COST 733 – WG4: Applications of weather type classifications

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WG4 within COST733?

WG1: Existing methods and applications (finished!)

WG2: Implementation and development of weather types classification methods

WG3: Comparison of selected weather types classifications

WG4: Testing methods for various applications

- Selection of dedicated applications **(done)**
- Collection/development of application software (**in progress**)
- Performance of the selected applications using available weather type data including those provided by WG2 (**in progress**)
- Comparison of the application results with using different weather type methods (**in progress**)
- Final assessment of the results and uncertainties (**end of action**)
- Presentation and release of results to the other WGs and the interested scientific community (**in progress**)
- Recommend specifications for a new (common) method to WG2 (**in progress**)

Status of the COST733 catalogue

WG2: Implementation and development of weather types classification methods

The COST733cat catalogue has the following 6 primary features:

1. Input parameter/level: MLSP, GPH1000-500 (U, V, T)

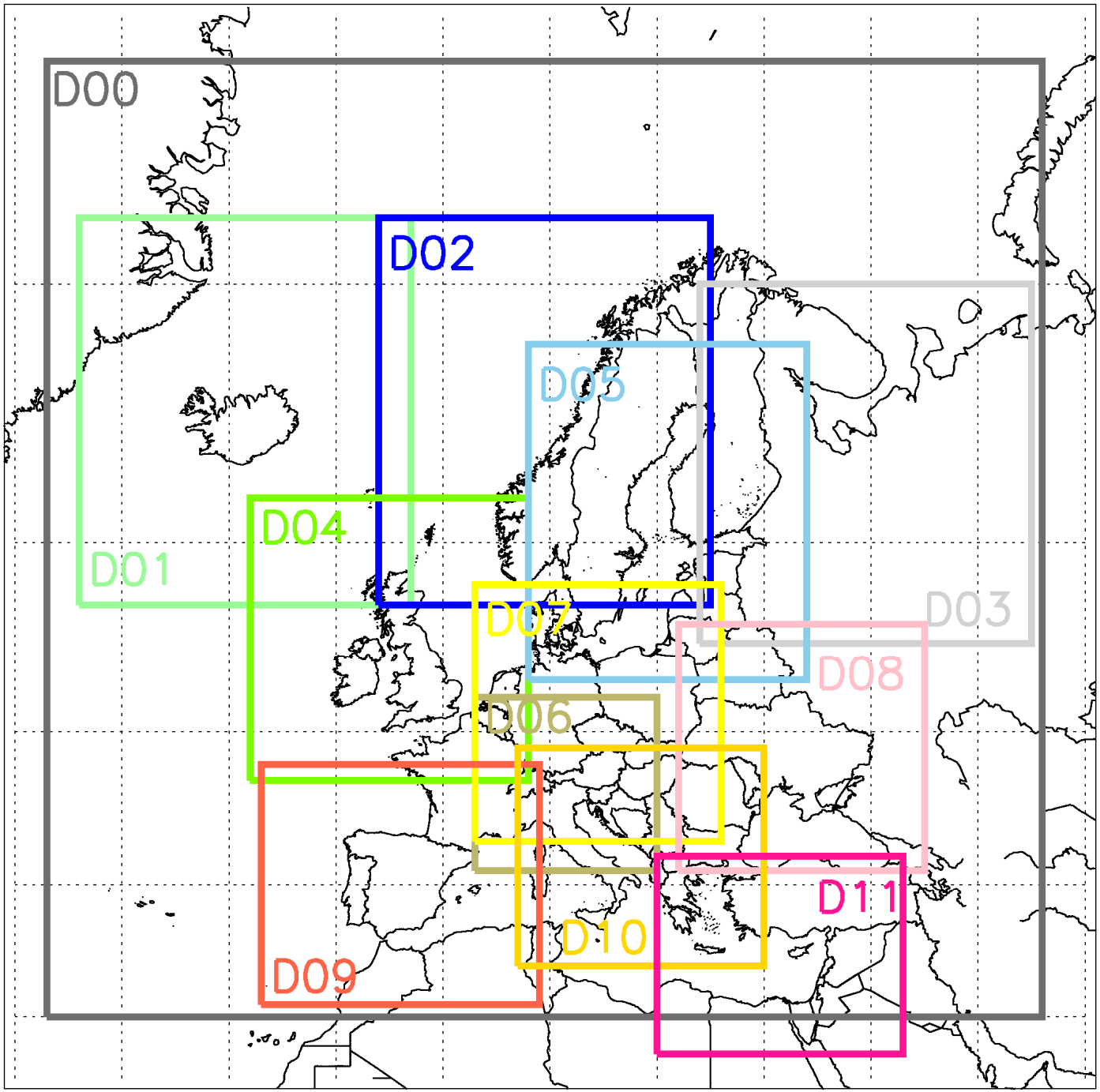
→ fixed for one variant of each method: ERA40 MSLP

