

Analysis of climatic conditions of wildfires in Belgium with an automatic daily atmospheric circulation patterns classification

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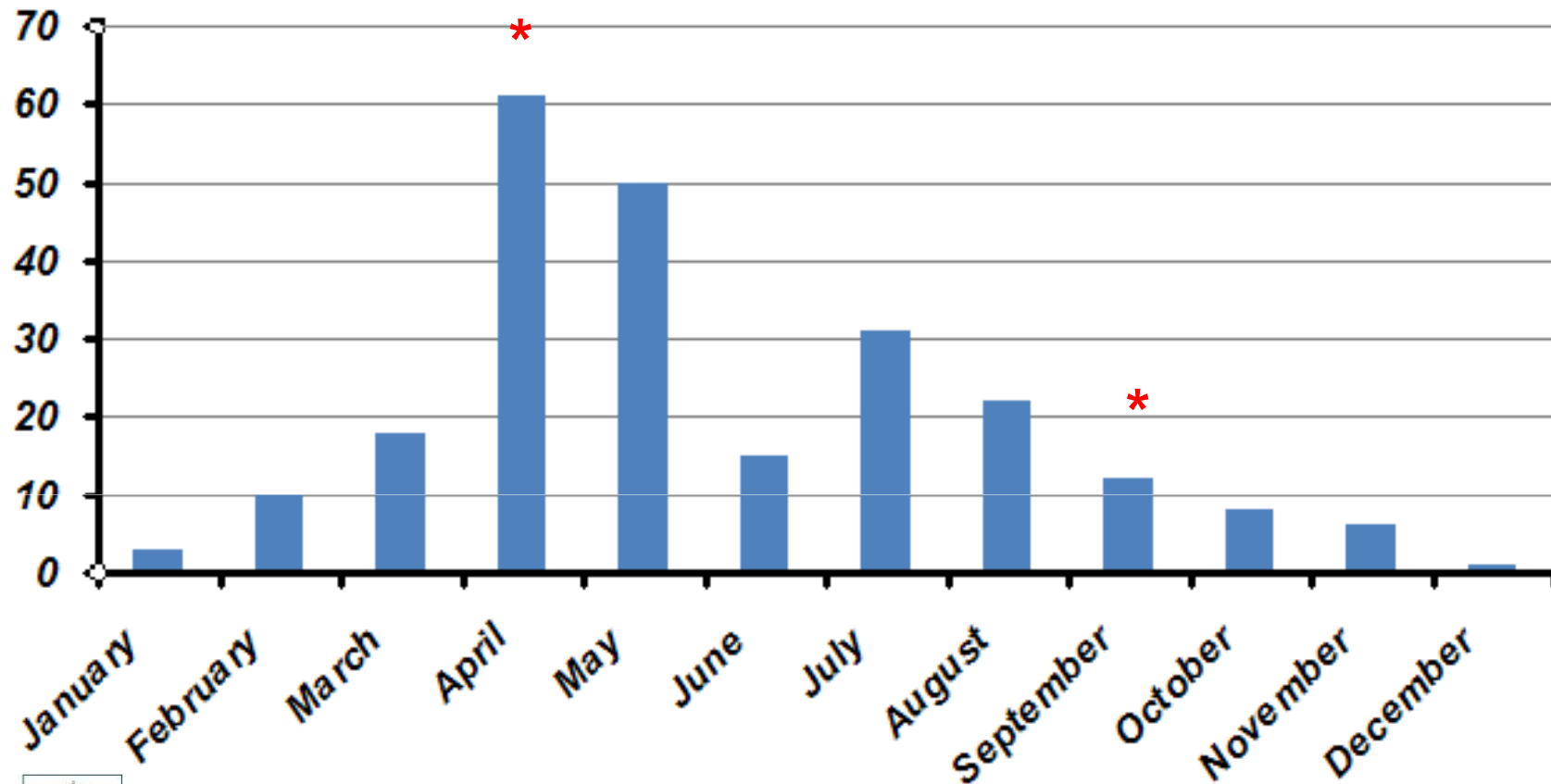
1. Case study :

1958-2007 forest database focused on date of wildfire, size and type of vegetation burned in the Hautes-Fagnes region which is situated in the eastern side of Belgium at altitude higher than 550m

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Monthly amount of wildfires (1958-2007)



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2. Way of working :

- ***Automatic daily atmospheric circulation patterns classification in April and September and during the years 1958-2007***
(1500 days for each month)
(this classification comes from our teamwork done within the
COST733 Action)
- ***Choice of a lower number of classes to obtain a better stratification :***
10 classes (arbitrary choice)
- ***our method is funded on a research of the best frequency distribution of similar patterns obtained for a given similarity index threshold***
- ***classes are extracted from 850 hPa geopotential heights***

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- **The geopotential heights of 850 hPa level were extracted from the *ERA-40 database* on the period 1958-2002 and from *ECMWF operational analysis* until the end of 2007.**
- **We compute a similarity index based on the absolute difference between two atmospheric circulation maps. This index is the sum of the absolute difference (meter of geopotential) for all the grid points of two different isobaric maps.**
This index is normalized to vary between 0 and 1.
Its value is 1 for the atmospheric circulation map with itself.
It is near zero if the two atmospheric circulation maps (i.e. days) are very different.

