‘seasonal forecast verification’.

Seasonal forecast verification tool



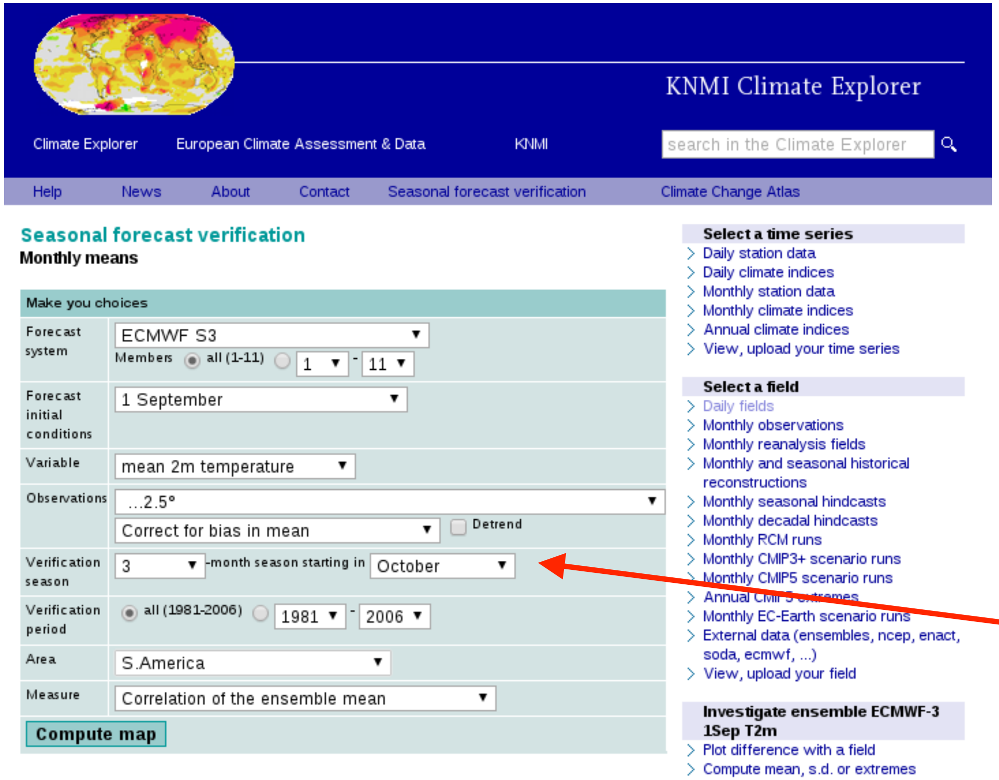
- Click ‘seasonal forecast verification’.
- Select ‘ECMWF S3’ and click.

Seasonal forecast verification tool



- Click ‘seasonal forecast verification’.
- Select ‘ECMWF S3’ and click.
- Initial conditions:
  1 September
- Variable:
  mean 2m temperature
- Observations: CRU 2.5°

Seasonal forecast verification tool



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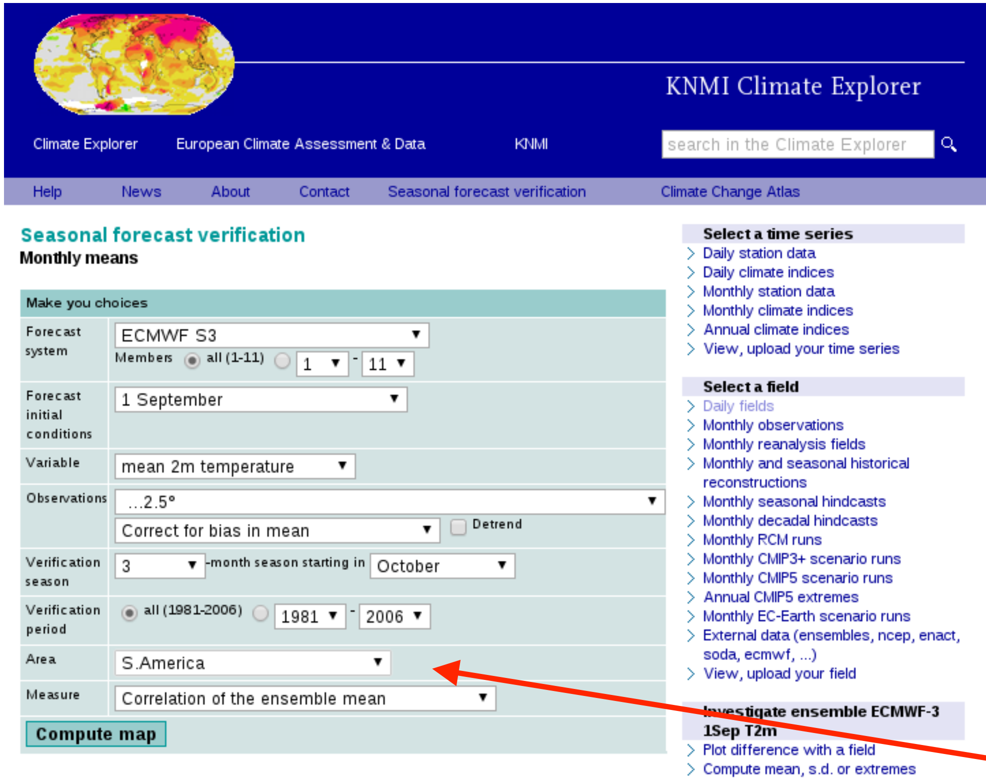
- Initial conditions: 1 September
- Variable: mean 2m temperature
- Observations: CRU 2.5°
- Verification: 3-month starting in October.

Seasonal forecast verification tool



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- Select ‘ECMWF S3’ and click.
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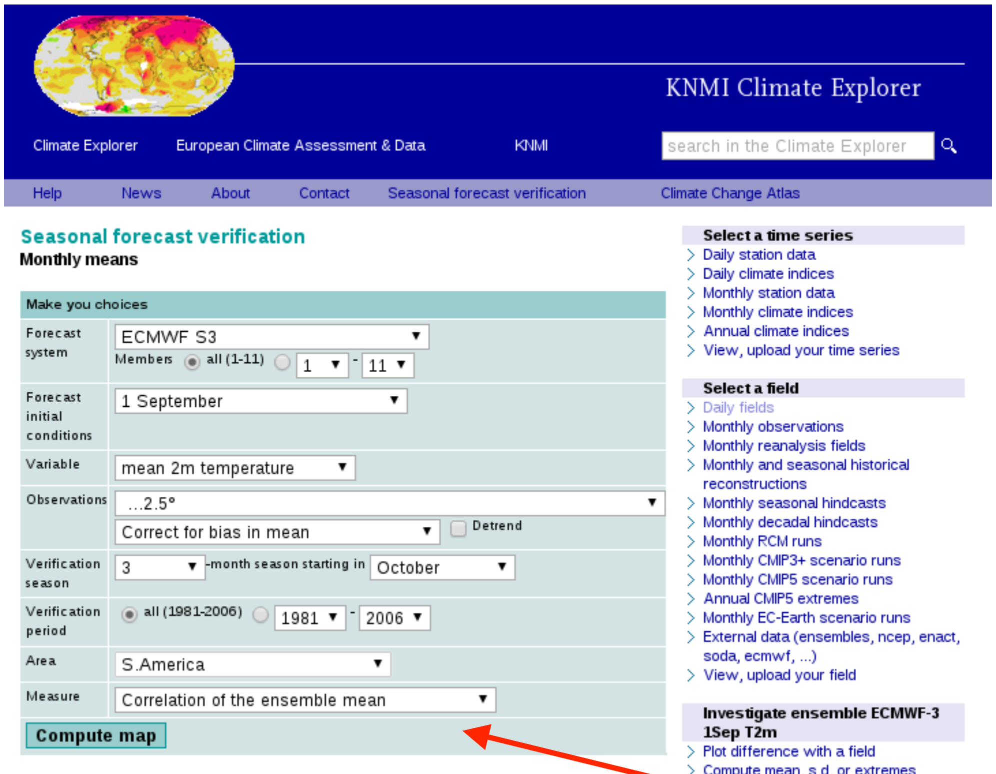
- Observations: CRU 2.5°
- Verification: 3-month starting in October.
- Area: South America

