

# Course of streaming-situations over the Alps from 1961 to 2003 for 850 hPa

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# Overview

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1. Definition of streaming-types
2. Frequency in the normal-period 1961 to 1990
3. Variance of  $ST(\text{year})$  in 30 years and ..
4. Rare cases for 10 types for 1961 to 2003
5. Seasonal distributions
6. Variation from day to day
7. Conclusions

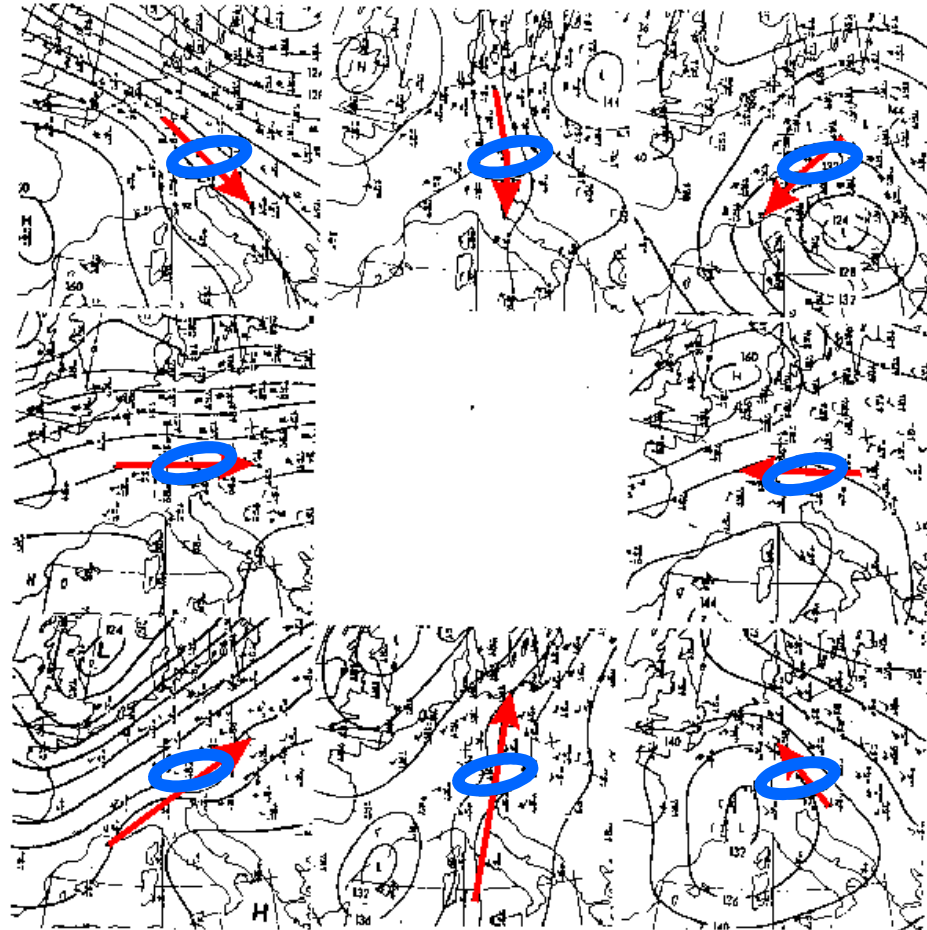
# Definition

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- Flow over Alpine Space (Eastern Part)
- Streaming from advectations
- Streaming with more than 15 Kts
- From 8 directions
- As High (low horizontal p-gradient)
- As Variable (frontal situation or changing directions)