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- ***For a given similarity index threshold and for each atmospheric circulation map, the number of similar weather maps which had higher similarity index than the index threshold is computed. The atmospheric circulation map reference of the first class is the atmospheric circulation map which contains the maximum of similar other maps. The second atmospheric circulation map reference is the 2nd largest class and so on for 10 decreasing similarity index thresholds.***
- ***The similarity index threshold is decremented from 1 to 0 until 100% of atmospheric circulation maps are classified. This similarity index threshold (just as it) is used to classify the elements in the class #1. To classify elements in the class #2, we use this similarity index threshold minus a fixed rate. In class #3, we use this similarity index threshold minus 2 times this fixed rate. The similarity index threshold and the fixed rate are chosen to classify 100% of atmospheric circulation maps and to minimise the total classes-pondered standard deviation.***

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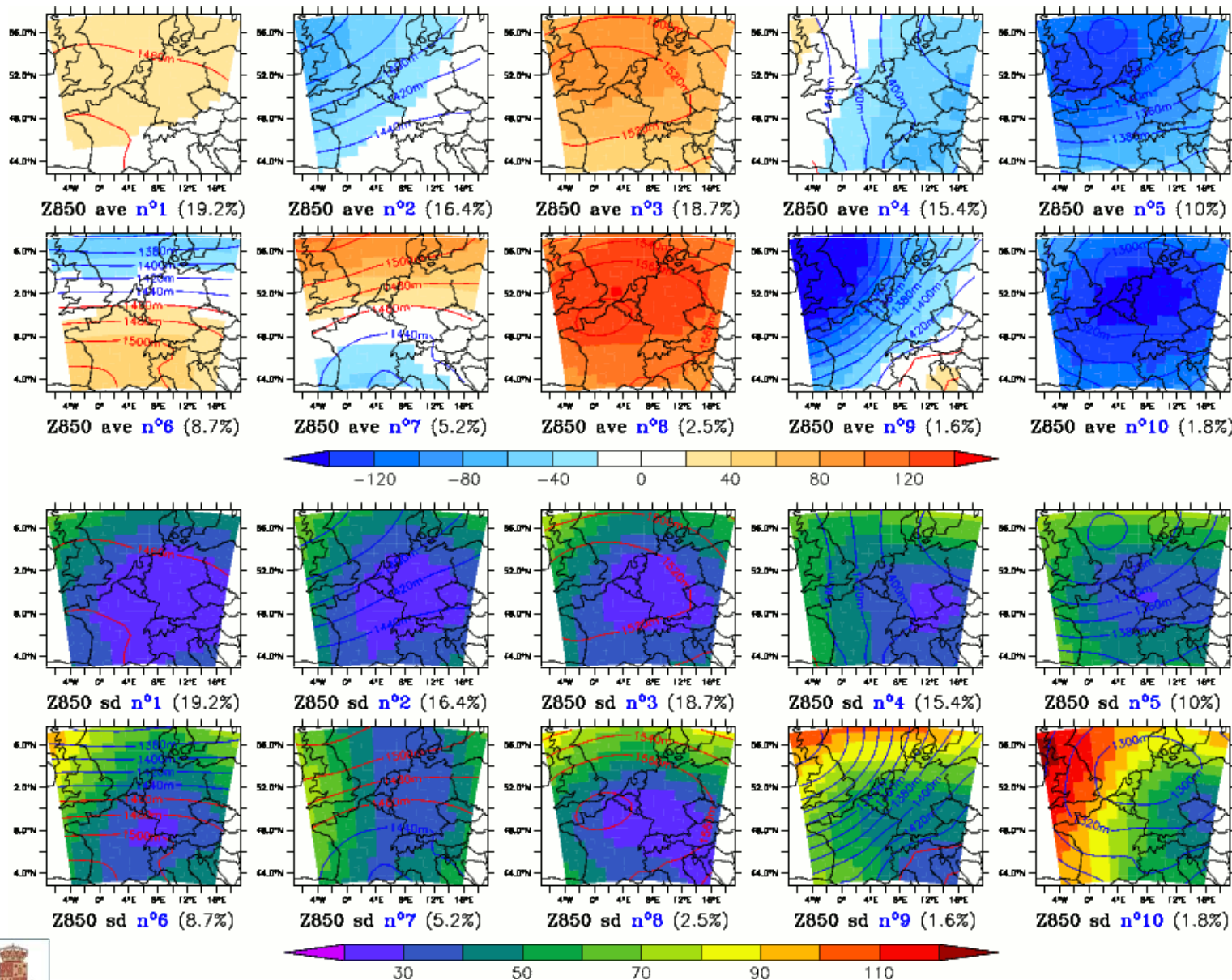
3. Results for April