2. Temporal configuration:

→ fixed: ERA40-period (09/1957-08/2002), full year, daily 12Z

3. Spatial domain:

→ fixed: 12 unified domains of varying scale


D00
D01
D02
D03
D04
D05
D06
D07
D08
D09
D10
D11

4. Number of types: varying between 4 and 43 types

→ fixed: for 3 variants of each method: 9, 18, 27 (±2)

5. Distance measure (similarity between patterns):

→ variable: Euclidean distance, correlation, PC-loadings, PC-scores

6. Method:

→ Variable, and can be grouped as follows:

- Subjective (for comparison only)
- THRESholds (mostly based on wind strength/directions)
- PCA based (key patterns explaining maximum of covariance)
- LEADer algorithm (key patterns by maximum of similar patterns)
- Optimization algorithms - OPT

Automated & scalable methods

1.) **CKMEANS**	K-means (most different days as seeds)	OPT	Enke et al.
2.) **EZ850/ESLP**	Leader algorithm	LEAD	Erpicum et al.
3.) **GWT**	Objectified Gros-Weather-Types	THRES	Beck
4.) **KH**	Leader algorithm using Kirchofer score	LEAD	Kirchofer
5.) **LITADVE/LITTC**	Threshold based advection	THRES	Litinski
6.) **LUND**	Leader algorithm and assignment	LEAD	Lund
7.) **LWT2**	Objectivized Lamb weather types (Jenk./Coll.)	THRES	James
8.) **NNW**	Neural Networkds (SOMs) 2000 epochs	OPT	Michaelides et al.
9.) **P27**	PCA based	PCA	Kruzinga
10.) **PCACA**	K-means CA of PC-scores (hierachical CA seeds)	OPT	Rasilla Alvarez
11.) **PCAXTR**	Using extreme s-mode PC-scores	PCA	Esteban
12.) **PCAXTRKM**	K-means (using PCAXTR seeds)	OPT	Esteban
13.) **PETISCO**	K-means (using precipitation relevant seeds)	OPT	Petisco
14.) **SANDRA**	Simulated Annealing & diversified RAndomisation CA	OPT	Philipp
15.) **SANDRAS**	SANDRA cluster analysis using 3-day sequences	OPT	Philipp
16.) **TPCA**	Using oblique rotated t-mode PCA loadings	PCA	Huth
17.) **WLK**	DWD wetterlagenklassification (incl. T, humidity)	THRES	Dittmann et al.

Subjective & non-scalable methods (used for comparison)