Classifikation from R. Steinacker –  
„Dynamiker“,  $N_p = 15705$  days

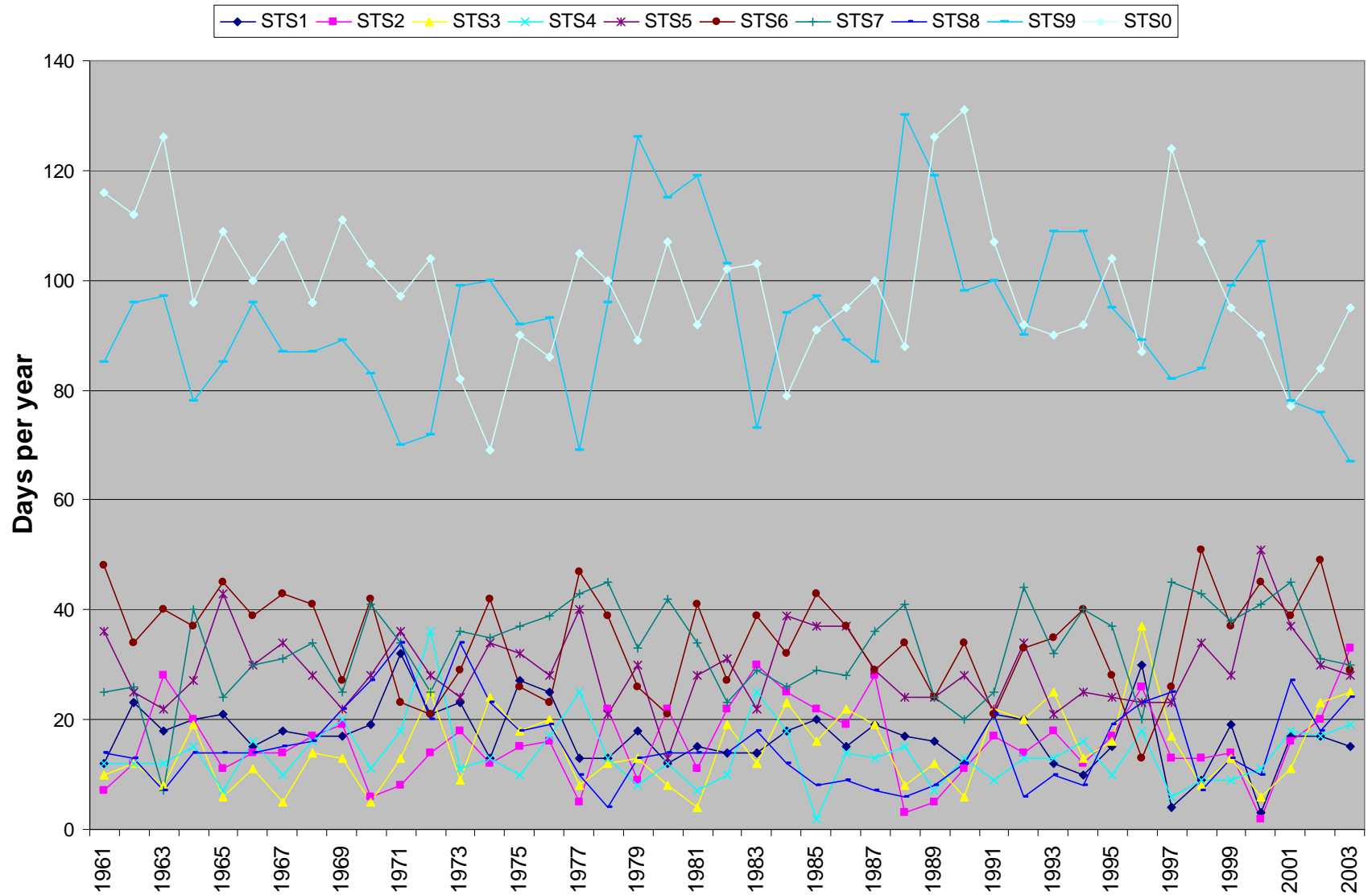
# 850 hPa exists 8 sectors



Examples for weathersituations and streamingtypes in 850 hPa

# 43 annual streaming

Frequency streaming situations per year; from R. Steinacker, R.W.; Aug. 2010.