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APRIL

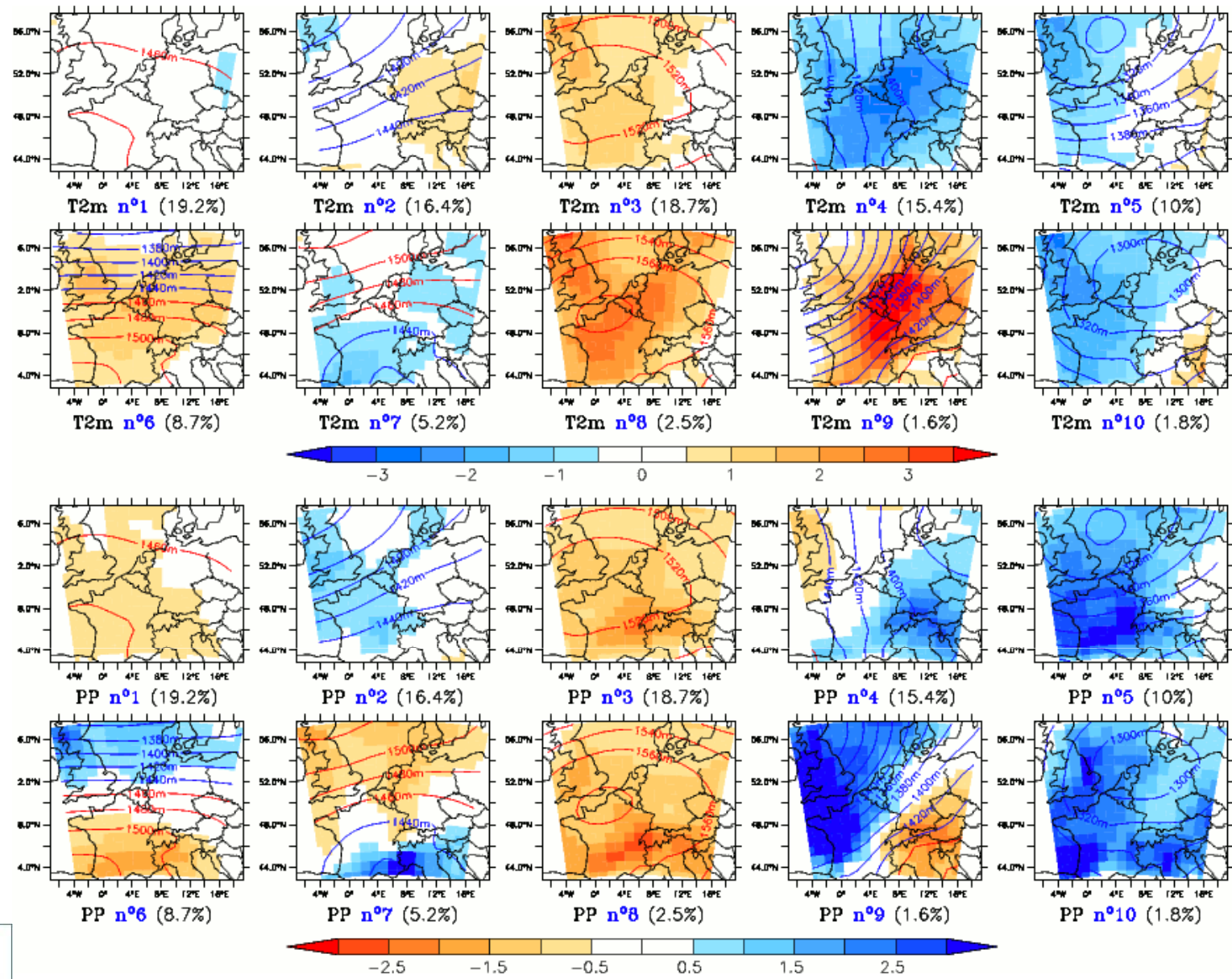
- Little domain
- Centered on eastern part of Belgium
- 700 km in each direction (zonal and meridional directions)
- maps of 850hPa average height
- maps of standard deviation



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APRIL



- warmer and dryer classes :
No.3
No.8
- normal temperature and dry classes :
No.1
No.7
- rainy classes :
No.2
No.4
No.5
No.9
No.10

