Atmospheric circulation patterns associated with extreme precipitation amounts in Estonia

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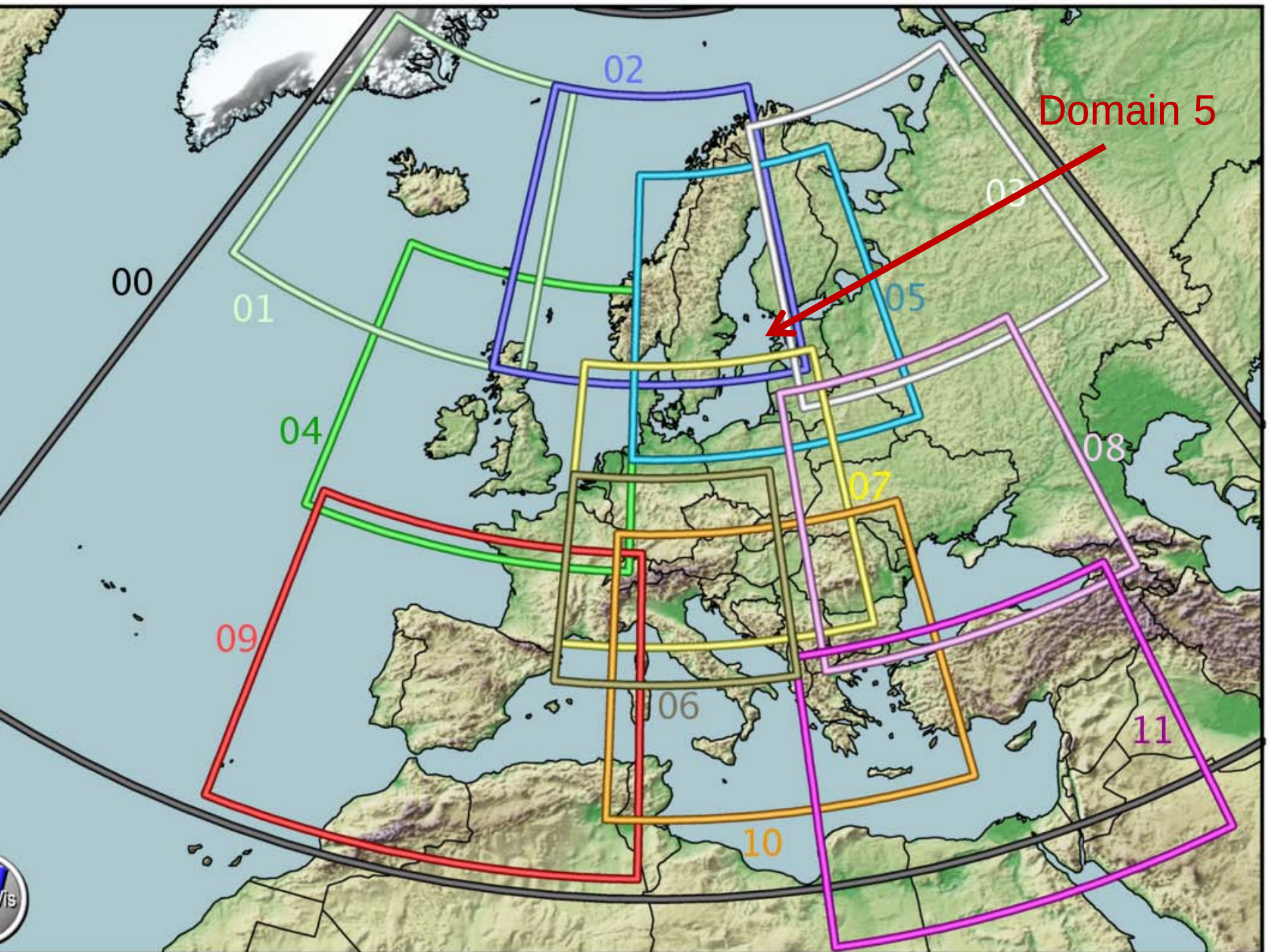
Outline

- Extreme precipitation
- Manual synoptic analysis
- Cyclones trajectories
- COST733 circulation types


