

# **AN OBJECTIVE METHOD OF THE STABILITY - SEGMENTED WIND ROSES CONSTRUCTION IN COMPLEX TERRAIN**

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# Overview

- **Motivation**
- **Wind roses used in SYMOS '97**
- **Method, input data, choice of testing stations**
- **Results, comparison with expert estimate and real data**
- **Conclusions, proposals for further work**

# Motivation

- Reference model for the regulatory purposes prescribed by the Czech environmental legislation – SYMOS Gaussian model (see e.g. Model Documentation System, <http://etc-acc.eionet.eu.int/databases/mds.html>)
- Among others, a stability-segmented wind rose used as a standard model input
- Wind rose from the nearby airport or meteorological station commonly used
- Owing to complex orography of the Czech Republic territory this approach is inapplicable over the majority of the country area-representativeness
- Roses should be modified by qualified expert with respect to the distinguished structures of the terrain shape
- Unbiased approach to the wind roses construction needed, objective method prospected

# Wind roses used in SYMOS'97

- 8 main wind direction sectors: N, NE, E, etc.
- 3 wind speed classes

Class	Range [m.s <sup>-1</sup> ]	Class representant [m.s <sup>-1</sup> ]
Weak wind	0.5 to 2.5	1.7
Moderate wind	2.6 to 7.5	5.0
Strong wind	over 7.5	11

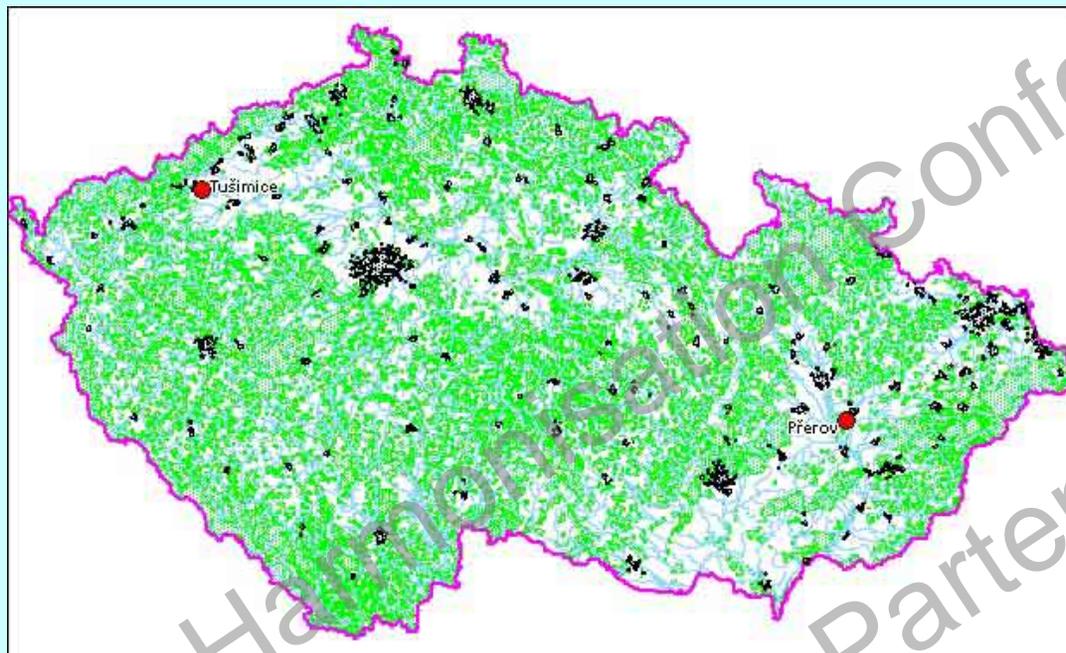
- 5 stability classes according to temperature gradient

Class	Gradient [°C/100 m]
I super stable	$\gamma < -1.6$
II stable	$-1.6 \leq \gamma < -0.7$
III isothermal	$-0.7 \leq \gamma < 0.6$
IV neutral	$0.6 \leq \gamma \leq 0.8$
V convective	$0.8 < \gamma$