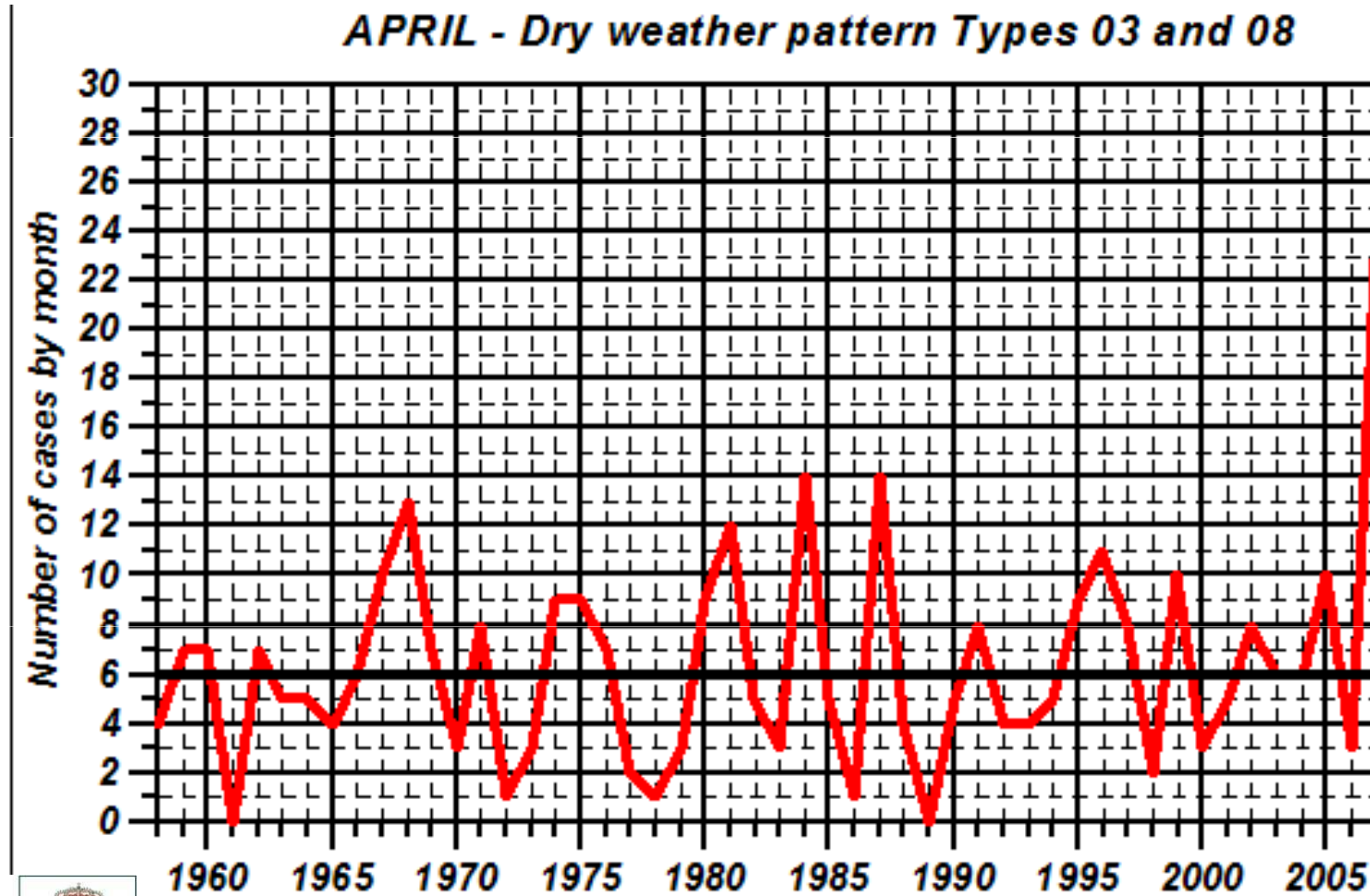
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APRIL

Year to year variability of a wildfire dangerousness index

APRIL - Dry weather pattern Types 03 and 08



- warmer and dryer classes :
No.3
No.8

• April 2007
was
exceptionally
dry and sunny

• (total relative frequency of these cases = 20 %)