Seasonal forecast verification tool



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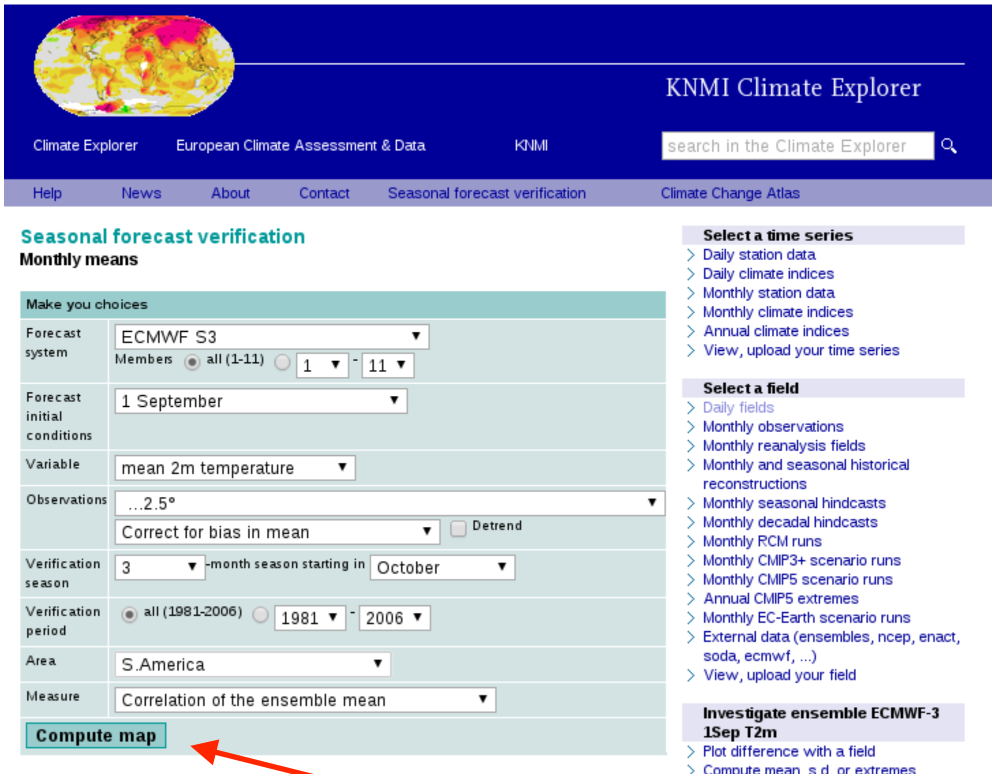
- Initial conditions: 1 September
- Variable: mean 2m temperature
- Observations: CRU 2.5°
- Verification: 3-month starting in October.
- Area: South America
- Measure: ‘correlation of ensemble mean’

Seasonal forecast verification tool



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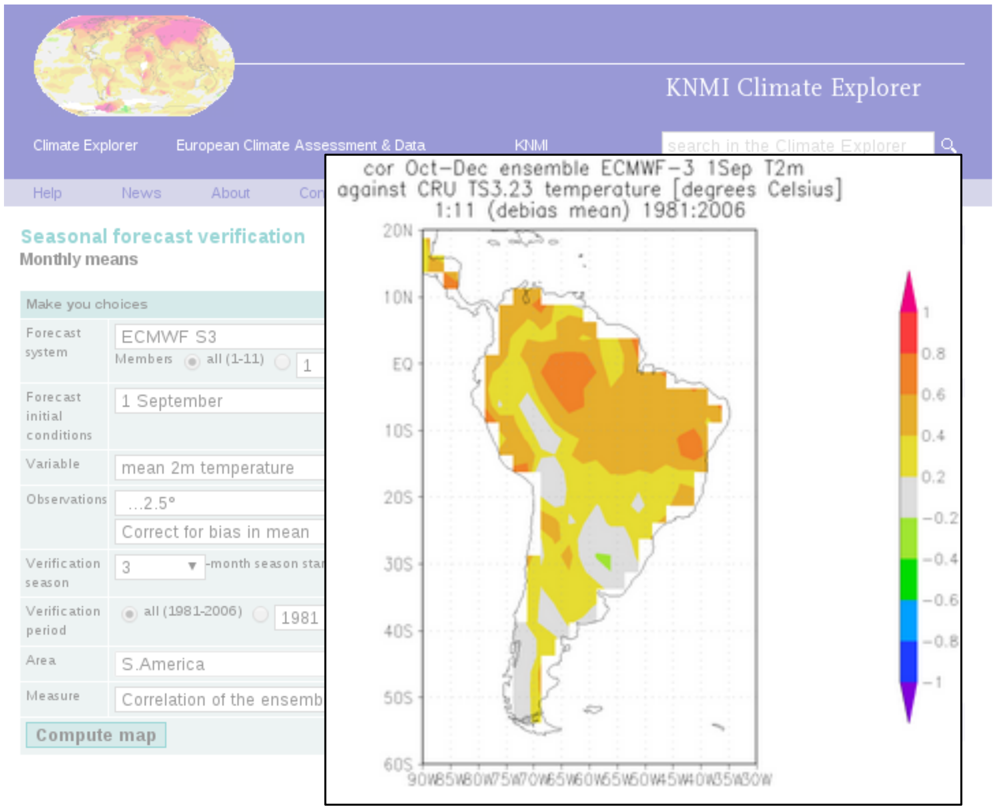
- Select ‘ECMWF S3’ and click.
- Initial conditions: 1 September
- Variable: mean 2m temperature
- Observations: CRU 2.5°
- Verification: 3-month starting in October.
- Area: South America
- Measure: ‘correlation of ensemble mean’
- ‘Compute map’

Seasonal forecast verification tool



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- Initial conditions:
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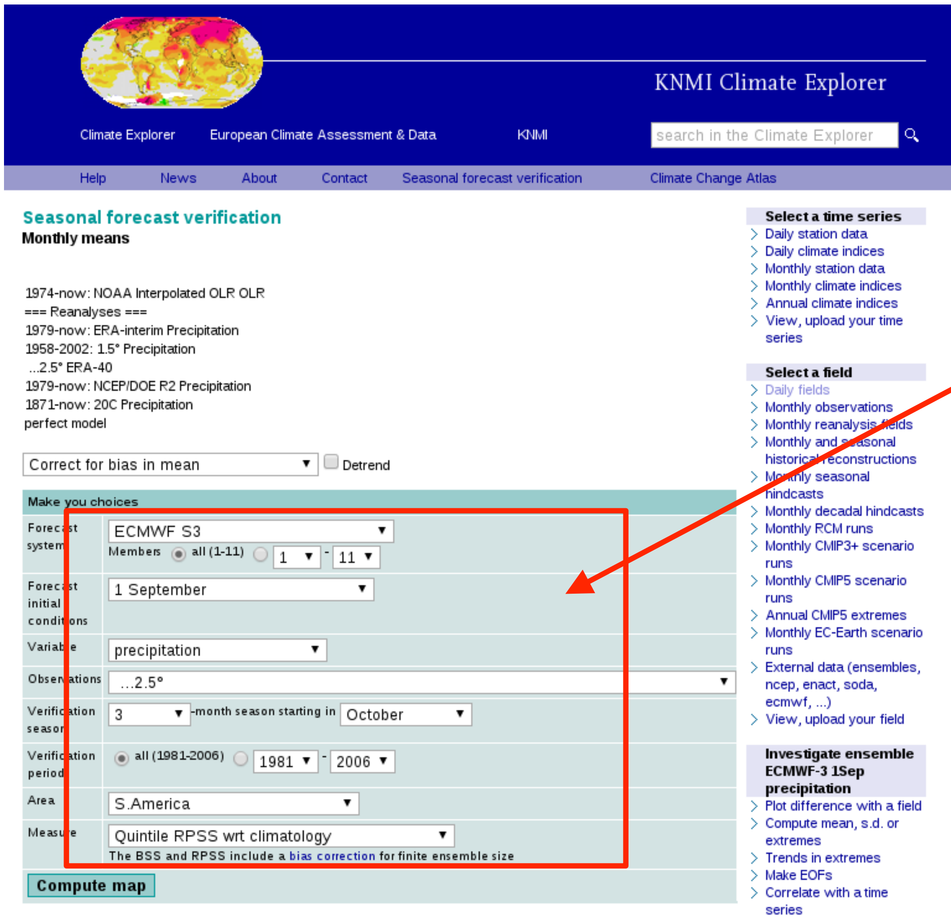
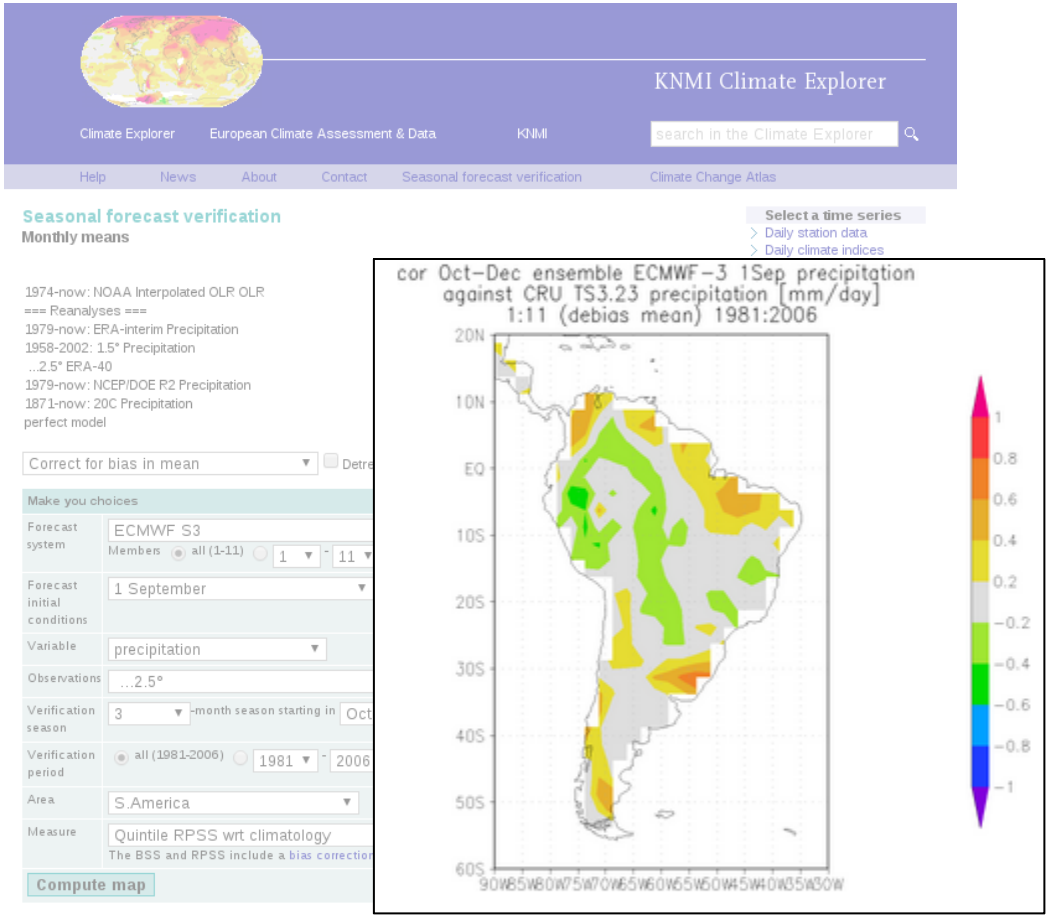
- Variable:
  mean 2m temperature
- Observations: CRU 2.5°
- Verification: 3-month starting in October.
- Area: South America
- Measure: ‘correlation of ensemble mean’
- ‘Compute map’