Domain 5
00
01
02
03
04
05
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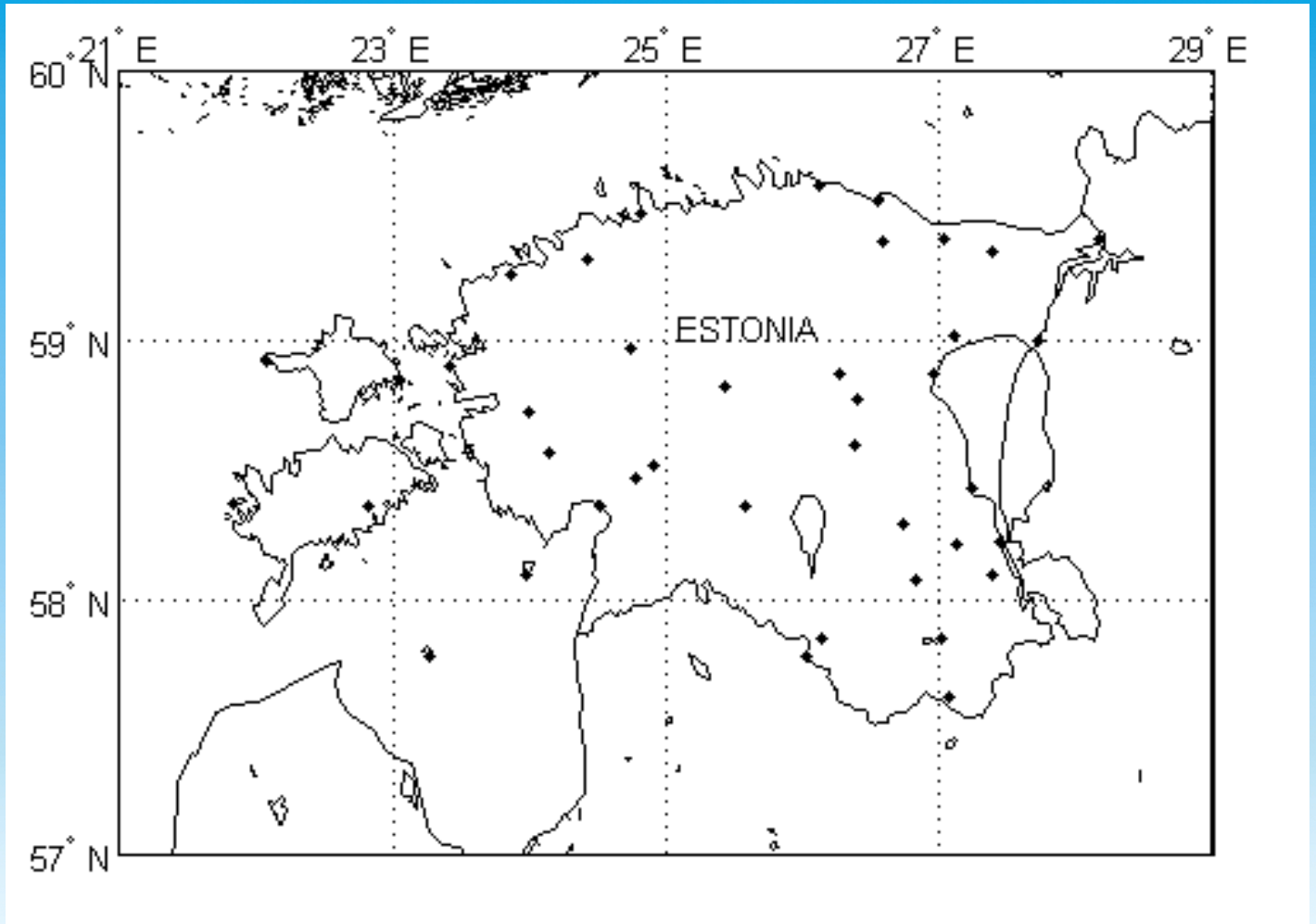
07
08
09
10
11



- Precipitation from 40 (98) stations
- 1961 - 2002(2005)

Manual analysis

Occurrences (in the number of days) of the heavy rainfall bringing synoptic weather types and their division between propagation tracks in the period 1961-2005.