• mean monthly number of days = 6

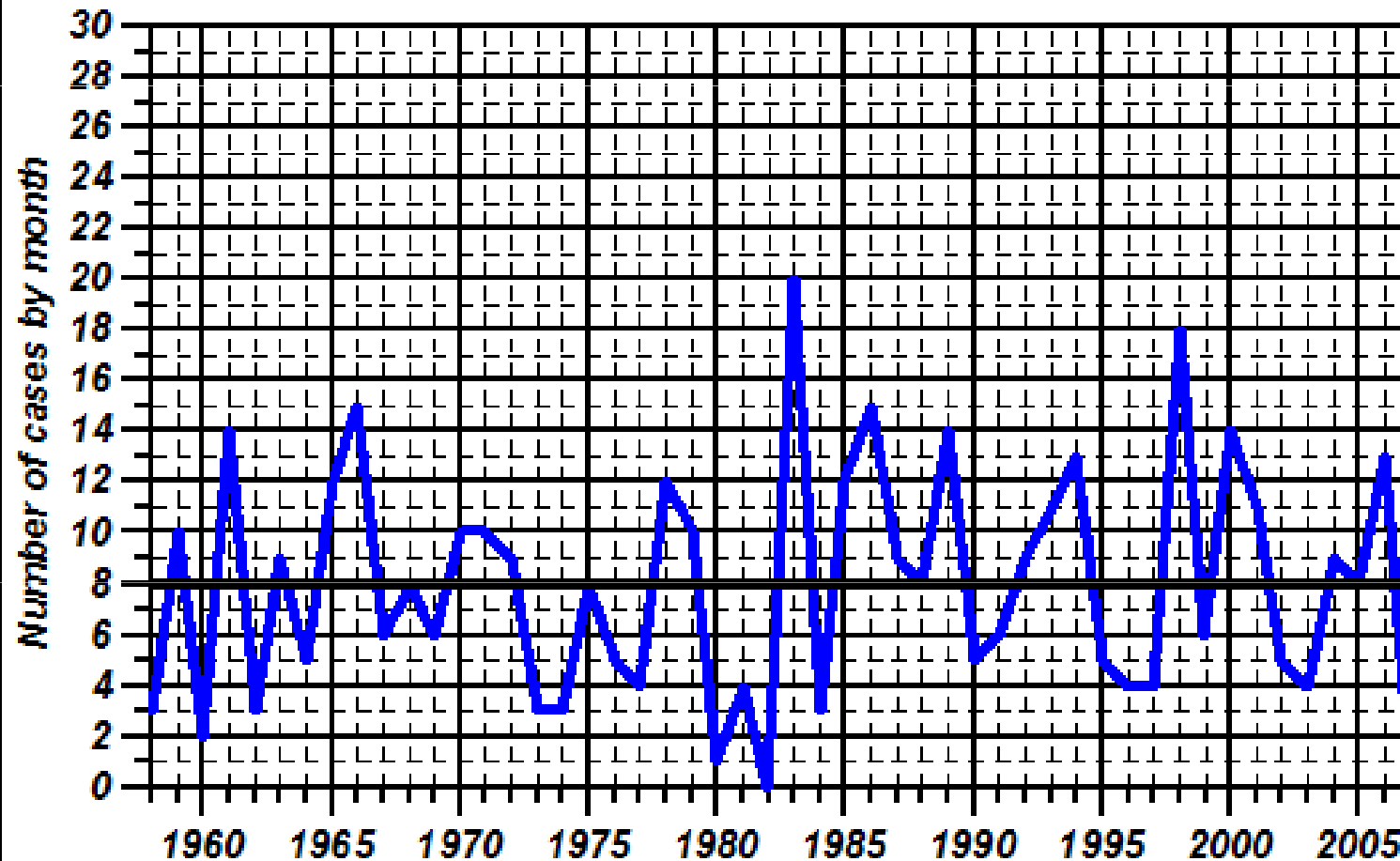
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APRIL

Year to year variability of a wildfire low risk index

APRIL - Rainy weather pattern Types 02 and 05



- rainy classes :
No.2
No.5
- total relative frequency of these cases = 26,4 %)
- mean monthly number of days = 8

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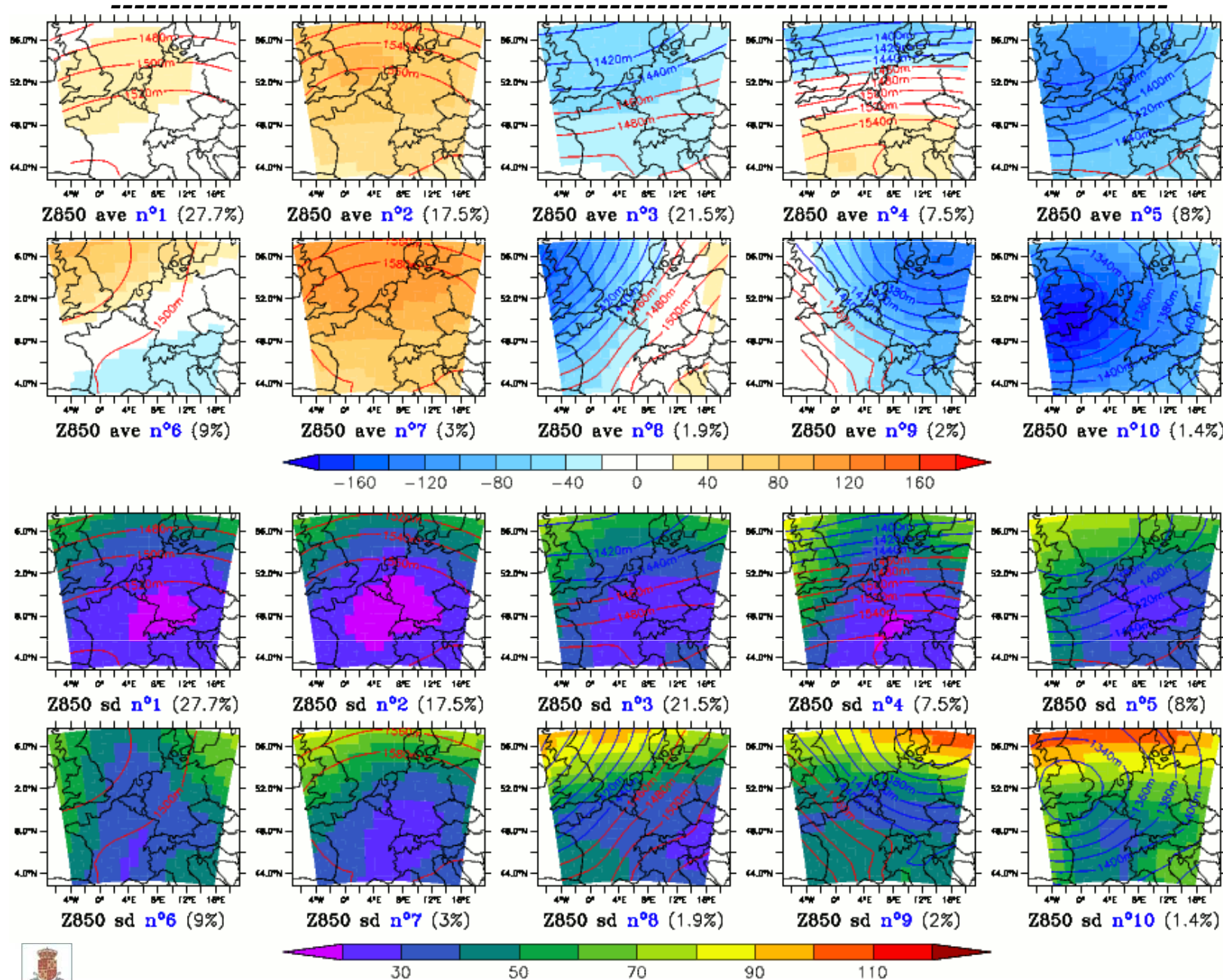
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3. Results for September