Seasonal forecast verification tool



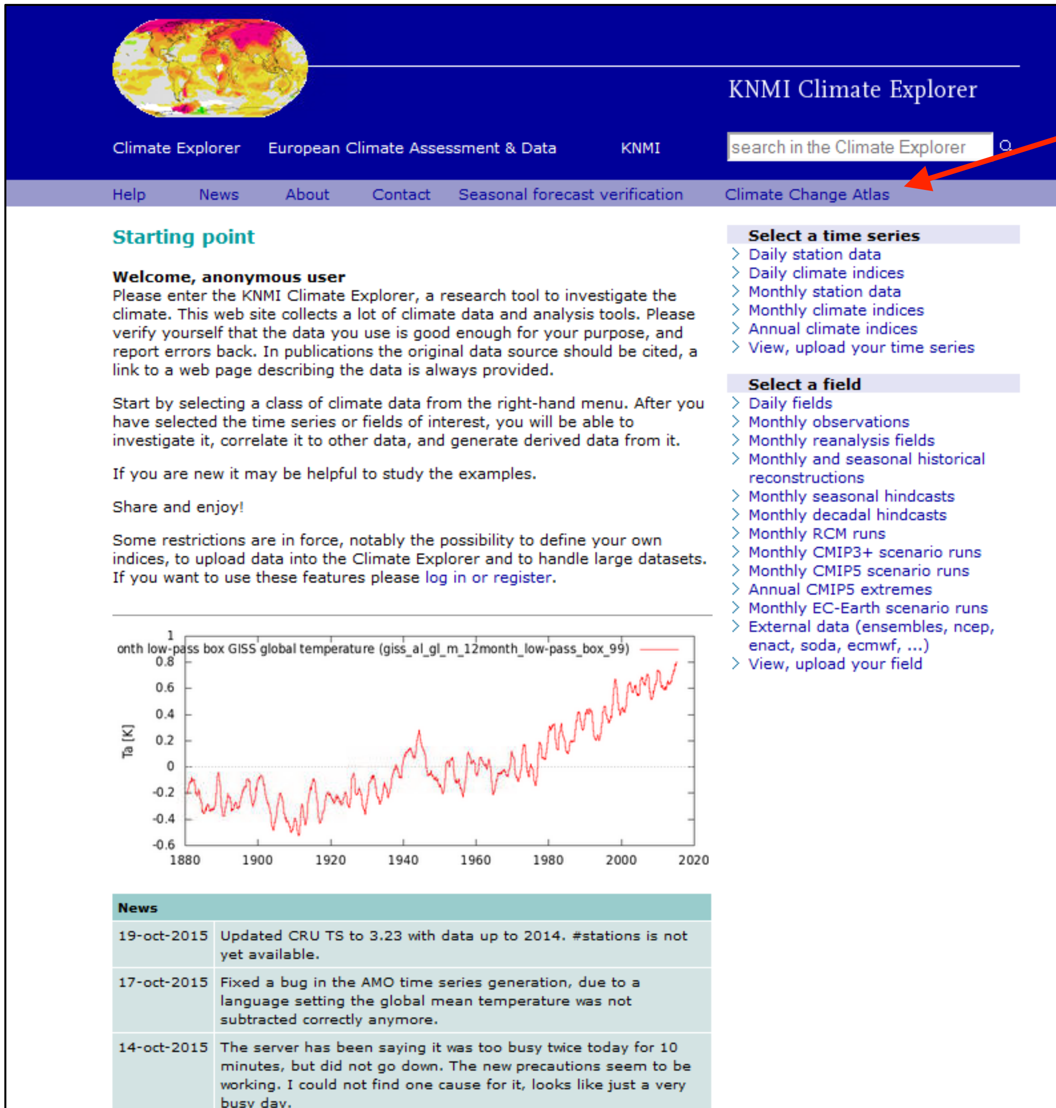
- Variable:
  mean 2m temperature
- Observations: CRU 2.5°
- Measure: ‘Quintile RPSS wrt climatology’
- ‘Compute map’

Seasonal forecast verification tool



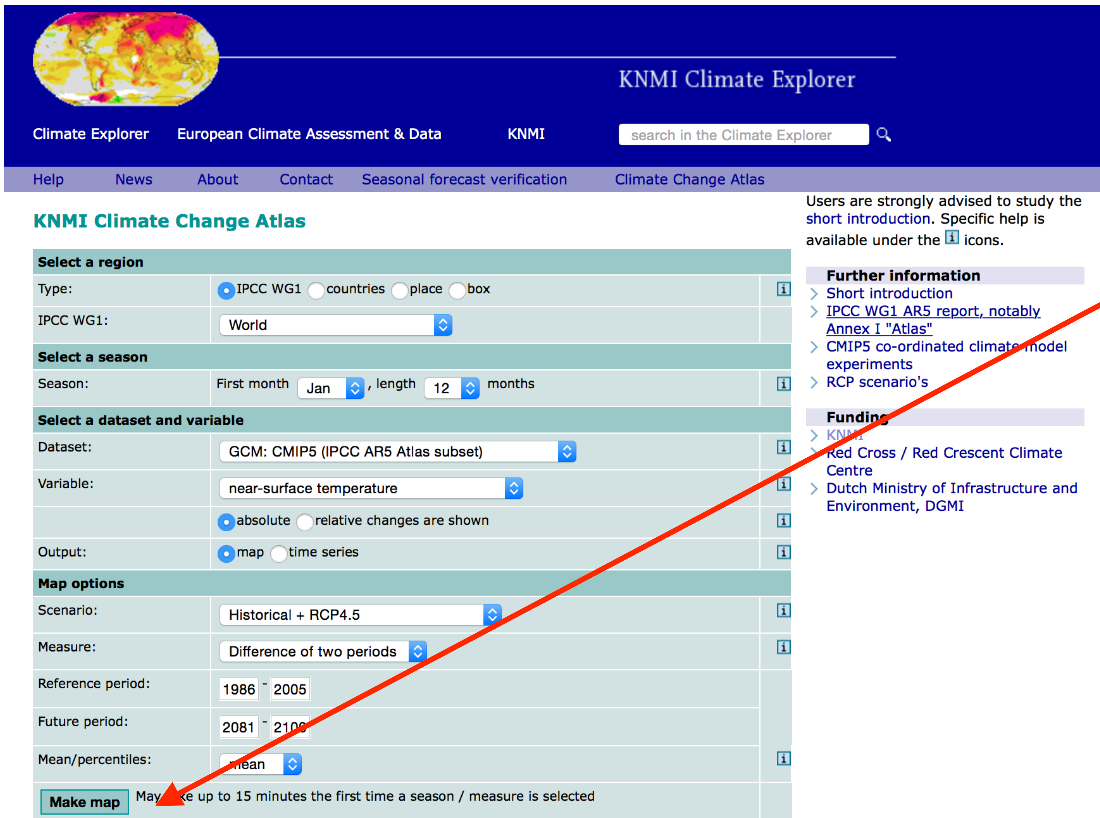
- Variable:
  mean 2m temperature
- Observations: CRU 2.5°
- Measure: 'Quintile RPSS wrt climatology'
- 'Compute map'.