Trajectory	A deep low	B minor low	C wave	D trough with front	E slow front	F convective	Unclassified	Sum
NW	2	5	-	11	-	-	-	18
W	8	2	-	14	-	-	-	24
SW	9	7	6	4	-	-	-	26
S	22	25	5	1	-	-	-	53
N	-	2	-	-	-	-	-	2
Local	8	16	9	2	-	-	-	35
Total	49	57	20	32	16	24	1	199

- Heavy rainfall - 50 mm in 24 h

(Mätlik and Post 2008)

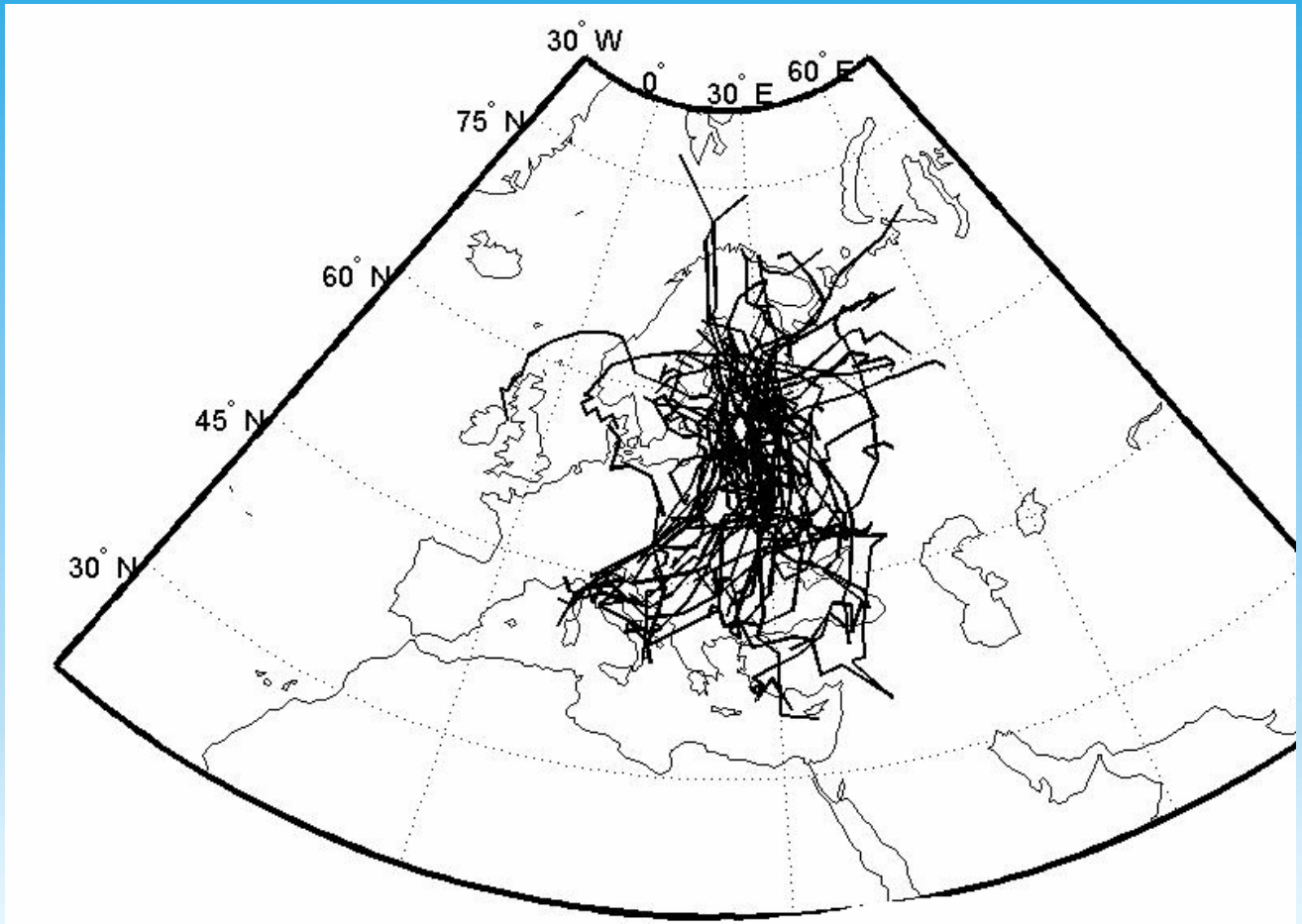
Cyclone tracks from (Zolina et al 2002)

Comparison between all cyclones influencing Estonian weather (Prilipko, 1982) and heavy rain bringing cyclones occurrencies in summer.