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SEPTEMBER



- Little domain

- Centered on eastern part of Belgium

- 700 km in each direction (zonal and meridional directions)

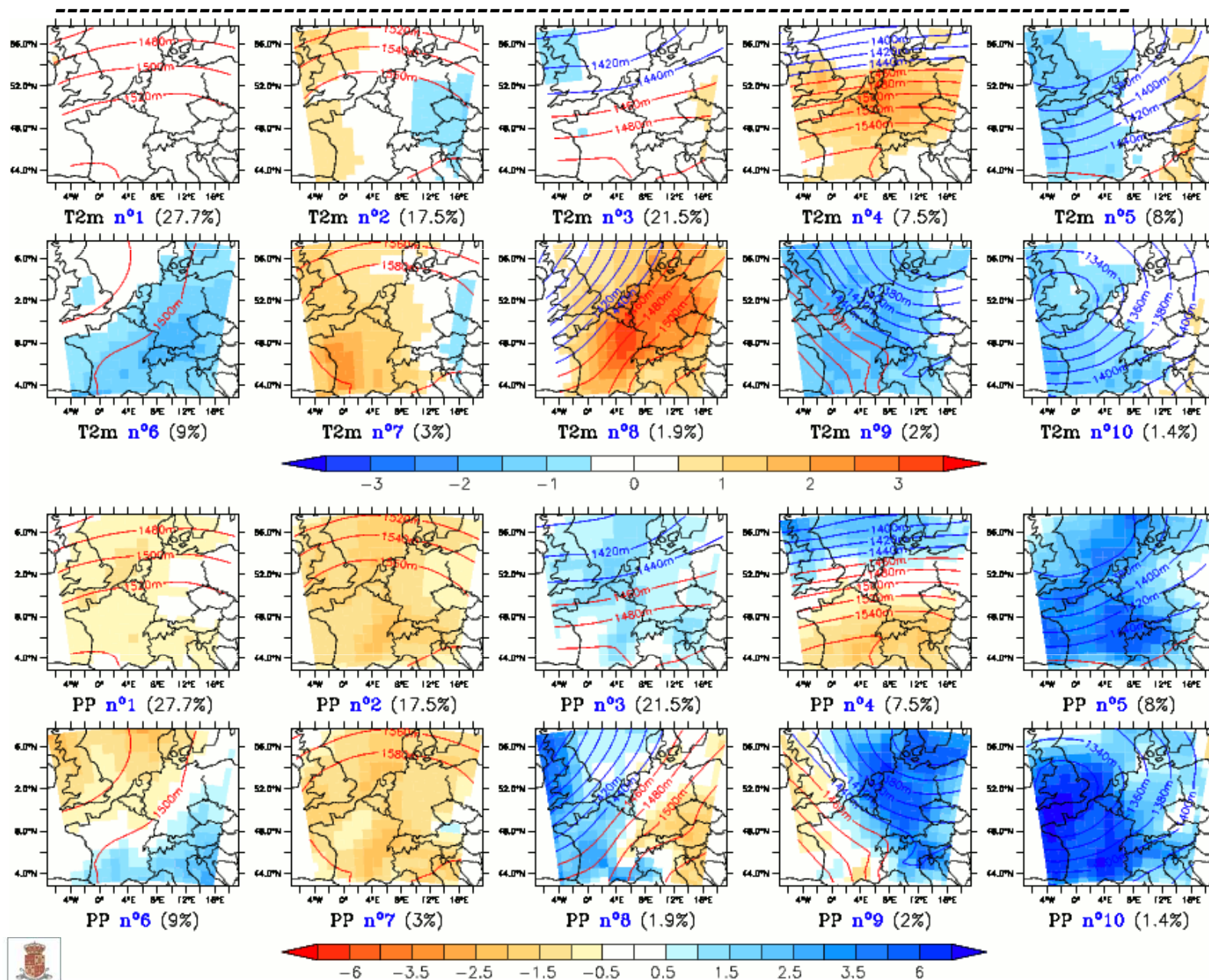