Climate Change Atlas



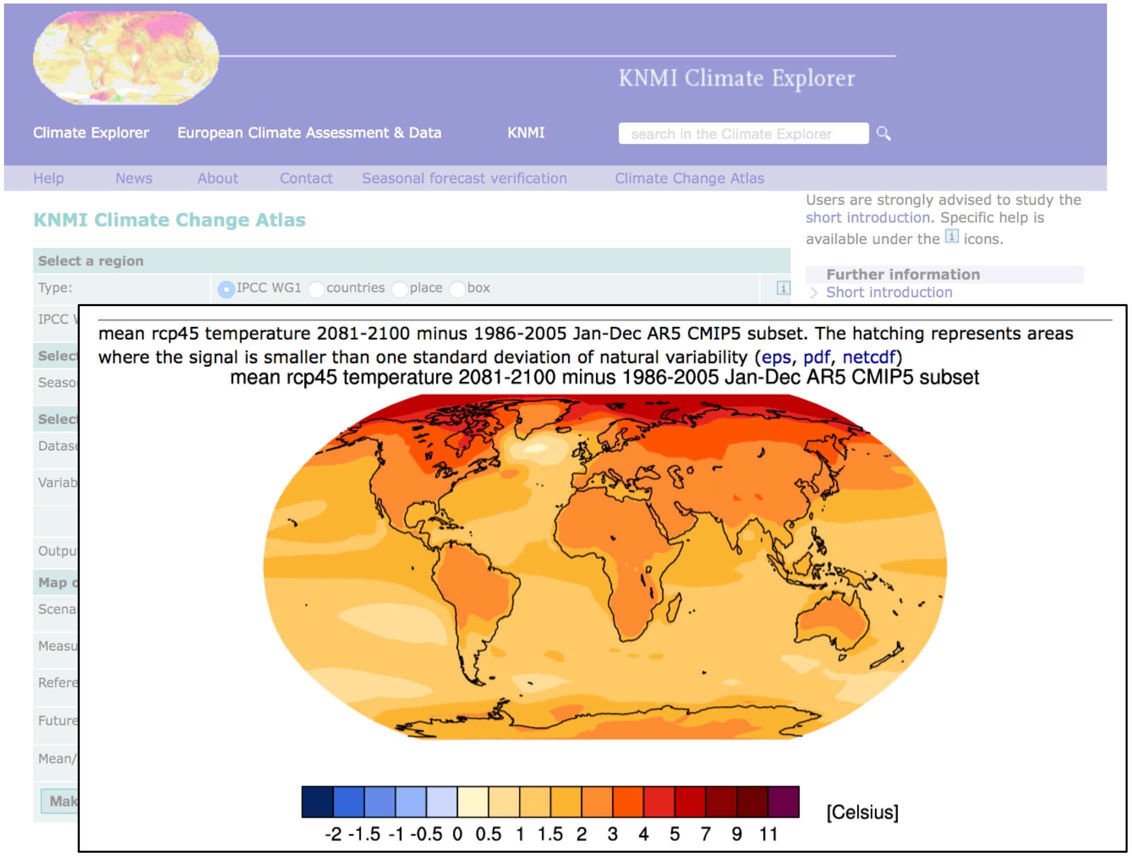
- Click “Climate Change Atlas”

Climate Change Atlas



- Click "Climate Change Atlas"
- Several different options… select the ones you want and click 'Make map'.

Climate Change Atlas



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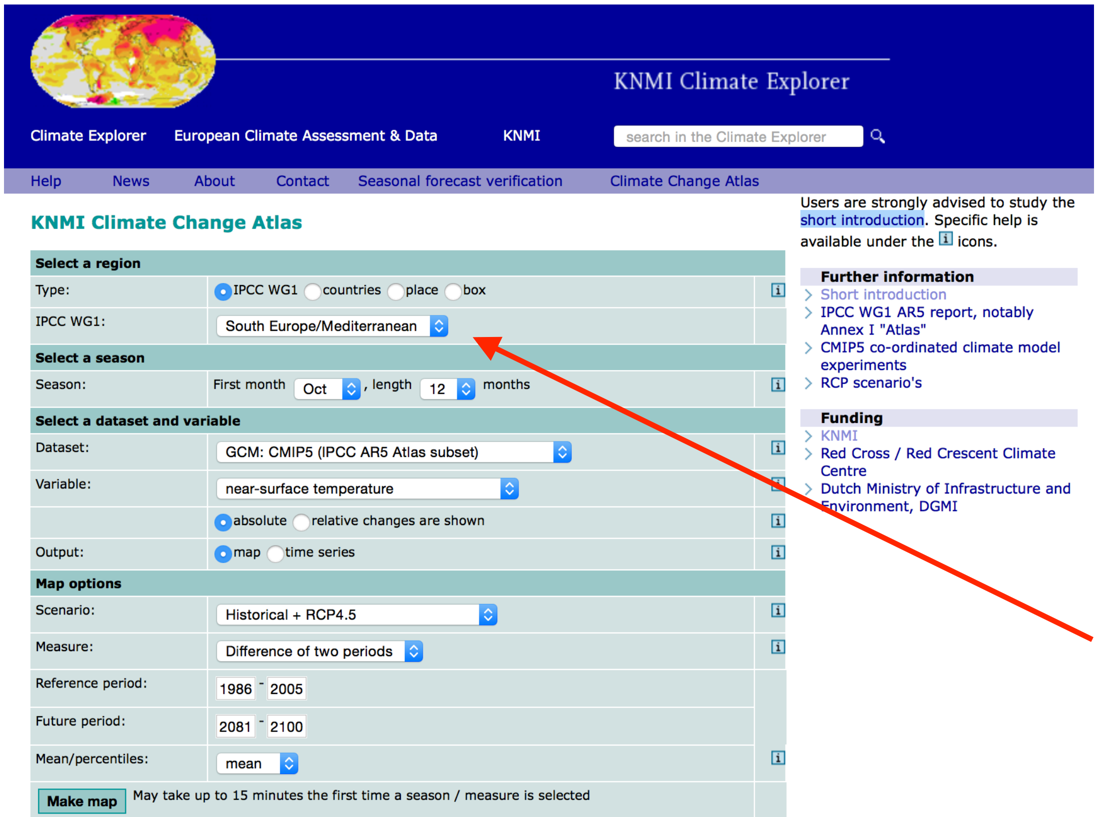
- Global temperature change plot (from IPCC AR5) – very familiar… but what about particular regions?

