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

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Overview

1. Definition of streaming-types
2. Frequency in the normal-period 1961 to 1990
3. Variance of ST(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

- Flow over Alpine Space (Eastern Part)
- Streaming from advections
- 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“, Np = 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.

Days per year

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### Frequency

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

<table>
<thead>
<tr>
<th>Direction</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15.1</td>
</tr>
<tr>
<td>SW</td>
<td>29.3</td>
</tr>
<tr>
<td>NE</td>
<td>17.9</td>
</tr>
<tr>
<td>W</td>
<td>34.4</td>
</tr>
<tr>
<td>E</td>
<td>15.5</td>
</tr>
<tr>
<td>NW</td>
<td>31.4</td>
</tr>
<tr>
<td>SE</td>
<td>13.1</td>
</tr>
<tr>
<td>High</td>
<td>94.1</td>
</tr>
<tr>
<td>S</td>
<td>13.9</td>
</tr>
<tr>
<td>Var</td>
<td>100.4</td>
</tr>
</tbody>
</table>
850 hPa

Frequency for direction of streaming 1961-2003; High = 85.1 and Var = 86.7 days per year
2. Statistical parameter: Variance

• Standard deviation

\[ \text{Standard deviation} \]

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

Variation coefficient … \( Vc = SD/MW \)
2. Variation

Variation coefficient 1961 to 1990

Streaming types from Steinacker

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3. rare cases 43 years

• 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

- 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

- 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

rel. frequency in seasons long-periode

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Monthly streaming types over 43 years

relative frequency STS

Month

VAR NE E SE S SW W NW N H

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Variations from day to day

• First approach was test of the duration of streaming-situations

• But later we analysed sector-variation

• Change + jumps

<table>
<thead>
<tr>
<th>Change DD</th>
<th>days</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ / - 45°</td>
<td>1785</td>
<td>11,4</td>
</tr>
<tr>
<td>+ / - 90°</td>
<td>185</td>
<td>1,2</td>
</tr>
<tr>
<td>+ / - 135°</td>
<td>37</td>
<td>0,2</td>
</tr>
<tr>
<td>+ / - 180°</td>
<td>15</td>
<td>0,1</td>
</tr>
</tbody>
</table>
Conclusion

• Steady is the change of the types

• \( \text{Adv} = 170.1, \ H = 94.1, \ \text{VAR} = 100.4 \text{ days for 1961-1990} \)

• 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!