Trajectory	All cyclones (%)	Heavy rain (%)
N	12-14	2
Scandinavian	19-20	10
W ja Skagerrak	14	11
SW	20	8
S	23	40
NE (diving)	2	2
British isles and the North Sea	11	8
local	-	19

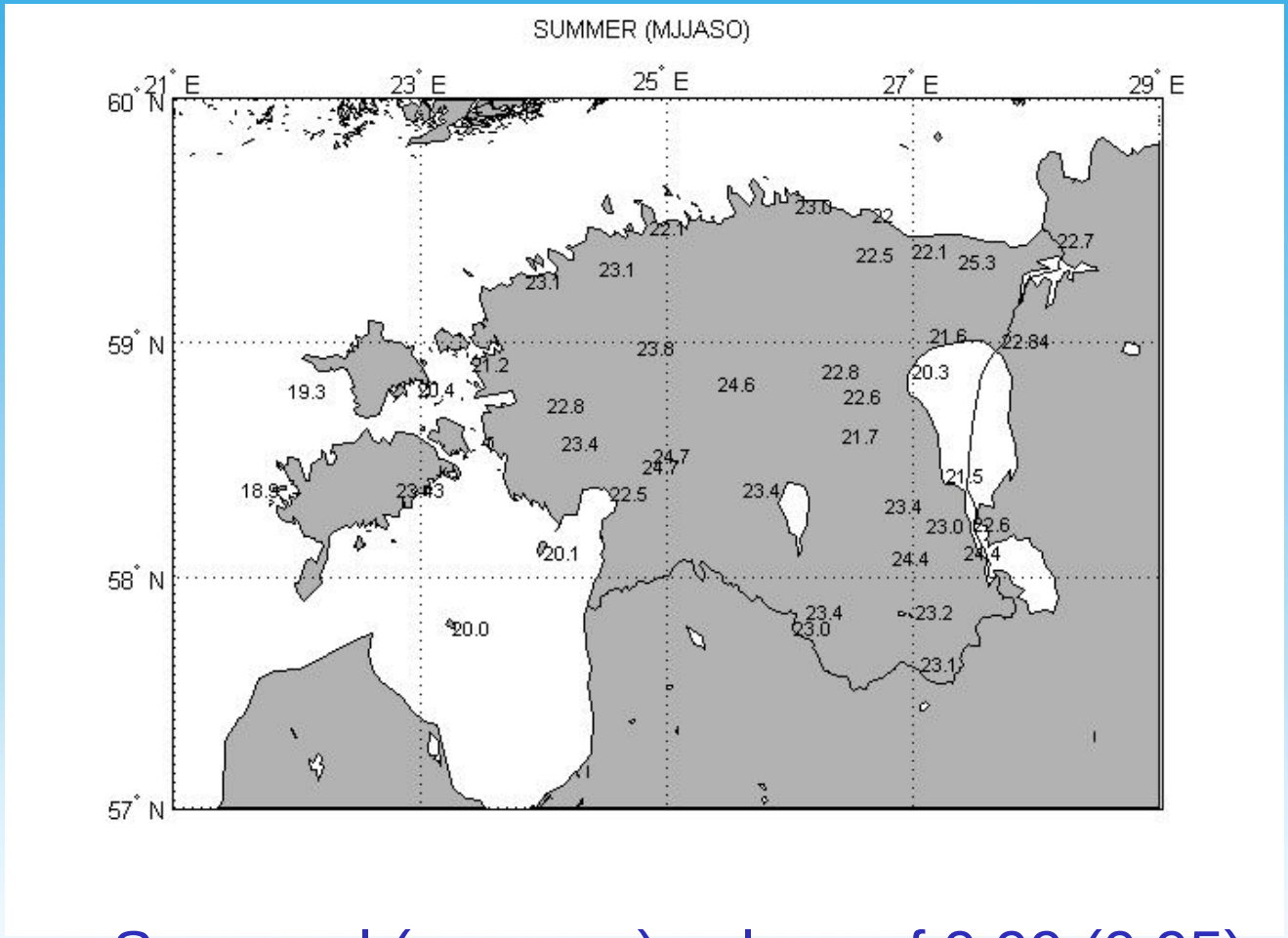
Toots, 2007

Cyclone tracks from (Zolina et al 2002)



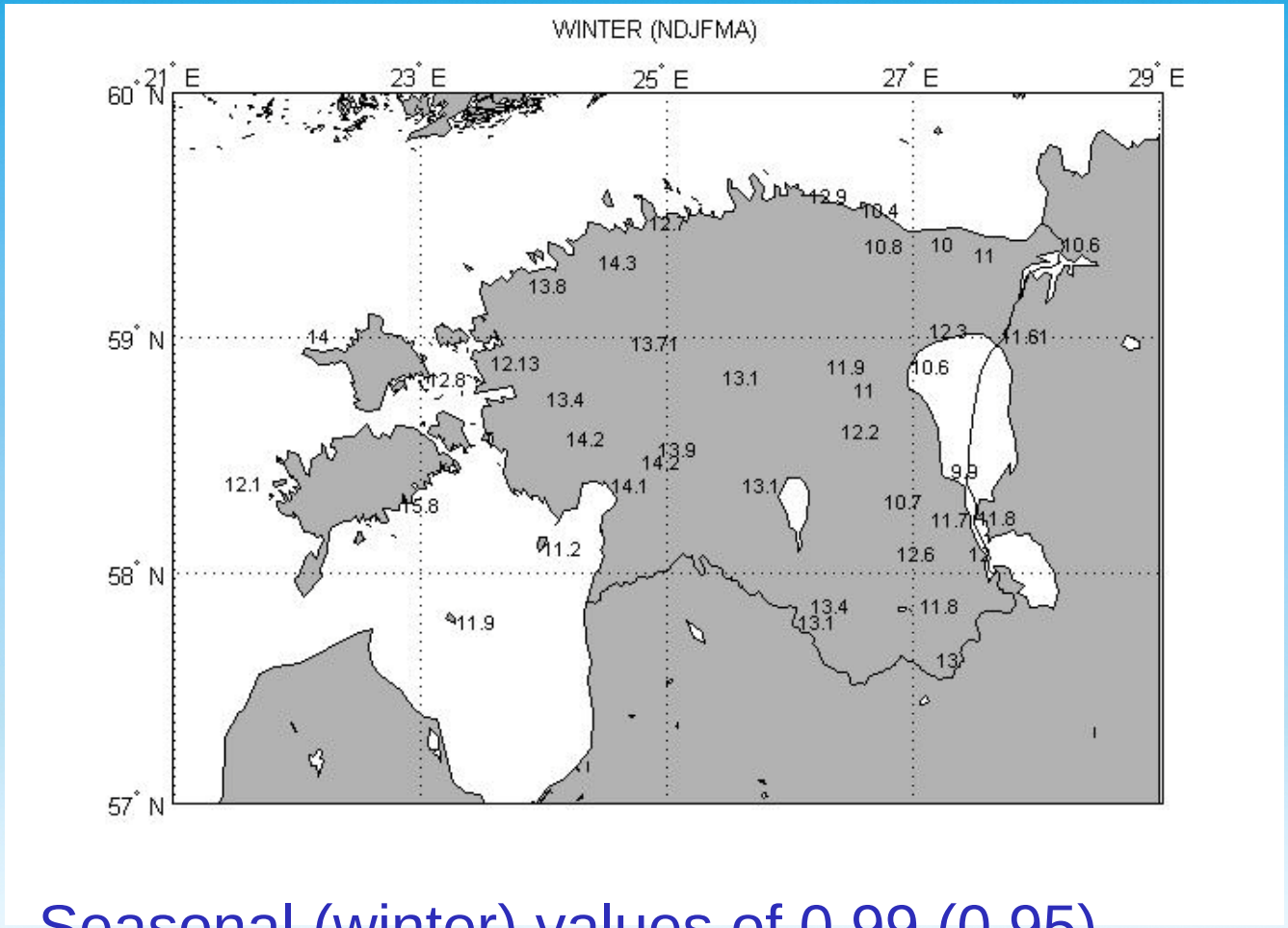
- Heavy rain bringing southern cyclones trajectories 1961-2005