# Method

- Well known CALMET preprocessor (<http://earthtec.vwh.net/download/calmet.pdf>) applied and tested for this purpose
- 2 meteorological stations providing hourly data of good quality, located in non-uniform or in complex terrain, chosen as testing points
- These data not used as a model input, for validation only
- Input data
  - one-year time series of hourly data from the neighbouring meteorological stations
  - upper-level data from the Czech radio-sounding stations
  - detailed digital terrain model of the testing station surroundings
- For the each grid point covering the area, CALMET provides a one-year series of hourly wind and temperature data in suitably set of height levels
- Vertical temperature gradients evaluated, the modeled wind data arranged according to SYMOS stability classes
- Stability-structured wind roses for three wind speed categories can be derived from the wind direction class-frequencies

# Testing stations



Tušimice

Long 13.3281° E

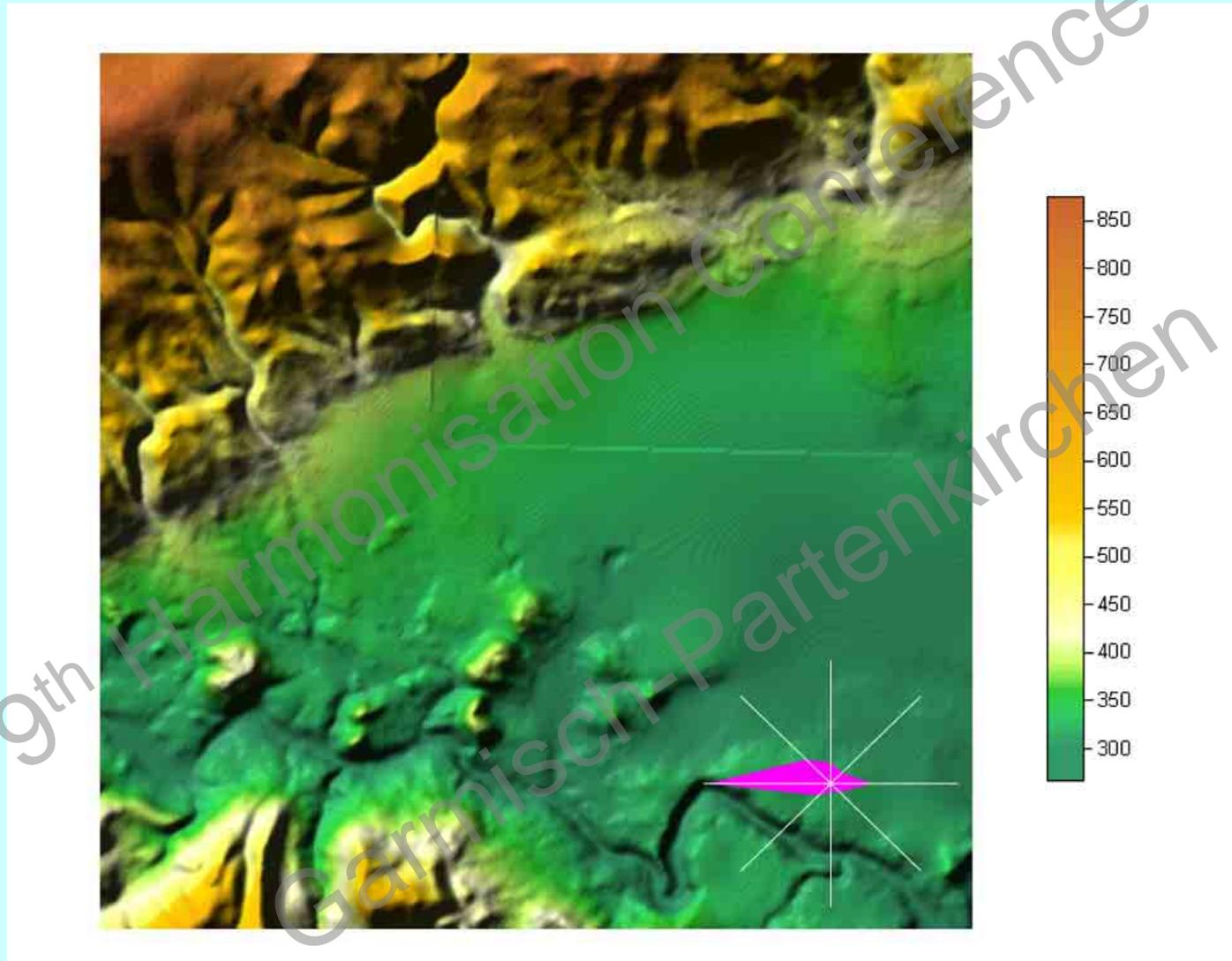
Lat 50.3764° N

Přerov

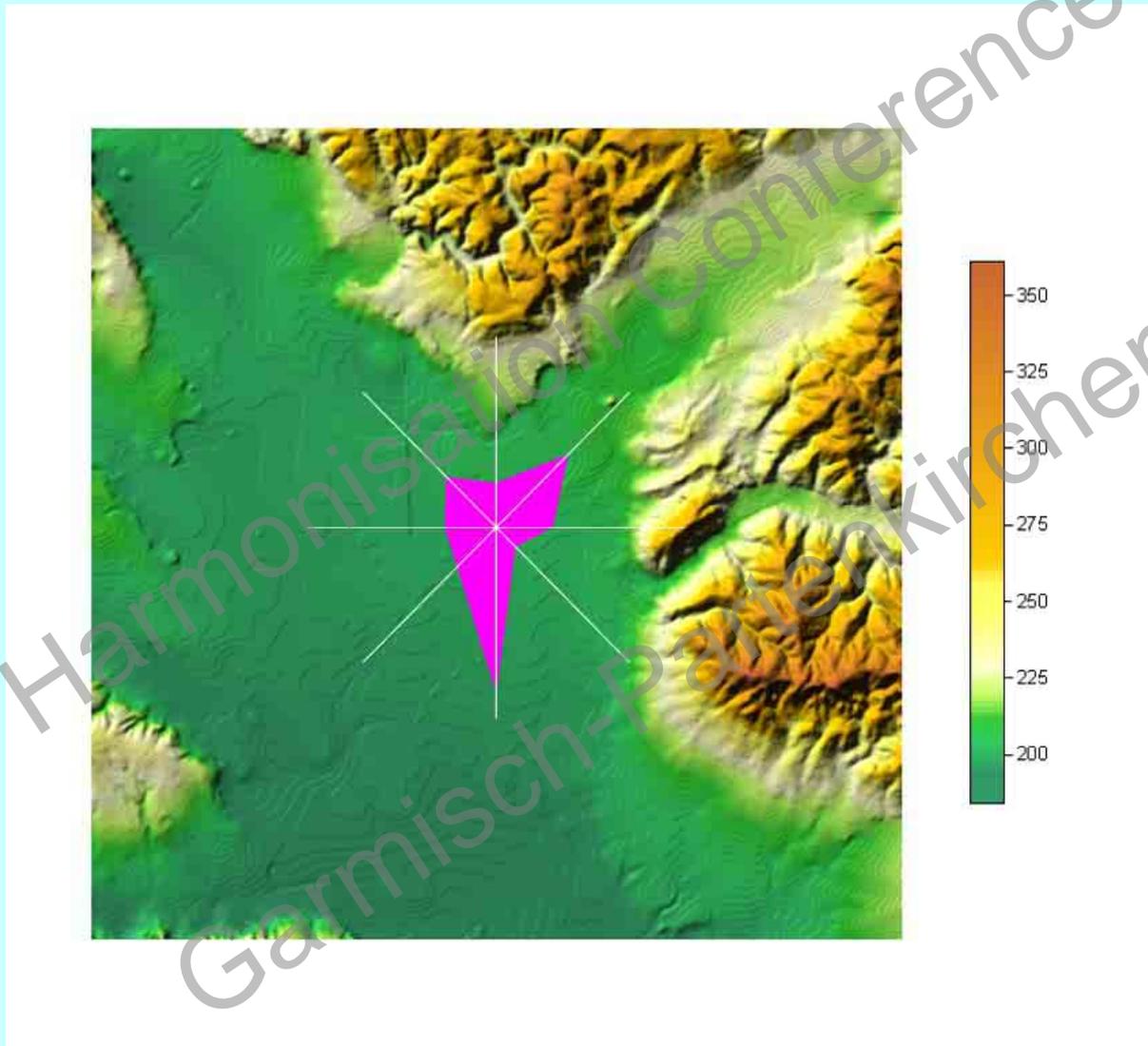
Long 17.4078° E

Lat 49.4242° N

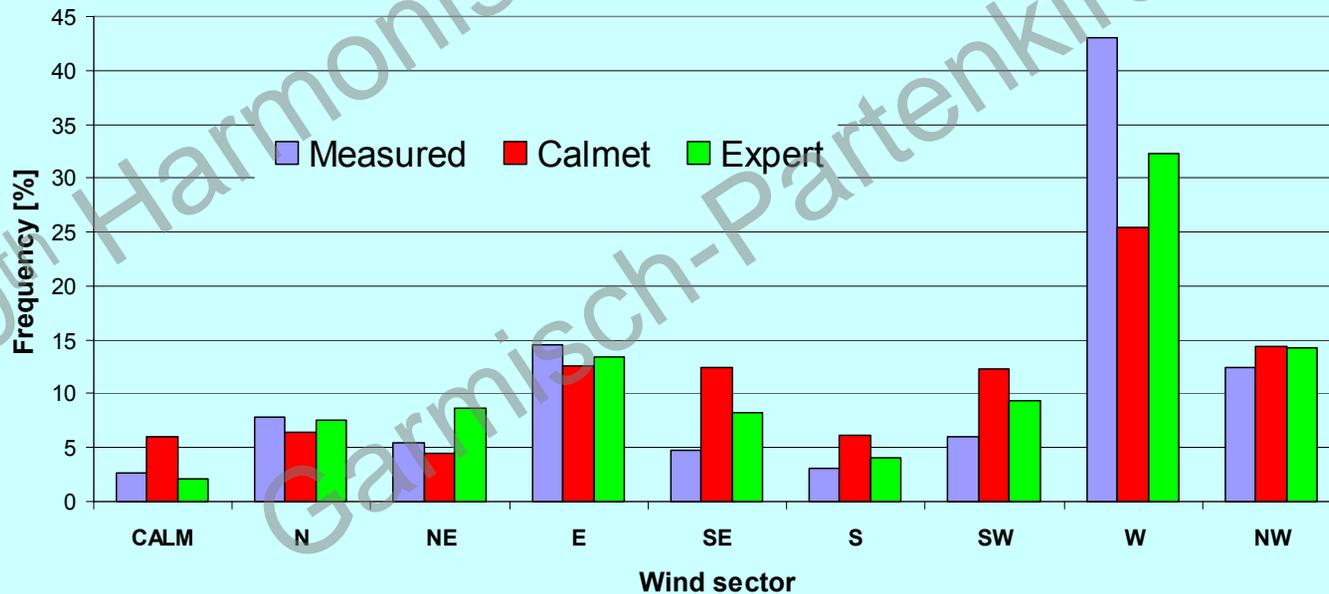
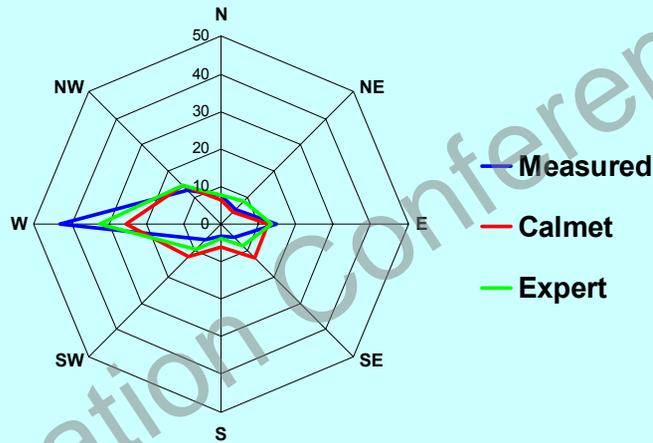
# Testing station Tušimice – terrain and rose 2002