ICAM 23. May 2011

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# Frequency

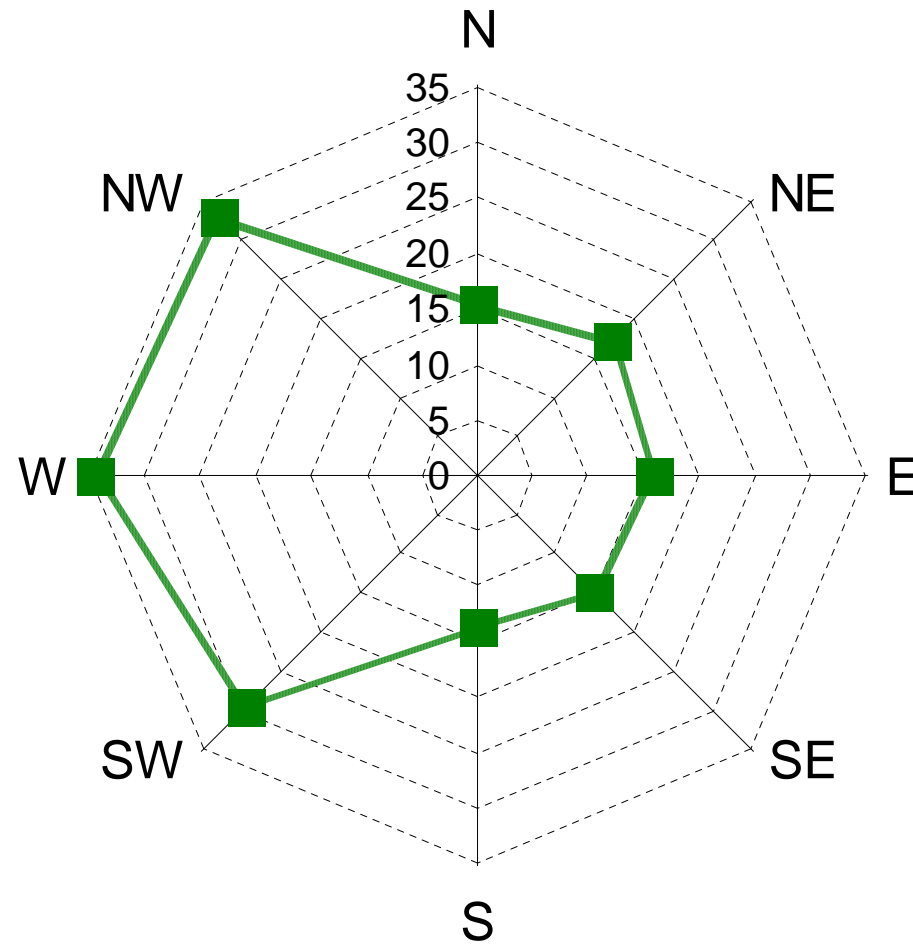
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10 types and quantity / year  
for normalperiod (1961-90)

N :	15,1	SW:	29,3
NE :	17,9	W:	34,4
E:	15,5	NW:	31,4
SE:	13,1	High:	94,1
S:	13,9	Var:	100,4

# 850 hPa

Frequency for direction of streaming 1961-2003; High = 85.1 and Var = 86.7 days per year