Extreme precipitation thresholds



Seasonal (summer) values of 0.99 (0.95) percentiles of daily precipitation frequency distribution

Extreme precipitation thresholds



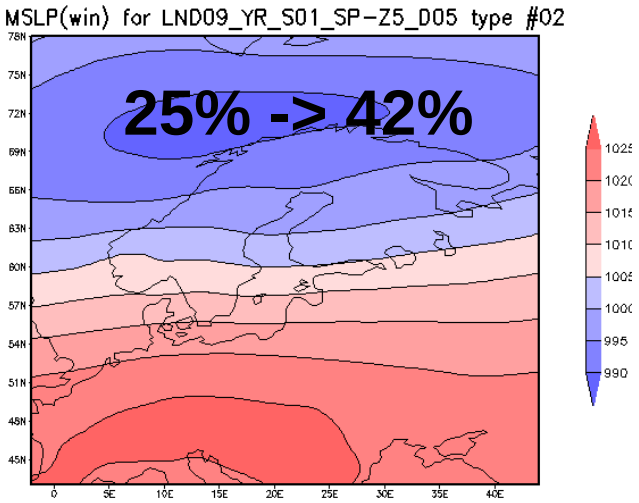
Seasonal (winter) values of 0.99 (0.95) percentiles of daily precipitation frequency distribution

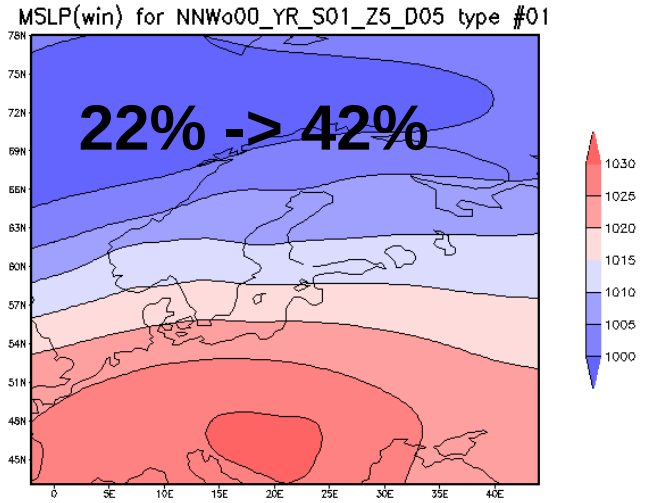
- To differentiate between frontal and convective precipitation, especially in the warm season, the days, when at least in 4 stations was registered extreme precipitation, were selected in the second step of analysis.
- After finding percentiles the extreme event days, and to these days responding circulation types were found from the database.
- For circulation types COST733CAT v2.0 1-day and yearly catalogs for domain 5 were used (Philipp et al 2010). There were 234 different classifications under the analysis.

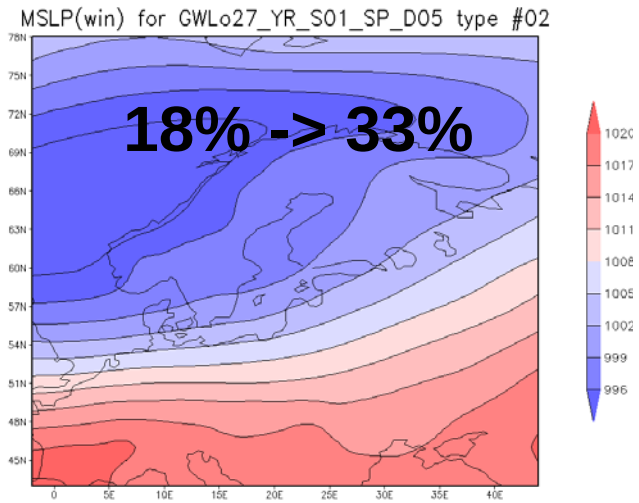
Circulation types from COST733 CAT v 2.0 catalogs