Climate Change Atlas



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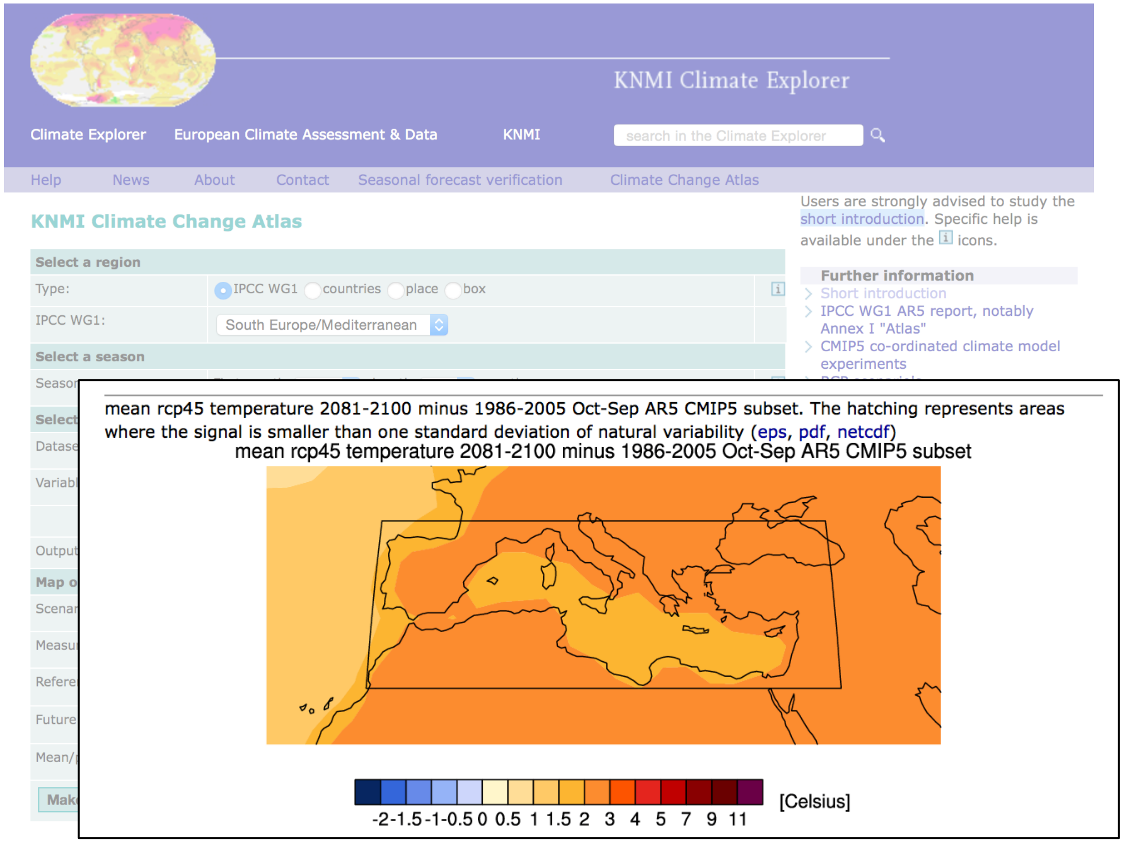
Climate Change Atlas



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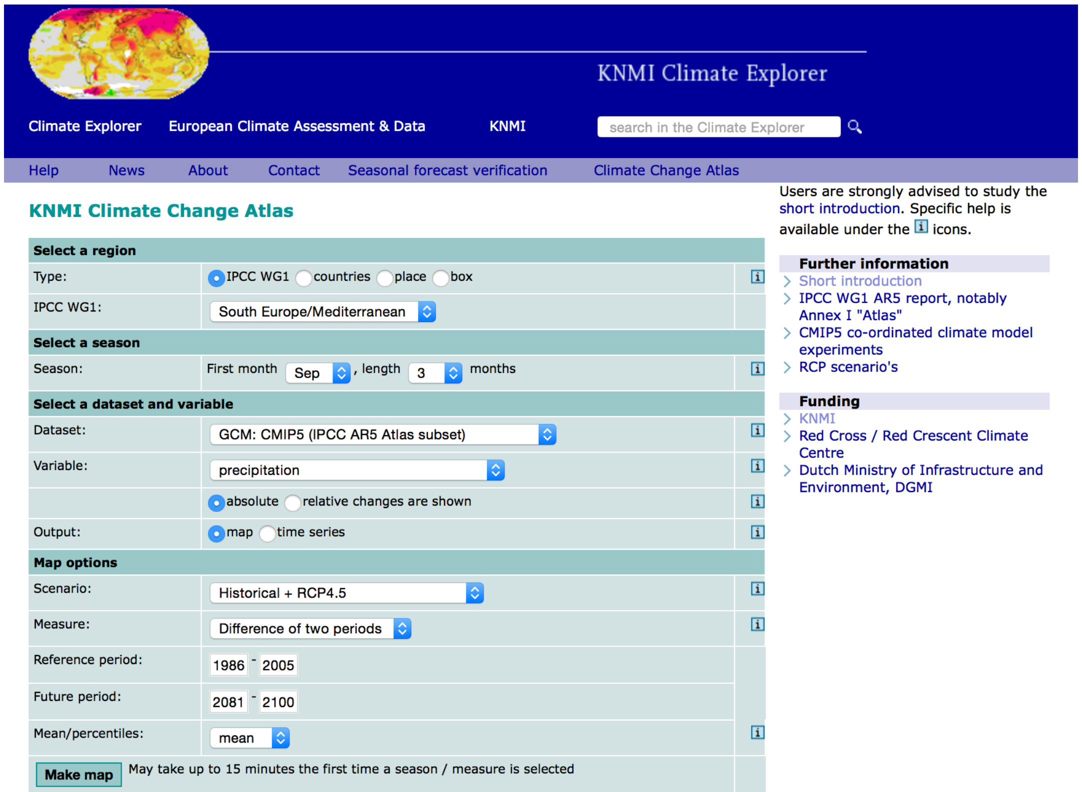
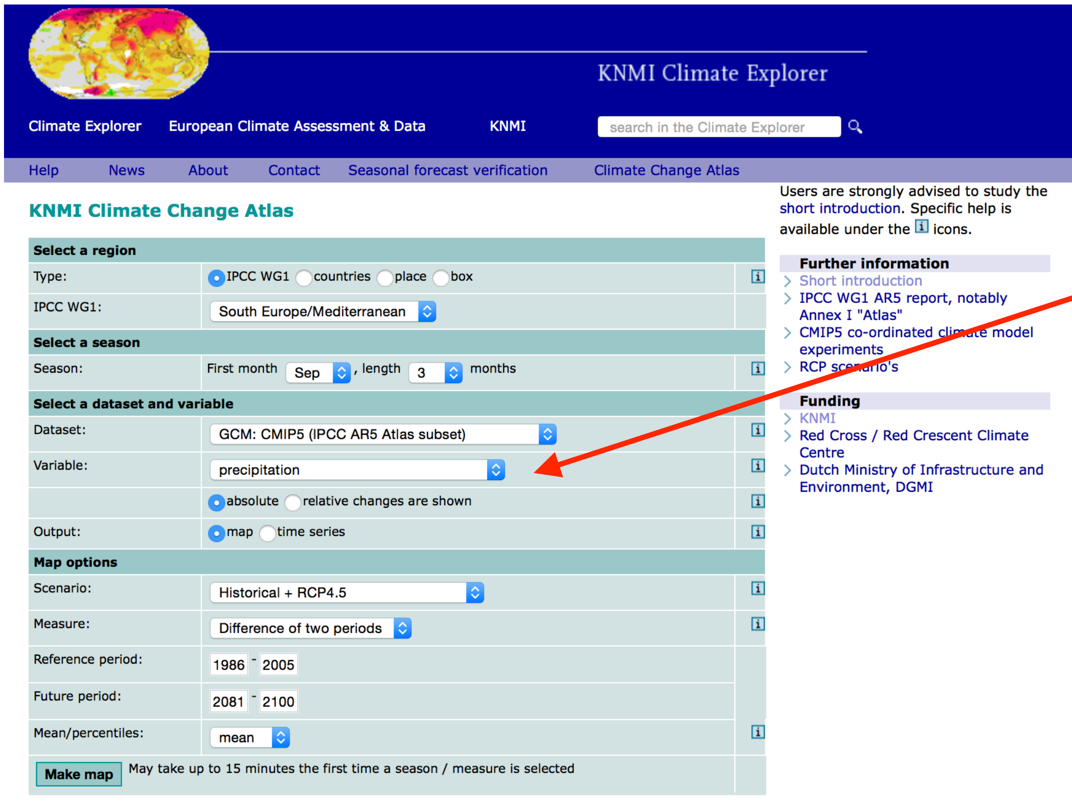