## 2. Statistical parameter: Variance

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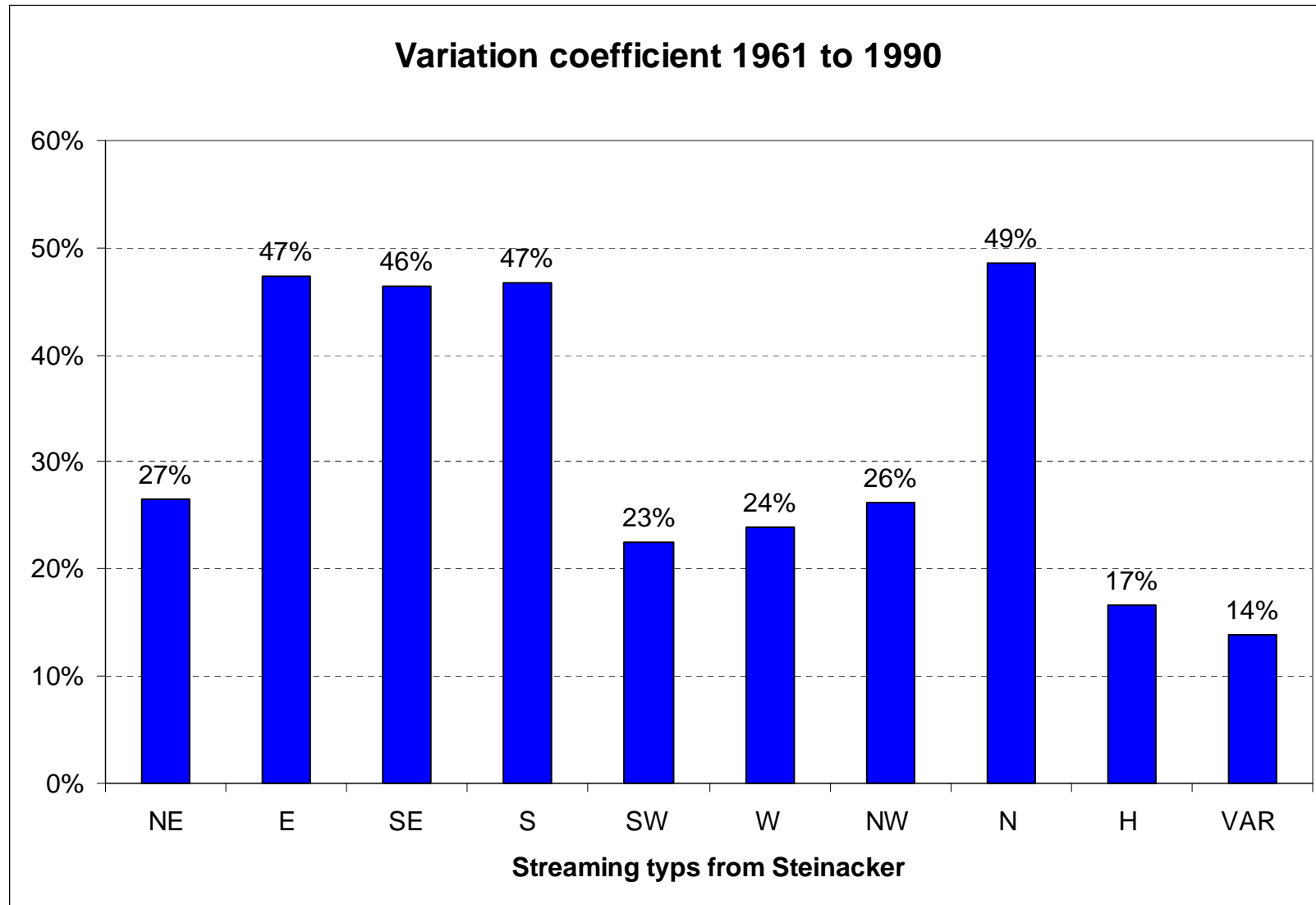
- Standarddeviation

$$[\text{Sum (quantity (i) minus median)}^2 / (n_i-1)]^{1/2}$$

Variationcoefficient ...  $V_c = \text{SD}/\text{MW}$



## 2. Variation



# 3. rare cases 43 years

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- The limit was 2.SD ( + / - ) each type (prob 5%)
- There are 15 years with rare cases
- We found in the 15 years 6 Minima (scarly) and 12 Maxima (often)
- There are 2 Periods without extremcases 1981 to 1987 and 1989 to 1995