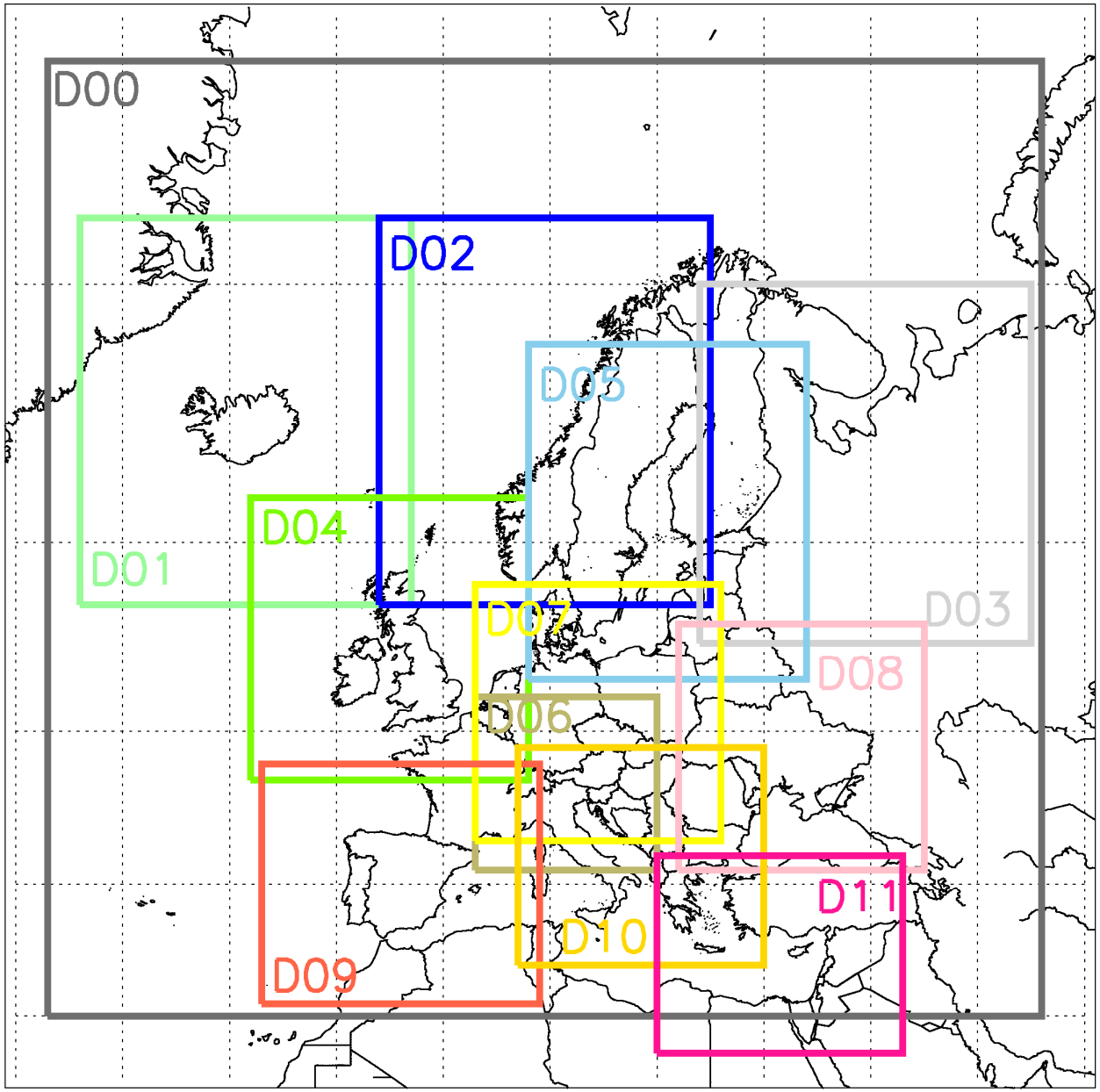
1.) **HBGWL, HBGWT**	Subjective Hess/Brezowsky Groswetterlagen/Types
2.) **OGWL, OGWLSLP**	Objectivized HBGWL
3.) **PECZELY**	Subjective Hungarian
4.) **PERRET**	Subjective Swiss
5.) **SCHUEPP**	Partly subjective Swiss
6.) **ZAMG**	Non-scalable Austrian

***Source**, Philipp, A., ECAC, 2008*

In general, 5 subgroups are formed within WG4, dealing with different types of applications for different geographical regions:

- Hydrology
- Climatology
- Extreme events (e.g. hazards)
- Air quality
- Forest fires

	hydrology	climatology	extremes	Air quality	Forest fires
D00	2	7	1	5	1
D01		1			
D02		1			
D03					
D04		1		2	
D05		1		1	
D06	1	3		2	
D07		7	1	5	
D08		1	1	1	
D09		4		1	2
D10		3	1	2	1
D11					



In the end, the goal of WG4 is to provide guidelines on the use of the classification software for specific applications and regions of interest.

In this respect, we try to answer some key questions, e.g.:

- Does the classification benefit from other variables to be classified?
- Are there any differences in between seasons?
- Should sequencing be included in the classification?
- Does the domain size (and location) matter?

Other variables to be included / classified?

Fr - HS5.15 – 11h30

Associations between weather types (WTs) and hydrological drought (A.K. Fleig)

Method	Input variables	Number of WTs	C
OGWL	**SLP, Z500**	**29**	**6**
OGWL	SLP	29	3
SANDRAS	**Z925, Z500**	**30**	**3**
SANDRAS	SLP	27	2
P27	Z500	27	3
P27	**SLP**	**27**	**5**
NNW	Z500	20	2
NNW	SLP	18	2
WLKC	**Z925, Z500, U/V700, PW**	**40**	**6**
WLKC	Z925, Z500, U/V700	28	5
HBGWL	SLP, Z500	29	1
PERRET	various	31	4
SCHUEEPP	SLP, Z500	40	4
ZAMG	various	43	4

- Comparison of 73 classifications on domain00
- 1964 – 2001
- Correlation between the
  - cumulative frequencies of drought supporting WTs
  - number of regional drought days (16/4 -15/10)

  in six regions in Danmark and Great Britain.
- Performance measure: ***C*** = number of regions with significant correlation (0-6)
- Only four methods could directly be compared for different input variables

➔ Input from two pressure levels might be preferable to SLP data only;

