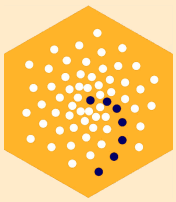# Climate indices based on different reanalyses datasets

Else van den Besselaar & Gerard van der Schrier

Royal Netherlands Meteorological Institute (KNMI)
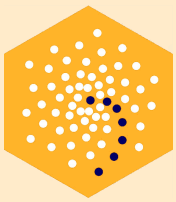
Indices codes

- Python code: ICCLIM
- R code: gridclimind
- CDO (Climate Data Operators)
- …

```
Now calculating indice PRCPTOT :
Using the reanalyses UKMO

Going into output file: /data2/Else/UERRA//UKMOens/Nativegrid/Indices/prcptot_UKMO_ens20_20060101-20101231_SON_latlongrid.nc

2017-11-22 10:51:32,847    ***************************************************************************************
2017-11-22 10:51:32,847    *                                                                                 *
2017-11-22 10:51:32,847    *        icclim                                                          V4.2.6    *
2017-11-22 10:51:32,847    *                                                                                 *
2017-11-22 10:51:32,847    *                                                                                 *
2017-11-22 10:51:32,848    *        Wed Nov 22 10:51:32 2017 GMT                                             *
2017-11-22 10:51:32,848    *                                                                                 *
2017-11-22 10:51:32,848    *        BEGIN EXECUTION                                                          *
2017-11-22 10:51:32,848    *                                                                                 *
2017-11-22 10:51:32,848    ***************************************************************************************
2017-11-22 10:51:32,895 Loading data...
2017-11-22 10:51:56,231 [Processing: ] 20.00%
2017-11-22 10:51:56,767 [Processing: ] 40.00%
2017-11-22 10:51:57,304 [Processing: ] 60.00%
2017-11-22 10:51:57,841 [Processing: ] 80.00%
2017-11-22 10:51:58,379 [Processing: ] 100.00%
2017-11-22 10:51:58,413    ***************************************************************************************
2017-11-22 10:51:58,413    *                                                                                 *
2017-11-22 10:51:58,413    *        icclim                                                          V4.2.6    *
2017-11-22 10:51:58,413    *                                                                                 *
2017-11-22 10:51:58,413    *                                                                                 *
2017-11-22 10:51:58,413    *        Wed Nov 22 10:51:58 2017 GMT                                             *
2017-11-22 10:51:58,414    *                                                                                 *
2017-11-22 10:51:58,414    *        END EXECUTION                                                            *
2017-11-22 10:51:58,414    *                                                                                 *
2017-11-22 10:51:58,414    *        CP SECS = 25.560                                                         *
2017-11-22 10:51:58,414    *                                                                                 *
2017-11-22 10:51:58,414    ***************************************************************************************
```
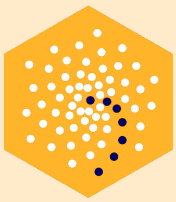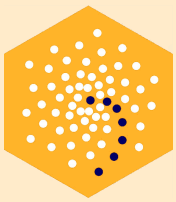
Indices codes

- Python ICCLIM (used here)

  - Can specify time period and/or season
  - Can specify which variable to use
  - Scriptable
  - Needs daily values as input
  - Need to split up into separate ensemble members
  - Not on rotated grids
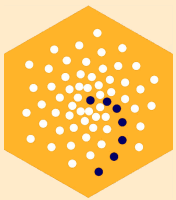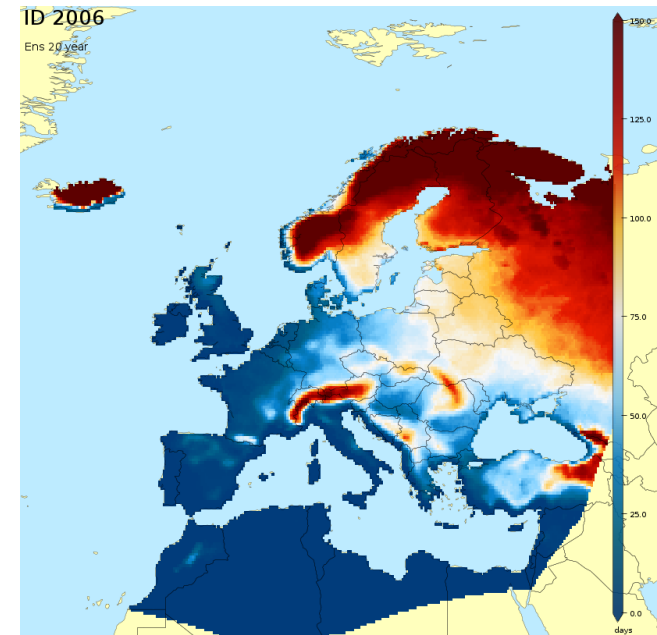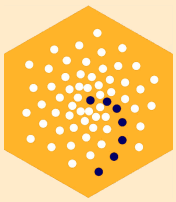 - Temperature input in Kelvin