# Rare cases - chronology

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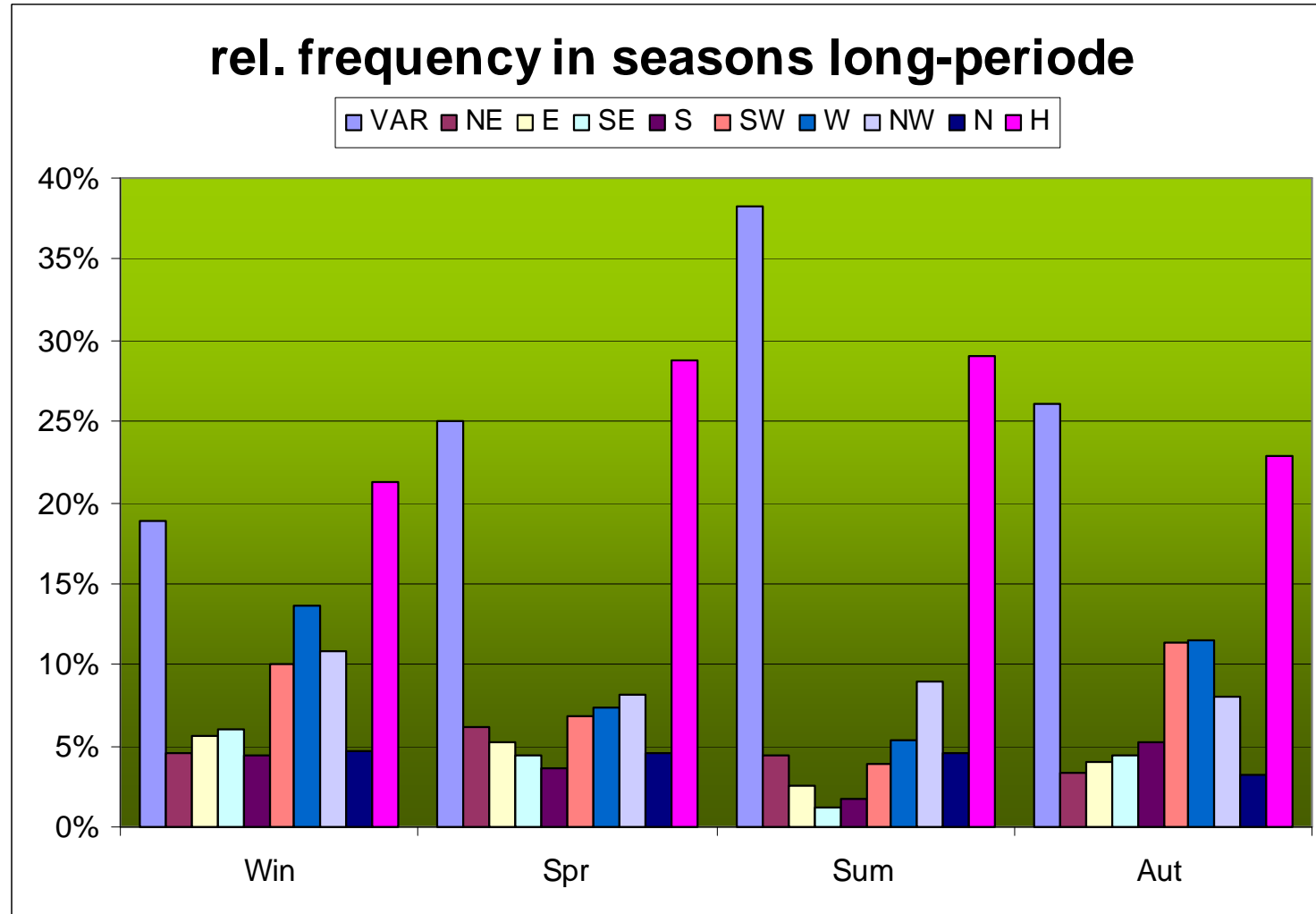
- 1963 scarly NW
- 1965 often SW
- 1971 often N, NE
- 1972 often S
- 1973 often N
- 1974 scarly VAR
- 1979 often H
- 1980 scarly SW
- 1988 often H
- 1996 scarly W and often NE, SE
- 1997 scarly NE
- 1998 often W
- 2000 scarly NE and often SW
- 2003 often E