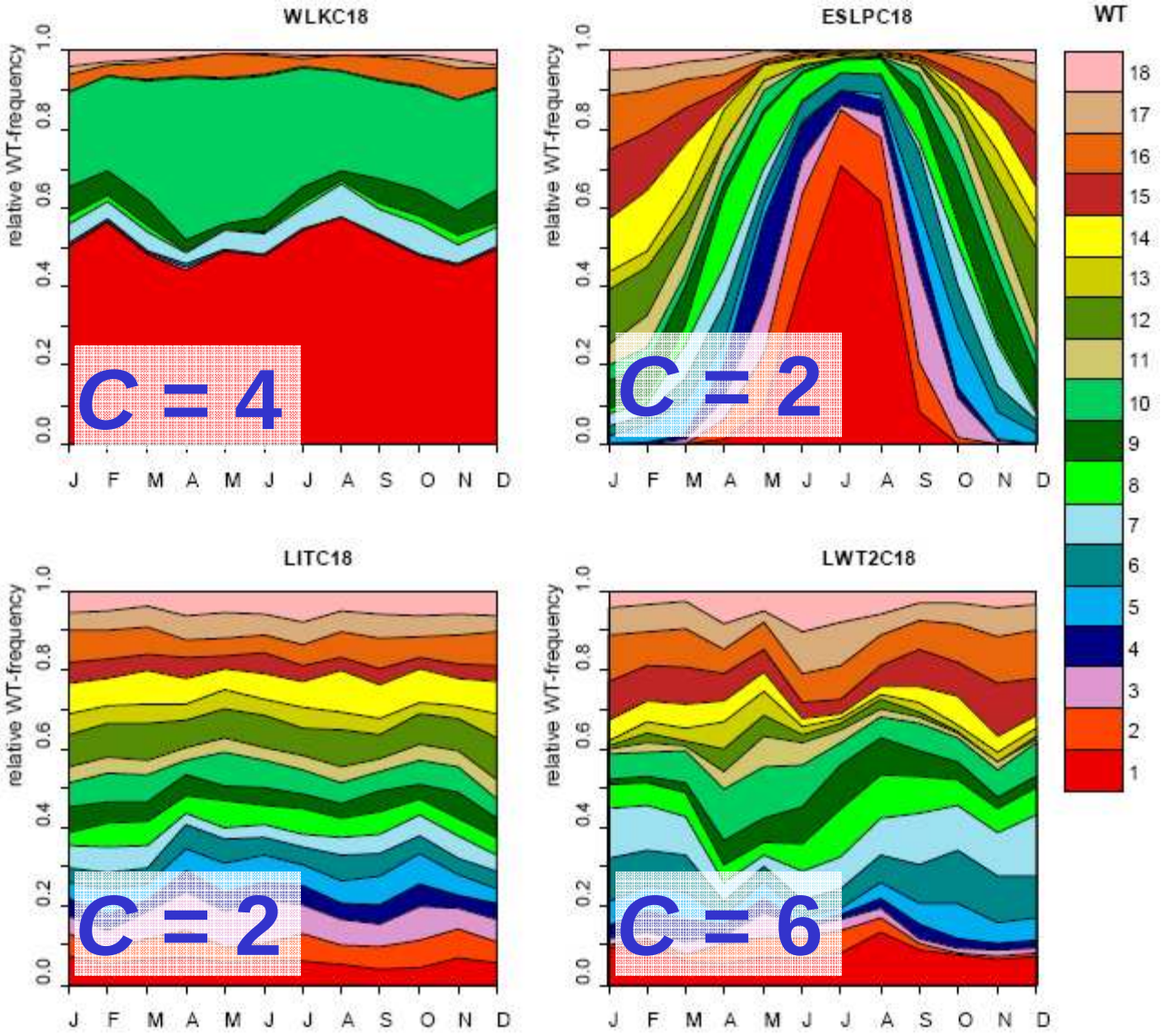
➔ Z500 alone is not better.

- Also most other classifications with input from two pressure levels performed better than WTCs with same number of WTs: (≥ 26 WTs: average C = 3.2)

➔ limited results, but using input from two pressure levels might be interessting for further classification developments within COST733.

Role of seasonality?

Normal monthly weather type frequencies (A. Fleig)



The distribution of WT occurances varies between the classifications with the same number of WTs;

- one extreme:
  few WTs dominating throughout the year or one season;
- other extreme:
  uniform distribution between all WTs throughout the year;

- best performing classifications:
  - some seasonality in WT occurances, but
  - no dominace of a single WT.

Outlook

- Construct guidelines on the use of the classification software for specific applications and regions of interest.

- Further extend our analysis concerning the importance of spatial scales, seasonality, multi-level data, sequencing…

- Possible testing of the classification software on other types of applications, e.g. circulation-type dependent model evaluation

Additional Information

- COST733 on the web:
  - www.cost733.org (official website)
  - http://geo21.geo.uni-augsburg.de/cost733wiki/ (unofficial website)

- Classification software (fortran code) will be made available under a GNU GPL License

- Training school on circulation typing methods and applications is planned for next autumn 2009 / spring 2010? Please check website for more up-to-date information!