

# **Developing conventions and protocols for representing derived climate and climate extremes indices**

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**with input from  
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## What is "derived climate and climate extremes indices" ?

A simple one:

*Frost days* (number of days when min. temp. drops below 0°C),

More complex ones:

Longest dry / wet / hot / cold spell

Growing / cooling / heating degree days

Max. precipitation accumulated over N days

Number of days above / below the climatological daily percentile value

Some involve more than one variable (e.g. precip. and temp.)

and more ....

Often they involve one or several threshold(s)

## How are they defined – who does it ?

(1) **Many groups** are producing such indices, often they are **partly user driven**

(2) Well-established core sets exist:

CCI/WCRP/JCOMM Expert Team on Climate Change Detection and Indices

**(ETCCDI)**

<<https://www.wcrp-climate.org/data-etccdi>>

WMO/CCI Expert Team on Sector-specific Climate Indices (**ET-SCI**)

<<http://www.wmo.int/pages/prog/wcp/ccl/opace/opace4/ET-SCI-4-1.php>>

European Climate Assessment & Dataset (**ECA&D**) and its international arm ICA&D

<<http://www.ecad.eu/indicesextremes/index.php>>

They share the same root: substantial overlap in indices, persons and software

Often netCDF files, no common metadata standard, sometimes elements from CF

## Why of interest to CF Metadata community ?

- Recurring threads on CF-Metadata email list
- ETCCDI has produced indices datasets from several cycles of CMIP  
These datasets have been used in several IPCC assessments
- Interaction on CF-Metadata list some 8-9 years ago --- partial progress
- Substantial development since then
  - ... of the CF convention
  - ... of user expectations on data quality and information
  - ... of data dissemination methods and infrastructure
- Increasing need for a metadata “standard” (= workable guidelines)
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## To be concrete: ETCCDI indices as a showcase (1)

Simple threshold indices are OK:

- number of days above (below) threshold, and [max] spell length: **CF1.7, example 7.12**

But if we change the fixed threshold to the 30yr climatological annual cycle of the 95<sup>th</sup> percentile of daily temperatures for each individual gridcell/station, i.e. the temperature **threshold is a 3-dim variable** [365, nlat, nlon], that is related to a quantile constant (0.95)?

this is an **important class of indices** common to ETCCDI and ET-SCI:

(txgt50p, tn10p, tx10p, tn90p, tx90p, r95ptot, r99ptot, r95p, r99p, WSDI, CSDI, ...)

## To be concrete: ETCCDI indices as a showcase (2)

(1) ETCCDI *growing season length* ("*gsl*") is based on a slightly involved definition of the start and the end of the season ....

Relates to the CF-Metadata email thread last spring

Recording "day of year on which something happens"

Furhermore, *gsl* is based on the "climatological year", i.e.

NH: 1 January – 31 December, SH: 1 July – 31 June

that complicated the time coordinate

(2) ETCCDI *warm spell duration index* ("*wsgi*") is count of days in spells of at least 6 consecutive days when  $T_{max} > 90$ th percentile

## A few other issues that have come up

- Standard names for non-strict comparisons :
  - number\_of\_days\_with\_air\_temperature\_above\_threshold (in CF)
  - number\_of\_days\_with\_air\_temperature\_at\_or\_above\_threshold (not in CF)(use case from ET-SCI)
- Indices based on high-frequency data (higher than daily resolution):  
Currently several standard names specifically states "...\_days\_...")  
but higher resolution are needed for precip and wind,  
e.g. precip "time of day on which something happens (begins/ends)"  
calls for "**frequency agnostic standard names**"
- How to handle **multi-variable indices**, e.g.
  - "wet and warm days" (precip > P, temp > T,
  - "zero-crossing days" (min.temp < 0°C and max.temp > 0°C)
- ... many more issues out there ...

## Suggestion

- An informal group of interested people is formed to take these matters further  
by
  - building, of course, on own experience and ideas
  - using ETCCDI and ET-SCI indices as a starting point  
(widely used and influential, link to CMIP and IPCC, provides reference software)
  - drawing on relevant discussions in archived email threadsto
  - produce templates, like example 7.12, where the CF machinery is already in place
  - suggest new standard names where appropriate
  - consider and explore extension to CF standards to handle derived climate and climate extremes indices
  - suggest where to draw the line what the CF conventions reasonably can and cannot handle in the foreseeable future
  - suggest next steps