# Rare cases – an overview

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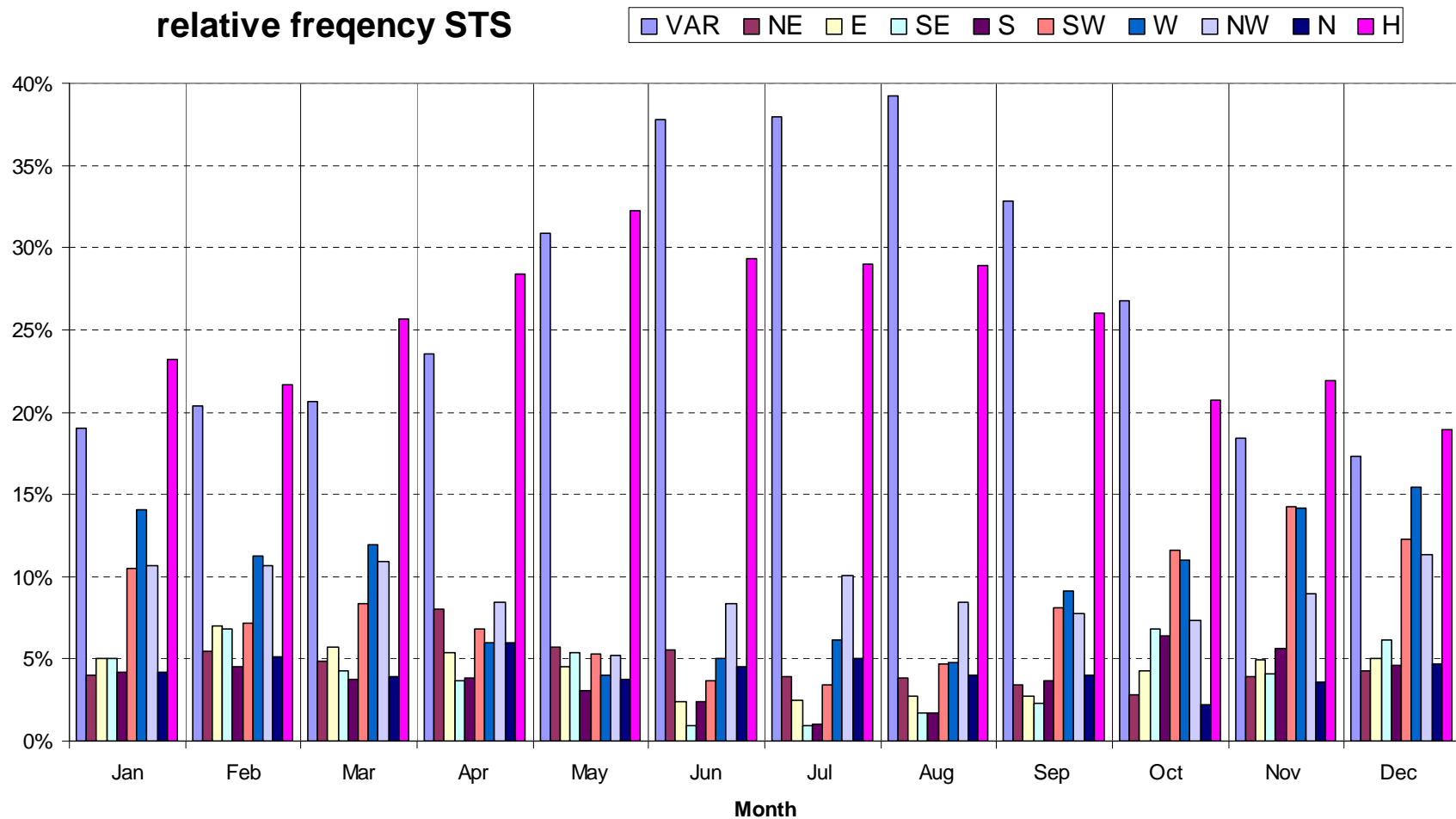
- A doubled case from type often in the years 1971 and 1996 shows the semi-chaotic structure of streaming in the alpine region
- From all types only three show strong variation in both extremes, the types are: SW, W and NE.
- The Type VAR never has a rare case.
- The probability for a year with quasi-normal condition is 65 percent.

# Seasonal distributions



# Monthly streaming types over 43 years

relative frequency STS



# Variations from day to day

- First approach was test of the duration of streaming-situations
- But later we analysed sector-variation
- Change + jumps

Change DD	days	%
+ / - 45 °	1785	11,4
+ / - 90 °	185	1,2
+ / - 135 °	37	0,2
+ / - 180°	15	0,1

# Conclusion

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- Steady is the change of the types
- Adv = 170.1, H = 94.1, VAR = 100.4 days for 1961-1990
- We found jumps from 135 degree direction (3 sectors) and 180° in 52 days in the whole period
- There are 2 periods without rare cases with a duration of 7 years



Thanks for your attention !