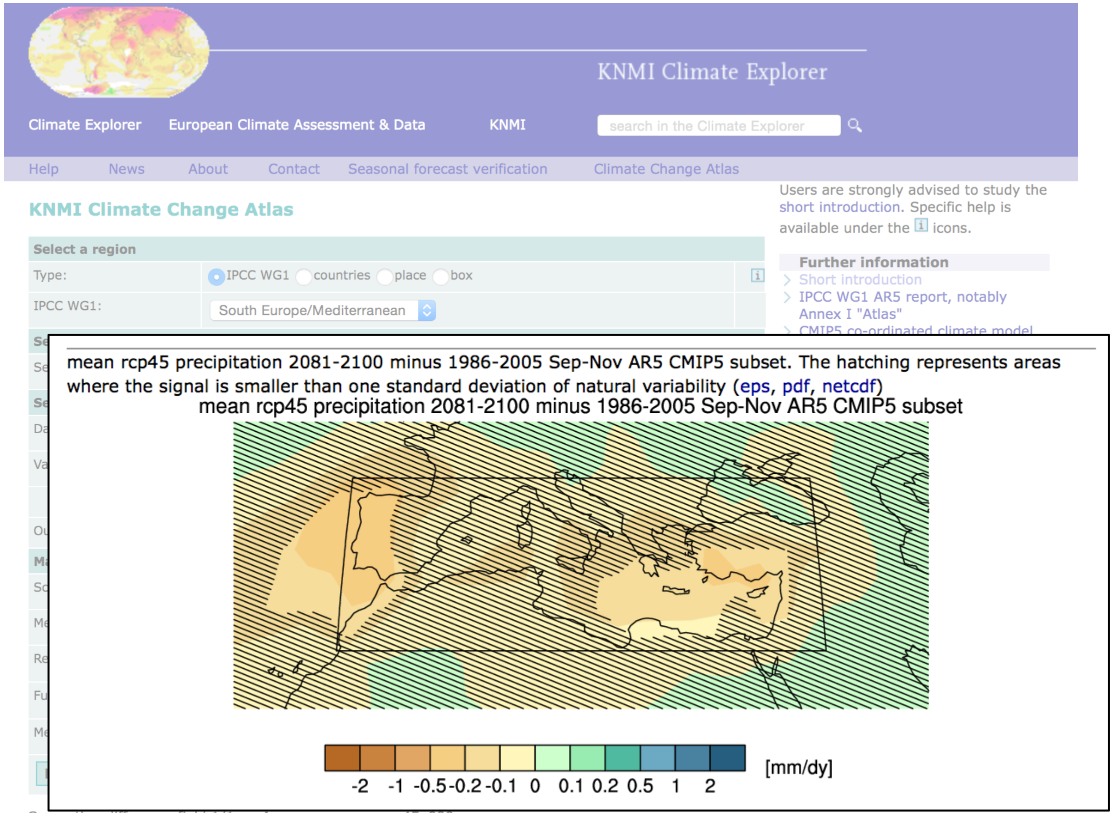
- How about precipitation change?

Climate Change Atlas



- How about precipitation change?
- Select variable: ‘precipitation’ and ‘Make map’.

Climate Change Atlas



- How about precipitation change?
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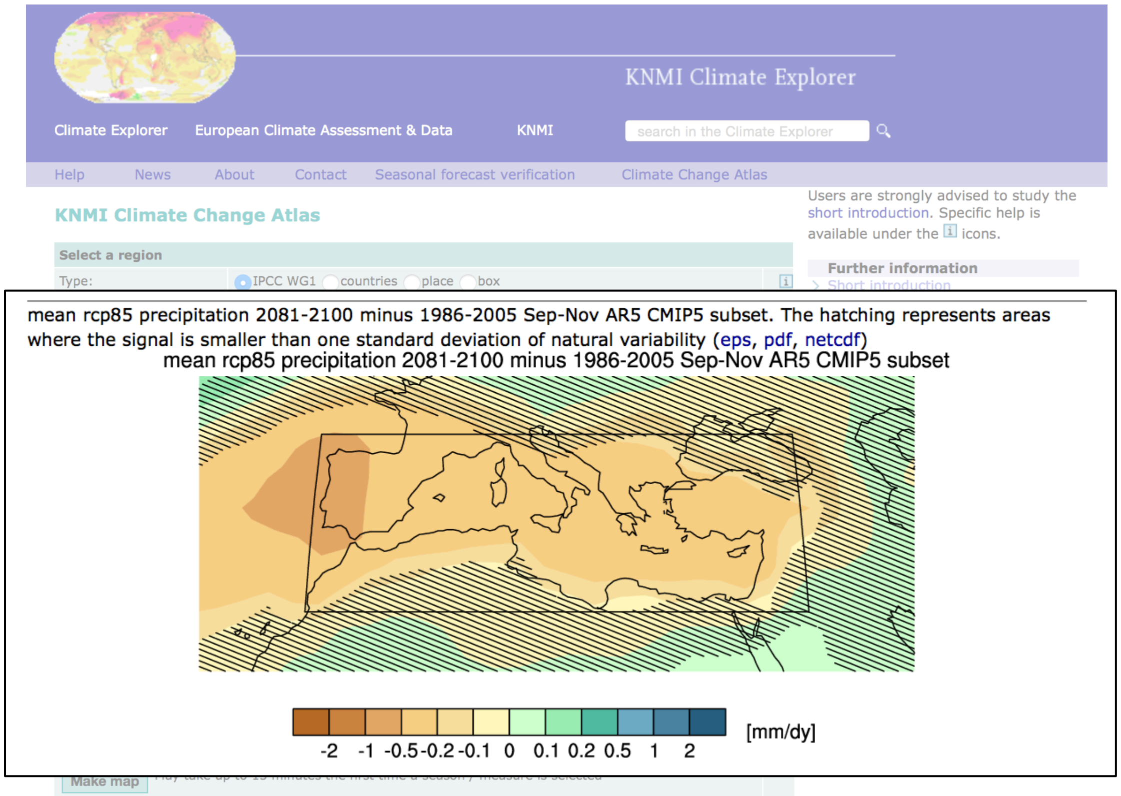
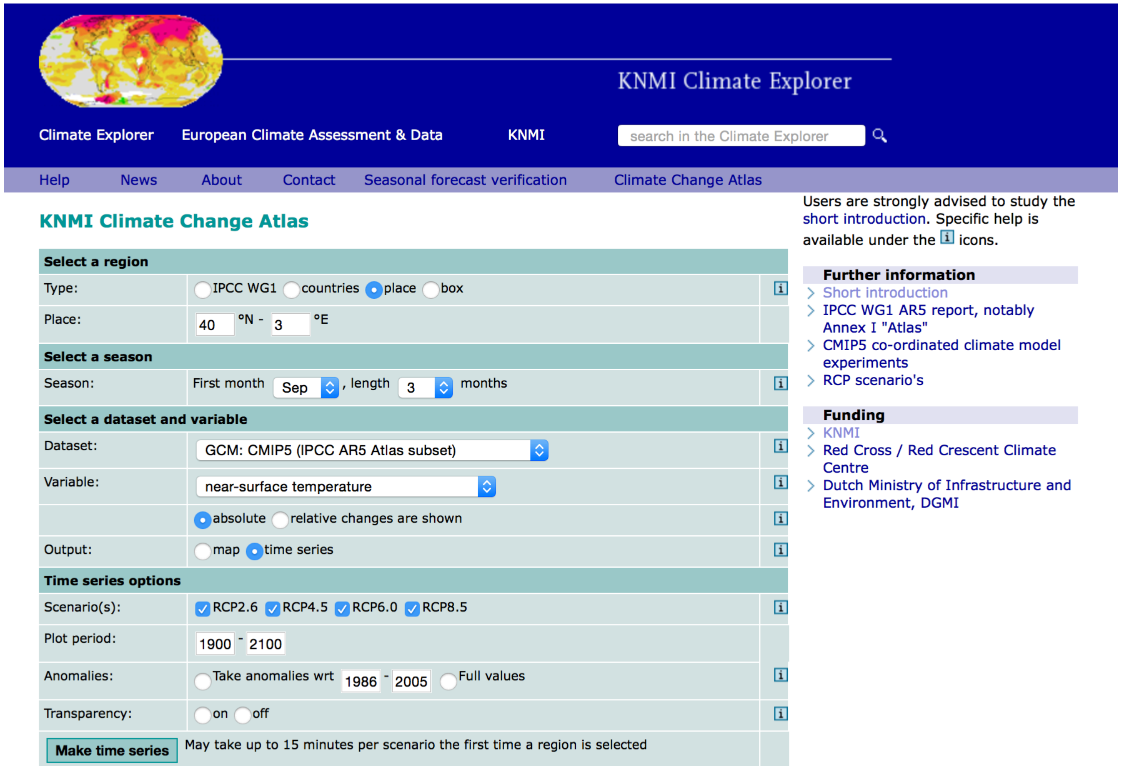
Climate Change Atlas



