

# Trans Weather Patterns – an extended outlook for the future climate

**A. Spekat, F. Kreienkamp, W. Enke**

Climate & Environment Consulting Potsdam GmbH

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# Themes

- Development
- New paths in the TWP study
- Results
- Outlook



## Background

- We are associated with the COST733 activity that addresses the identification of circulation patterns.
- Our tool is WETTREG, a statistical downscaling method.
- In a learning phase, the environment-to-circulation approach is applied and patterns are identified in the current state of the climate system.
- Enter pattern recognition, using a similarity measure to see if these patterns can be re-identified in a future climate, as modelled in GCM simulations.
- But is the collection of patterns the same in a future climate?
- Maybe other patterns emerge which we do not yet see?



## There are signs...

- Experience: The frequency distribution of the patterns increasingly degenerates in the scenario simulations over time
- i.o.w. initial resemblance of normal distribution develops into an accumulation in the high-temperature classes.

WL	2001	2011	2021	2031	2041	2051	2061	2071	2081	2091
1	0.4	1.0	0.0	0.2	0.1	0.0	0.2	0.0	0.0	0.0
2	4.2	3.5	1.7	2.7	1.7	0.5	1.2	0.1	0.1	0.1
3	12.3	9.5	8.8	9.0	5.9	3.4	2.8	3.2	1.2	0.9
4	22.0	21.0	19.3	16.1	17.6	12.2	10.9	10.2	5.0	4.5
5	20.7	24.7	20.2	17.8	21.1	21.7	17.9	19.1	13.8	14.8
6	13.0	17.2	17.1	15.4	17.5	21.2	18.2	17.5	21.2	18.5
7	12.3	11.2	12.6	12.8	13.8	15.2	14.2	13.3	12.8	16.4
8	5.3	5.8	5.7	10.9	11.3	9.6	13.3	13.8	17.9	16.5
9	4.9	3.2	7.4	8.6	5.8	7.5	7.5	10.0	10.4	9.0
10	4.9	3.2	7.2	6.4	5.2	8.7	13.8	12.8	17.5	19.3



- Another experience – increasing number of days in which the similarity measure indicates suboptimal fit.
- Hypothesis: There is a development of circulation patterns which leave the current "event horizon", let us call them **Trans Weather Patterns** (TWP).

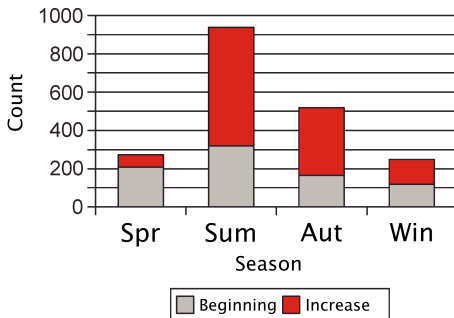
## TWP: A precursory study

- Strategy, learning from the experience:
- There are days in which a pattern is assigned, all right, but with a low similarity.
- Do those days have something in common?
- Build an “extra pool of misfits”, i.e. of days when the similarity measure is above a threshold.
- Perform separate pattern search just for this pool.



## TWP I

- Number of “misfits” is larger in summer than in other seasons
- Figure: Number of members of the extra pool (low similarity with known patterns) 2011–2040 (grey) and increase of this number from 2011–2040 to 2071–2100 (red); Region Central Germany









## Accumulating knowledge...

- TWP probably are **not** new atmospheric configurations with other positions of steering centers.
- TWP are distinct and extreme “cousins” of the – so far – warmest class.
- As shown earlier: There is a reduction of diversity in the classes towards the end of the 21st century.
- We were applying the environment-to-circulation approach, so: Cold classes die out, warm classes accumulate more and more members.
- Another rationale for the existence of new structures.



## Temperature signal – no TWP

- Difference between Scenario A1B, A2 or B1 2071–2100 and ECHAM5 20C 1971–2000.
- Average over Germany, from study of the Umweltbundesamt in Dessau in 2007.

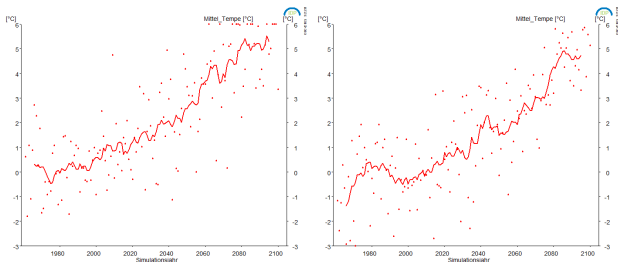
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	A1B	A2	B1
$\Delta T_{mit}$ [K]	+2,3	+2,1	+1,8

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# Temperature signal directly from ECHAM5 – no downscaling

- Difference between Scenario A1B 2071–2100 and ECHAM5 20C 1971–2000.
- The magnitude of the signal as produced by a GCM.



(a) Summer

(b) Winter



## What's to be expected?

- Clearly stronger orientation towards the GCM results, as compared to previous WETTREG studies
  - Stronger temperature signals
  - stronger extremes, particularly for temperature
  - Cannot be ruled out: Potential influence of model-specific signals!
- Source for new regional studies



- Painting by Cezanne: Bridge and Three Sources
- May give you an idea that sometimes things are recognizable, yet not completed.