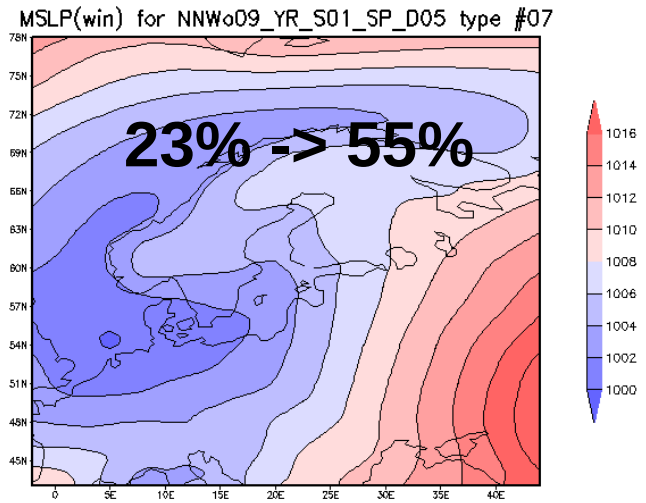
	Summer				Winter			
Threshold	P99	P95	P99_4	P95_4	P99	P95	P99_4	P95_4
No of events	1082	2792	225	1256	740	2222	252	1043
Highest increase in frequency compared to all days	14%	11%	19%	16%	24%	21%	32%	29%
No of catalogs for what increase is >=10%	10	3	49	19	36	18	78	41