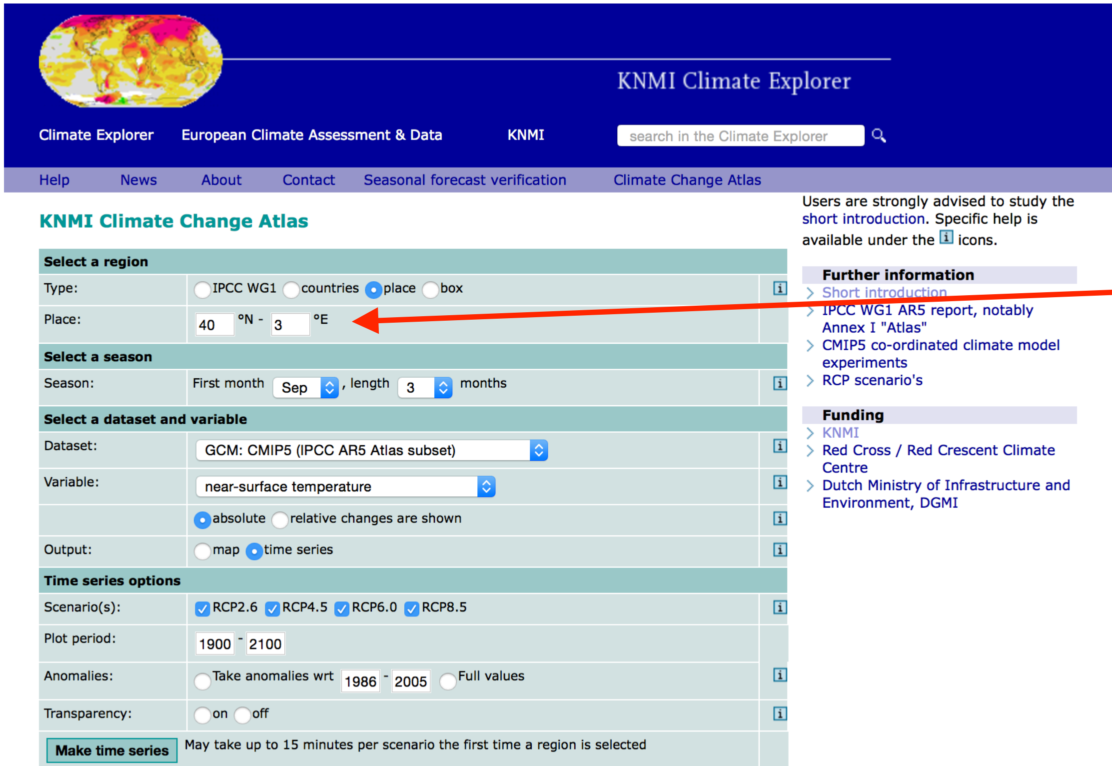
- How about precipitation change?
- Select variable: ‘precipitation’ and ‘Make map’.
- The hatching represents areas where the signal-noise ratio is low.
- We can also look at RCP8.5 where the signal is clearer.

Climate Change Atlas



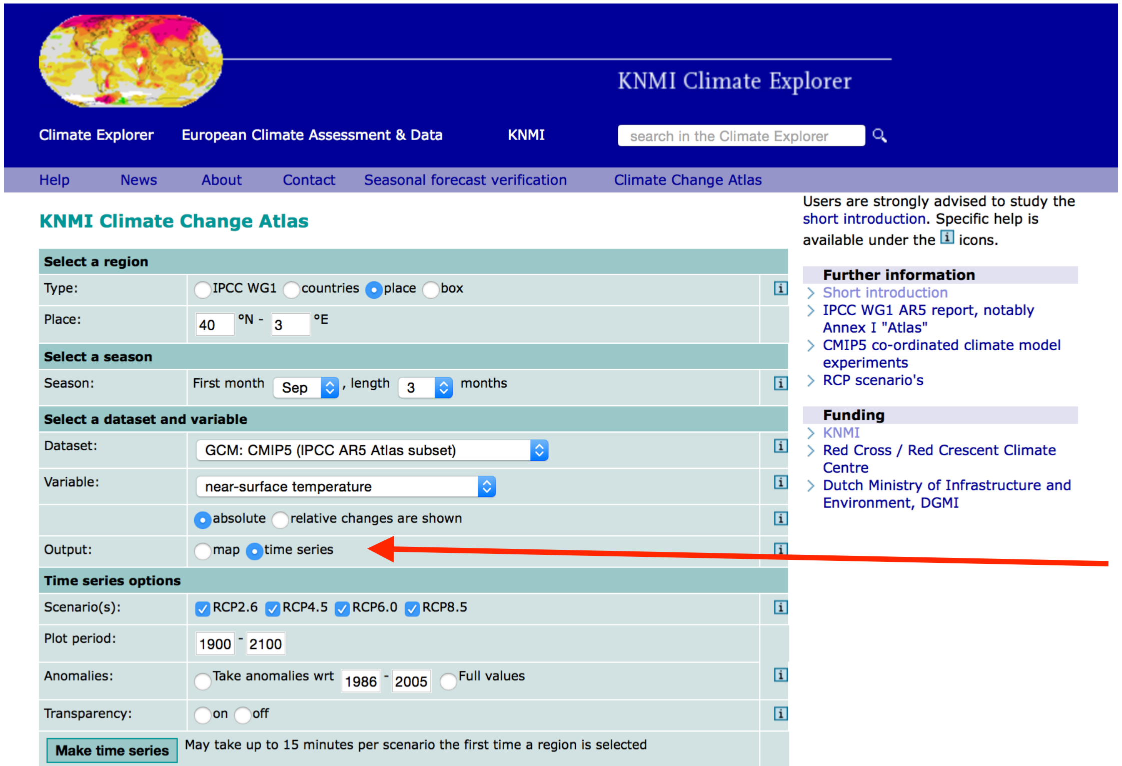
- We can also look at time series.

Climate Change Atlas



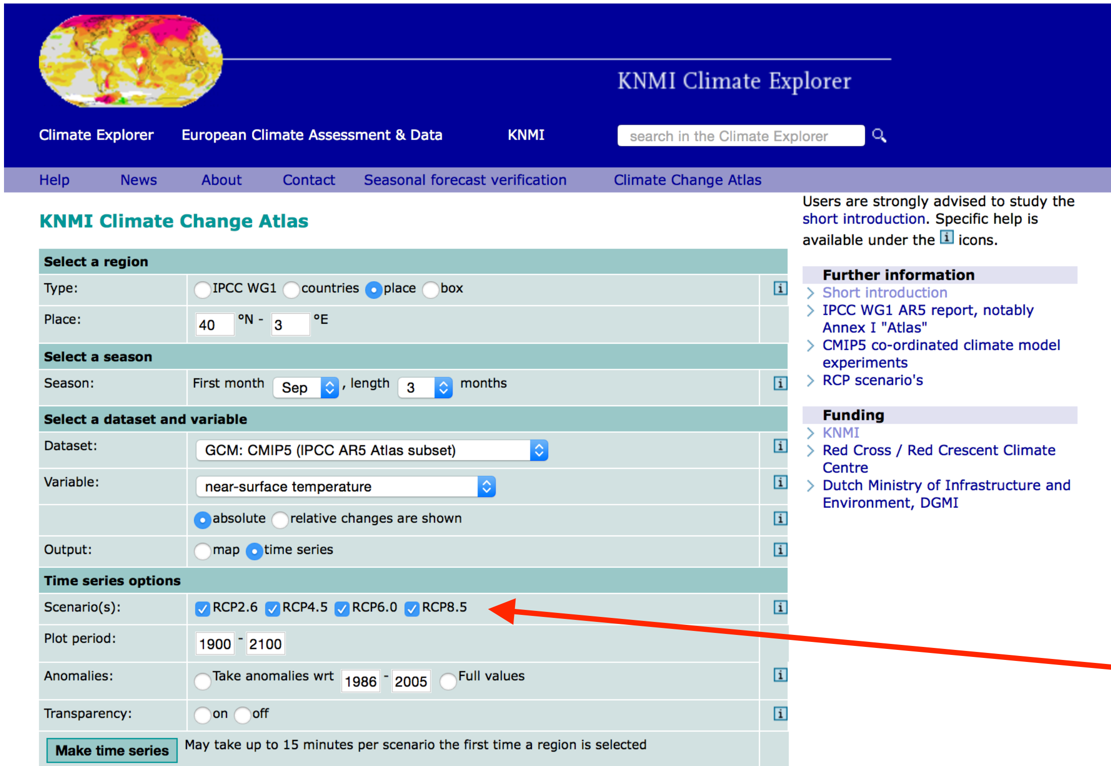
- We can also look at time series.
- Select ‘Place’ and 40N 3E; approximate location of Madrid.

Climate Change Atlas



- We can also look at time series.
- Select ‘Place’ and 40N 3E; approximate location of Madrid.
- Select ‘Variable’: ‘near surface temperature’.
- Select ‘Output’: time series.