Indices codes

- R code gridclimind

  - Can specify time period and/or season
  - Scriptable
  - Can not specify which variable to use (Can in newest version)
  - Only working on E-OBS (Newest version should work on other datasets)
  - Specific file name format
  - Needs daily values as input
  - Need to split up into separate ensemble members
  - Not on rotated grids
  - Temperature input in Celsius

Indices codes

- CDO

  - Scriptable
  - Works on rotated grids but header no longer in CF-convention
  - Needs daily values as input
  - 1 output value per input netcdf file
  - Need to split up into separate ensemble members
  - Temperature input in Celsius

ECA&D

Steps for calculations

- Extract data from MARS archive
- Create netcdf from grib files (we use fimex)
- Make daily values
- Split into individual ensembles members (if appl.)
- Regrid to regular lat/lon grid (closest to native grid as possible)
- Convert to Kelvin
- Run python indices script
- Combine ensemble members (if needed)

Indices availability

- Base period 1961-1990
- Not all reanalyses available for base period
- Some indices ready
- Available through http://www.ecad.eu/uerra/uerra_indices.php
- Work in progress...

UERRA climate indices

The UKMO reanalyses have been regridded to a 0.125 x 0.125 degree regular latitude-longitude grid using bilinear interpoloation. This was needed as the indices code icclim cannot handle rotated grids. The indices based on E-OBS are calculated on its native 0.25 x 0.25 degree regular latitude-longitude grid.

TX (Maximum temperature)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON

TXx (Maximum of daily maximum temperature)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON

Txn (Minimum of daily maximum temperature)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON

SU (Summer days)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON
E-OBS (2006, 100 ensemble members)	Annual

CSU (Consecutive Summer Days)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON
E-OBS (2006, 100 ensemble members)	Annual

ID (Ice Days)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON
E-OBS (2006, 100 ensemble members)	Annual

TN (Minimum temperature)

UKMO (2006-2010, 20 ensemble members)	Annual DJF MAM JJA SON

Indices visualization

- Few indices on http://euro4mvis.knmi.nl
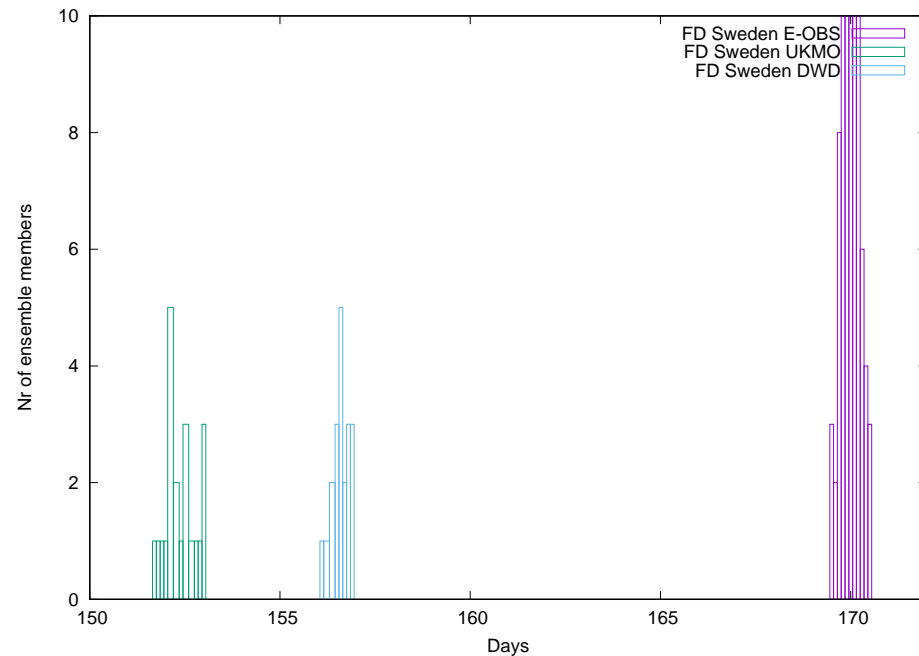- Click on 'Adaguc Viewer'
- Click top left viewer on 'Add layers'
- Click on 'UERRA'
- Select different dataset with drop down menu