- maps of 850hPa average height

- maps of standard deviation

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SEPTEMBER



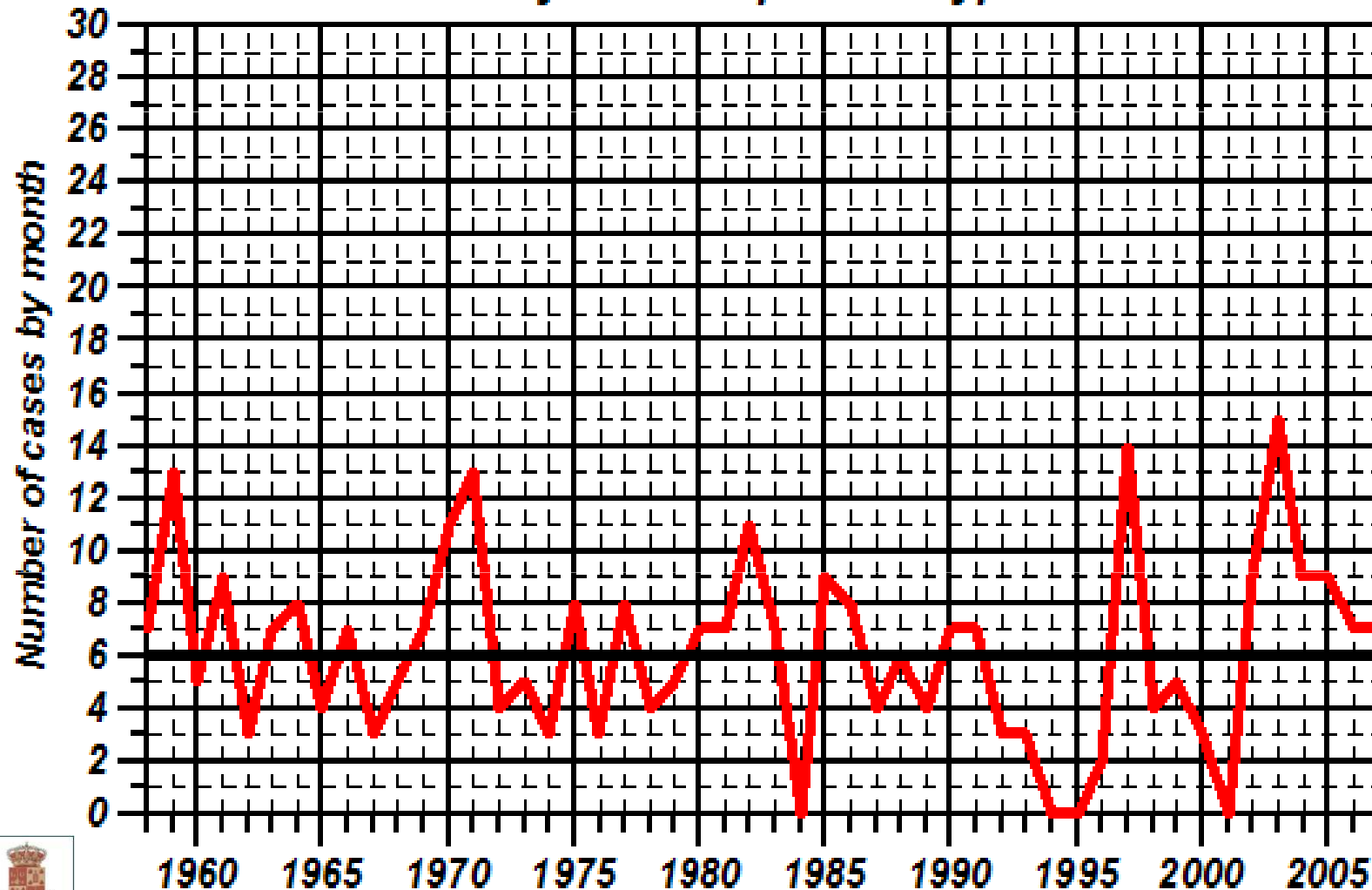
- normal or warm temperature and dry classes :
No.2
No.7