Climate Change Atlas



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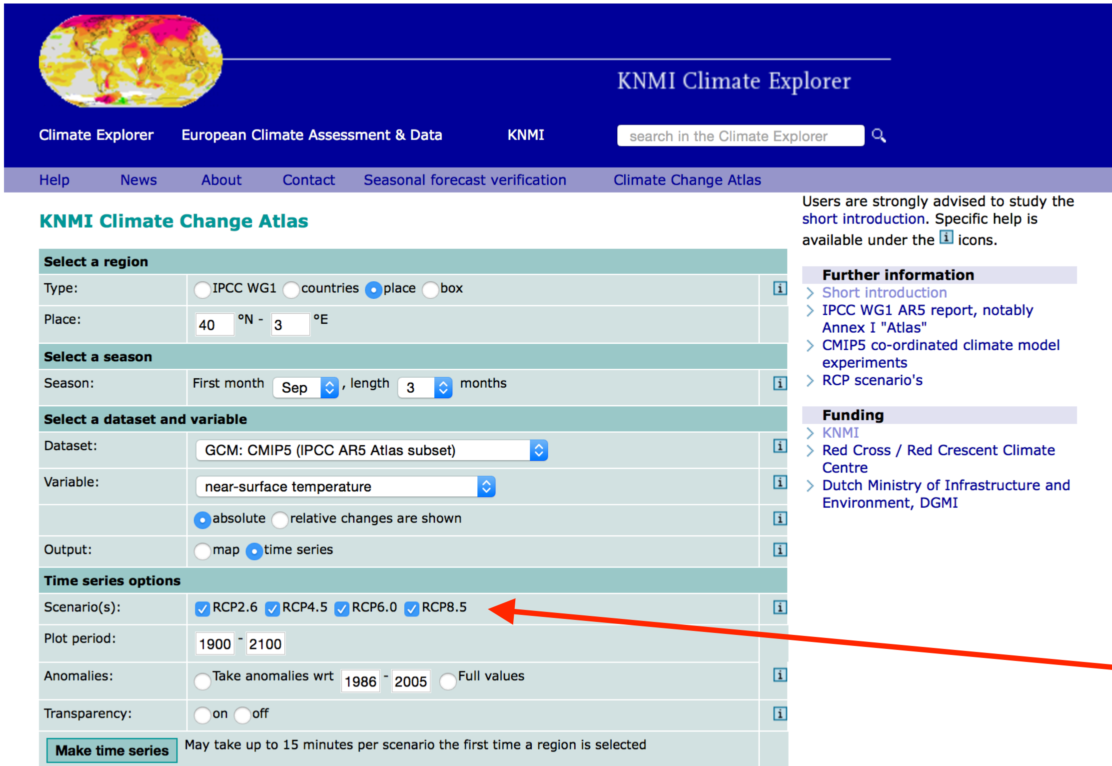
- Select 'Variable': 'near surface temperature'.
- Select 'Output': time series.
- I chose to look at all scenarios.

Climate Change Atlas



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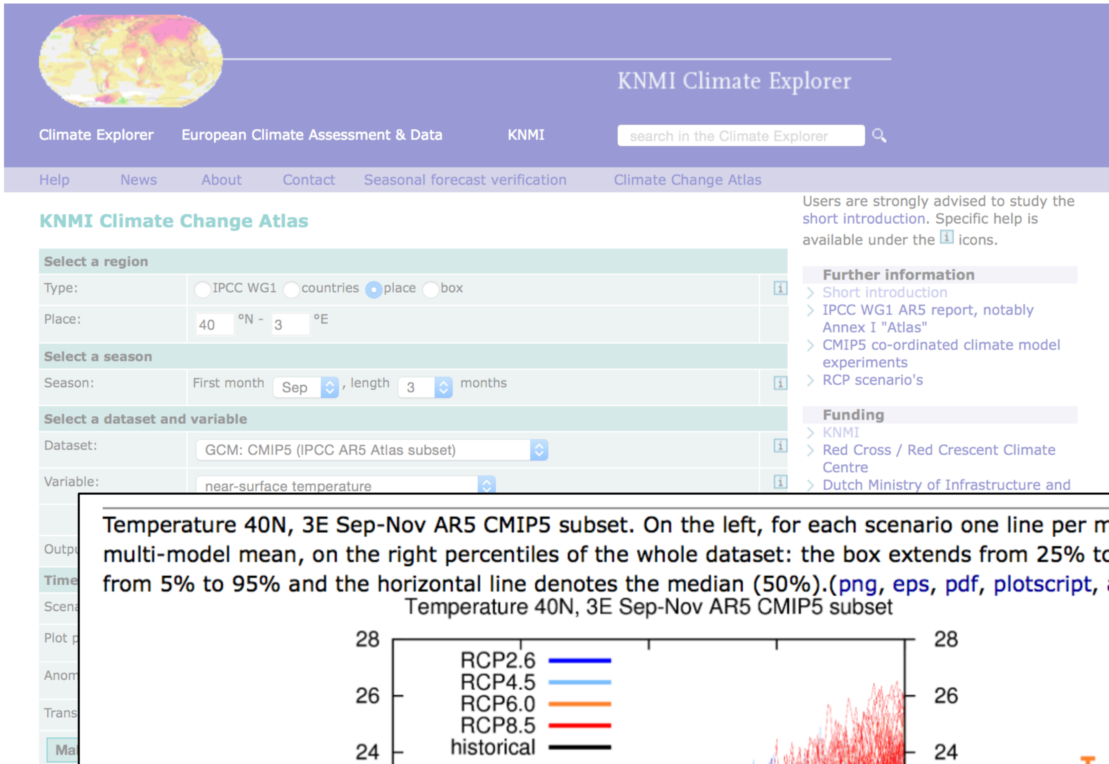
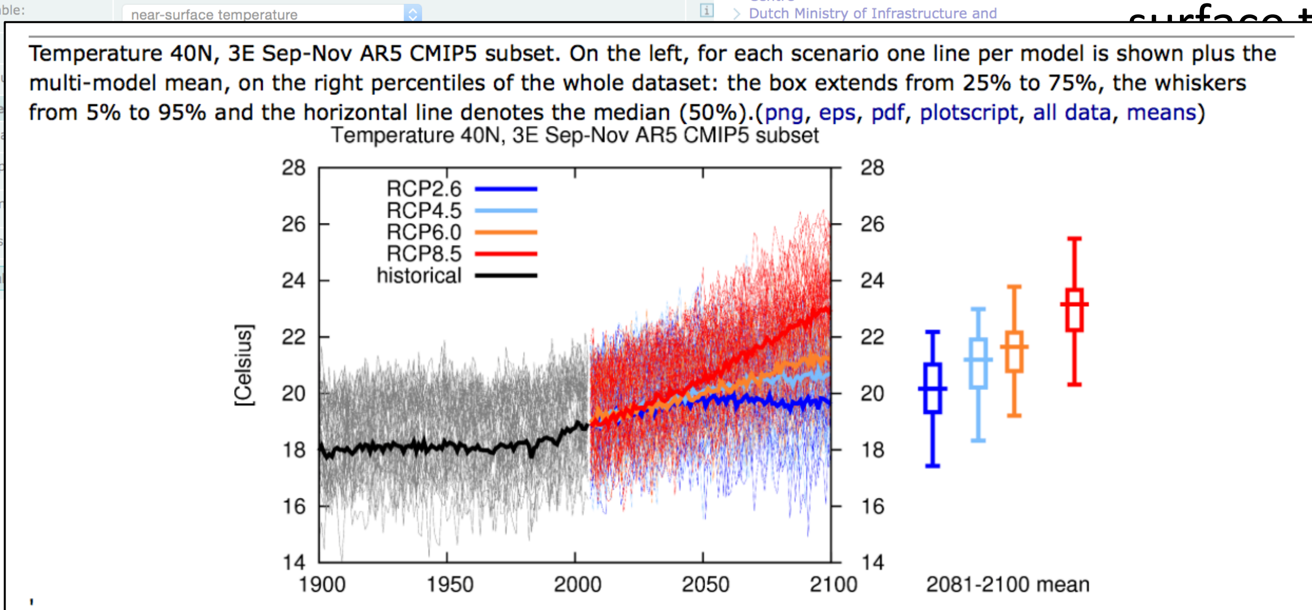
- Select ‘Output’: time series.
- I chose to look at all scenarios.
- WARNING: don’t do this yourself as the calculations will take 10-15 mins.

Climate Change Atlas





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The future of the Climate Explorer

- We hope that you find the Climate Explorer useful… its future development is driven by its users.
- Statistical functions are usually added on an ad-hoc basis… and often as a result of user feedback!
- Addition of hindcasts from ECMWF Season Forecast System 4.
- Possibility of dedicated funding at KNMI for future development…

Thank you

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