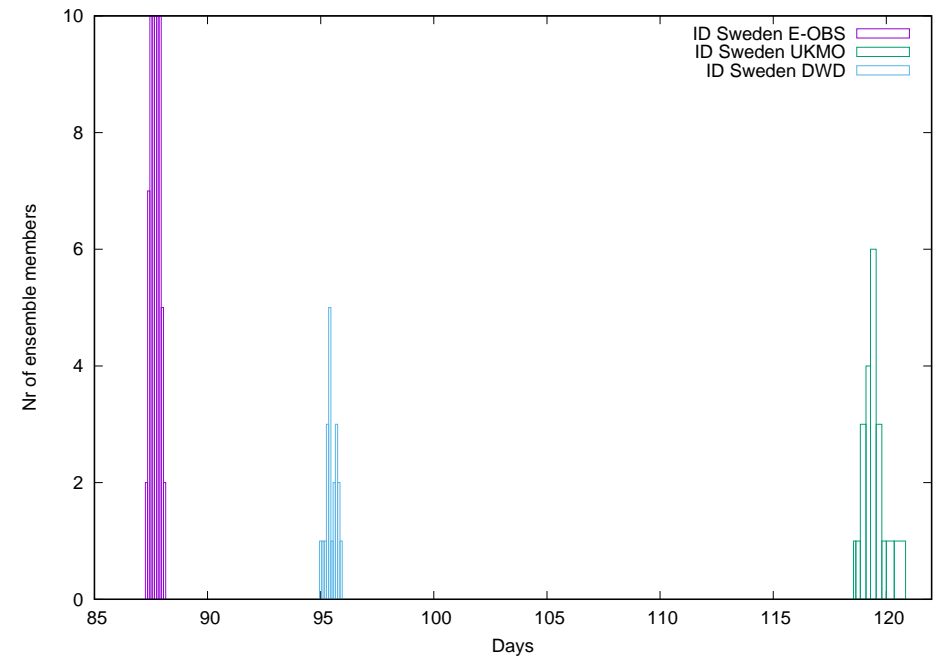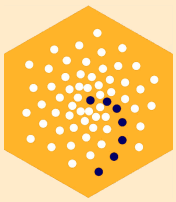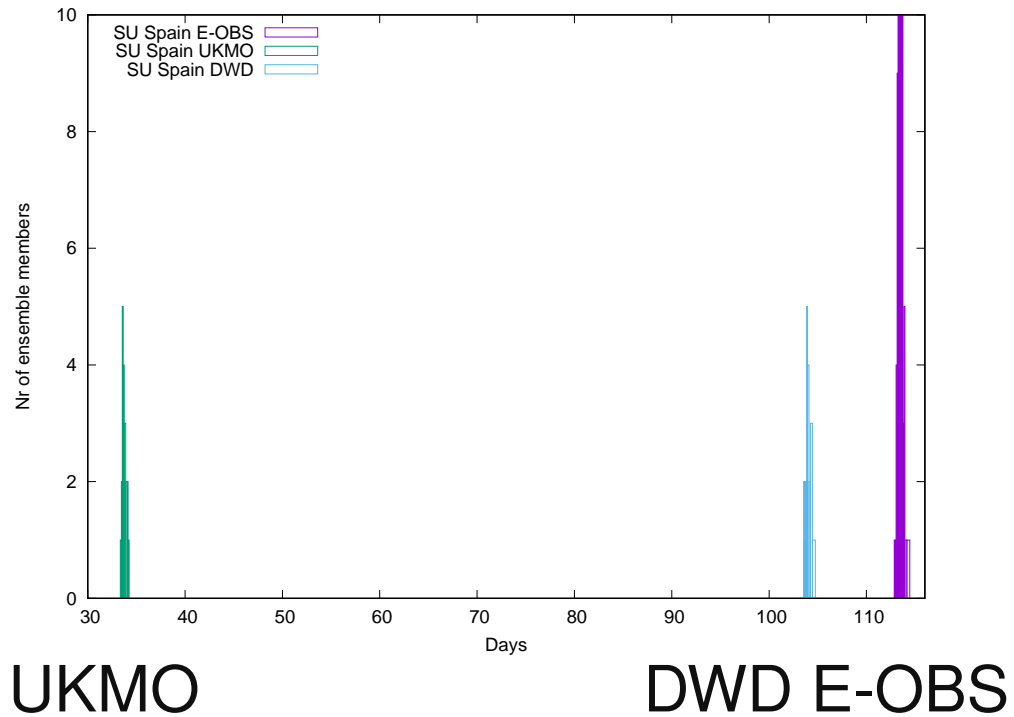# Example comparing datasets

Frost days Sweden

Ice days Sweden

Example comparing datasets

Summer days Spain

Tropical nights Spain

UKMO   DWD E-OBS   E-OBS   UKMO   DWD

Used for e.g.

Copernicus State of the Climate in September and October 2017

Info

- icclim: http://icclim.readthedocs.io/en/latest/
- gridclimind: https://github.com/ECA-D/climind/tree/includeMoreVariables
- CDO: https://code.mpimet.mpg.de/projects/cdo/

Download of UERRA indices files:
http://www.ecad.eu/uerra/uerra_indices.php