- normal or cold temperature and rainy classes :
No.3
No.5

- rainy other classes :
No.8
No.9
No.10

Year to year variability of a wildfire dangerousness index

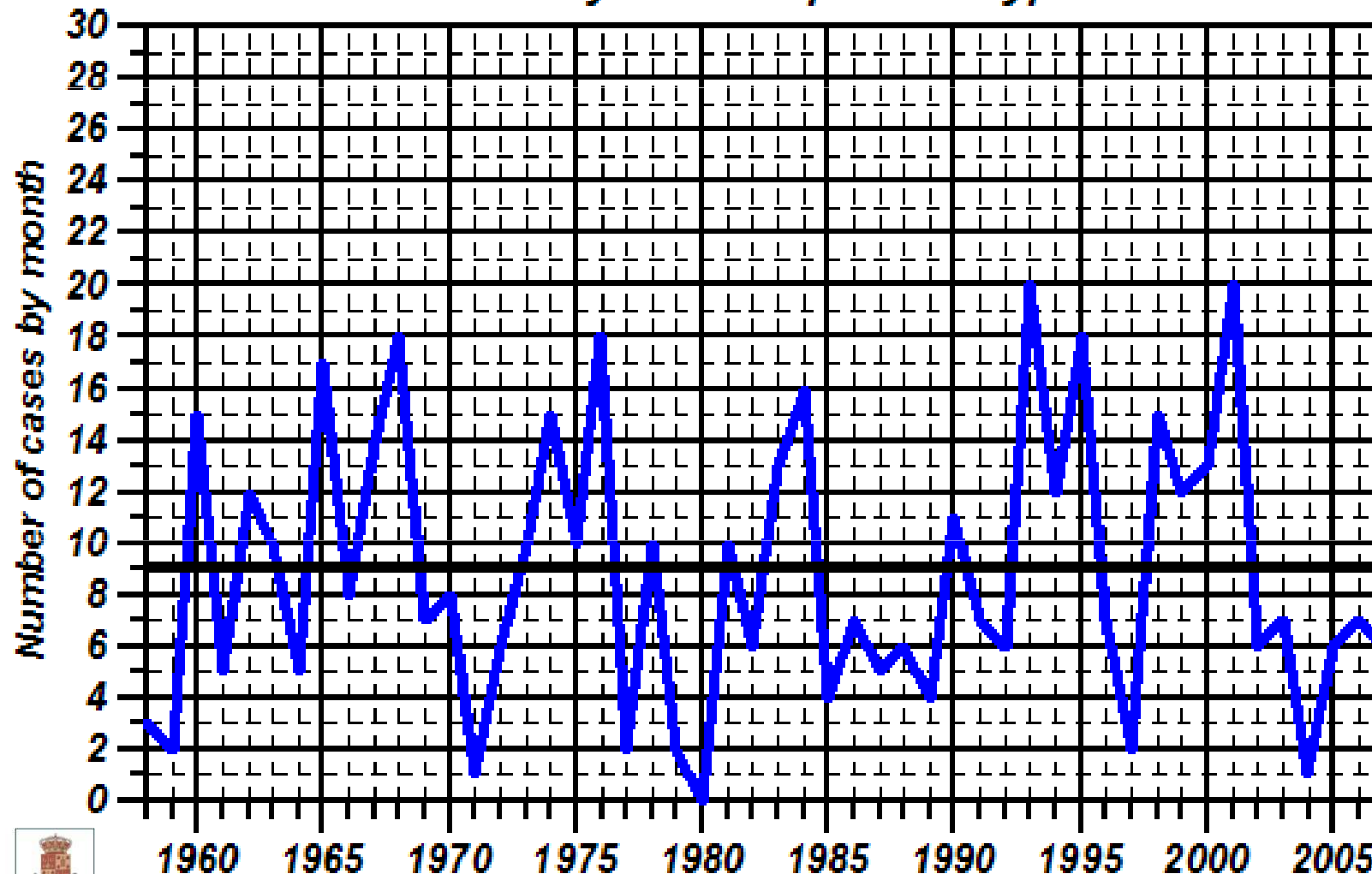
SEPTEMBER - Dry weather pattern Types 02 and 07



- dry classes :
No.2
No.7
- (total relative frequency = 20 %)
- mean monthly number of days = 6

Year to year variability of a wildfire low risk index

SEPTEMBER - Rainy weather pattern Types 03 and 05



- rainy classes :
No.3
No.5

- (total relative frequency = 30 %)

- mean monthly number of days = 9

4. Conclusion

Research of occurrence and persistence (lifetime) of 850 hPa regional geopotential height pattern classes (together with corresponding dry and sunny or rainy days and extremely dry or rainy months in the Hautes-Fagnes Belgian region) have led to develop two opposed indices for the monitoring of the risk of local wildfires before and at the end of the green season.

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Thank you for your attention