Winter

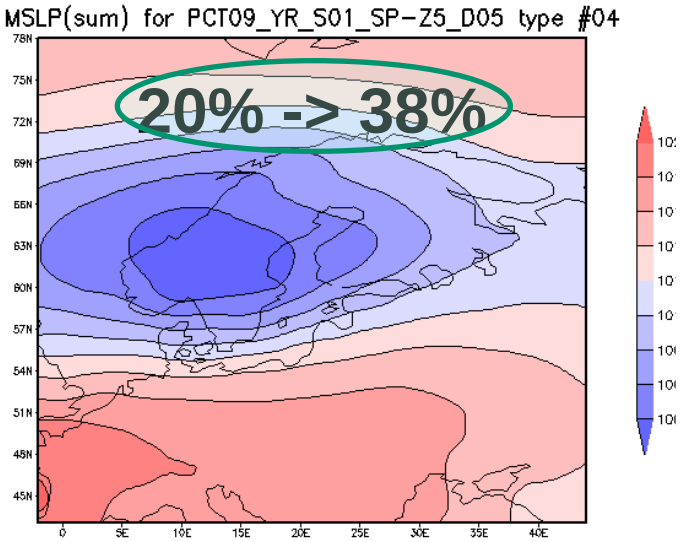

MSLP(win) for LND09_YR_S01_SP-Z5_D05 type #02
25% -> 42%

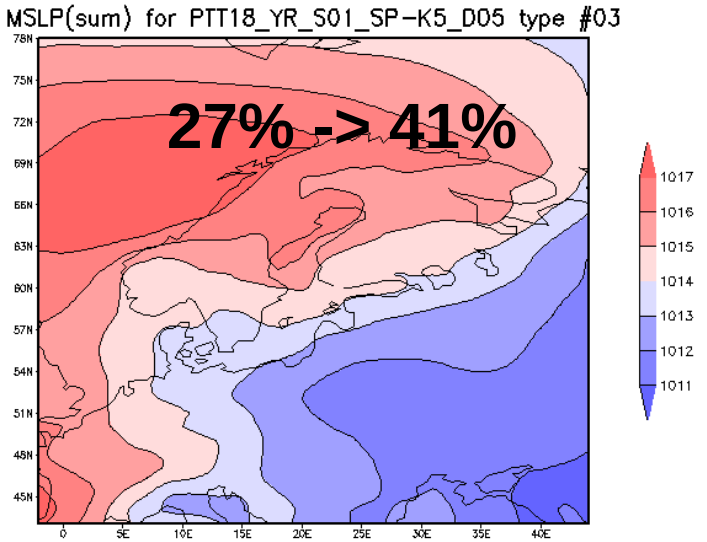

MSLP(win) for NNWo00_YR_S01_Z5_D05 type #01
22% -> 42%

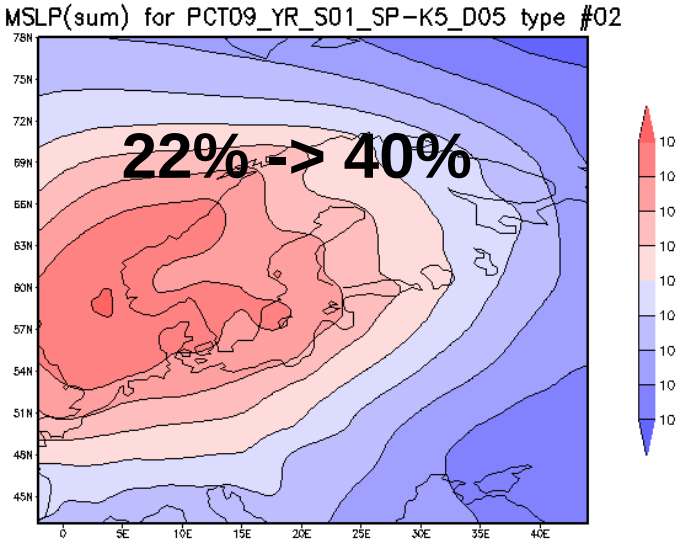

MSLP(win) for GWLo27_YR_S01_SP_D05 type #02
18% -> 33%

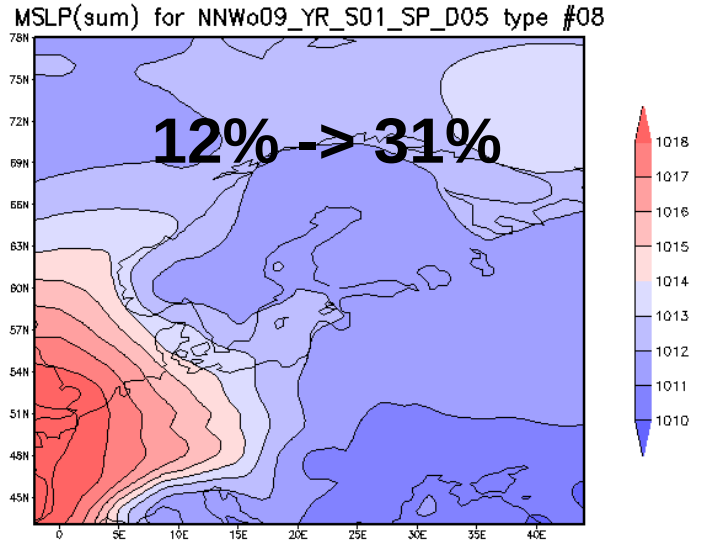

MSLP(win) for NNWo09_YR_S01_SP_D05 type #07
23% -> 55%

Summer


MSLP(sum) for PCT09_YR_S01_SP-Z5_D05 type #04
20% -> 38%


MSLP(sum) for PTT18_YR_S01_SP-K5_D05 type #03
27% -> 41%
1017
1016
1015
1014
1013
1012
1011


MSLP(sum) for PCT09_YR_S01_SP-K5_D05 type #02
22% -> 40%


MSLP(sum) for NNWo09_YR_S01_SP_D05 type #08
12% -> 31%
1018
1017
1016
1015
1014
1013
1012
1011
1010

Conclusions

- The circulation types patterns in catalogs represent the situations in circulation that bring extreme precipitation better for winter than for summer.
- The differentiation between the circulation types is also better for winter.
- Best classified SLP or
  - summer - SLP + 500 hPa to 850 hPa relative topography
  - winter - SLP + 500 hPa geopotential height.
- For winter the found the circulation patterns are common ones.
- For summer events the patterns are more special: in 3 out of 4 patterns exists the low pressure region that sits to the SE from the research area.