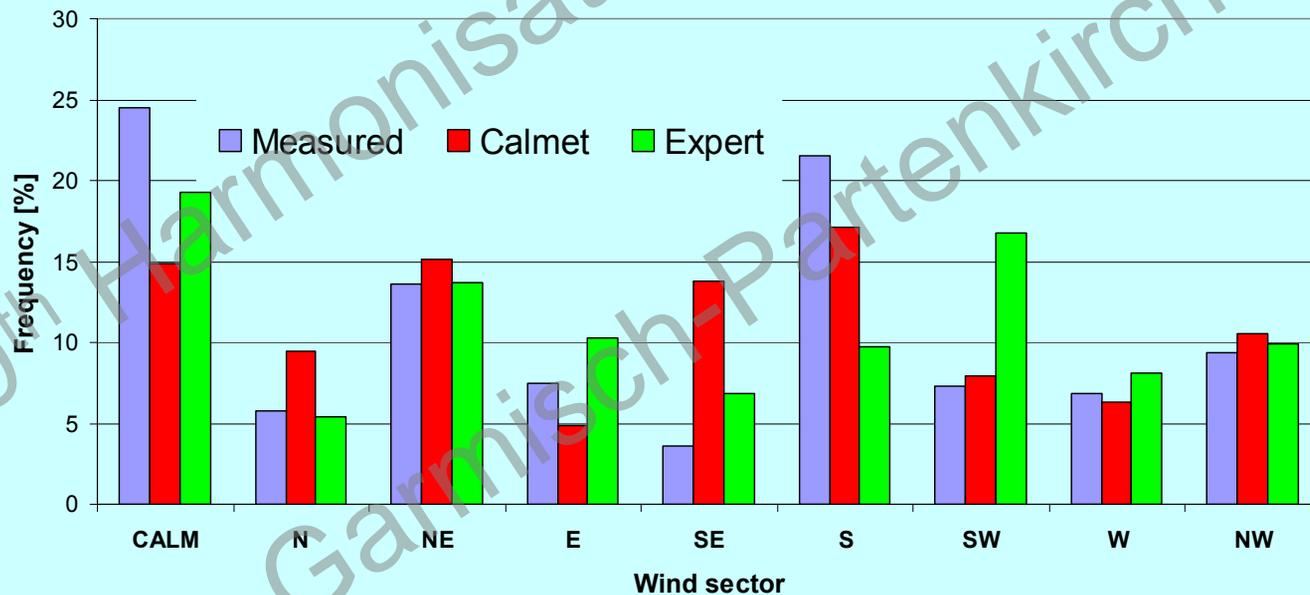
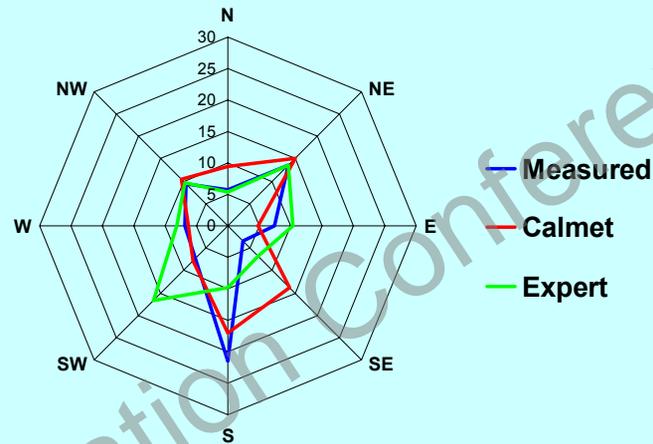
# Testing station Přerov – terrain and rose 2002



# Results – rose Tušimice 2002



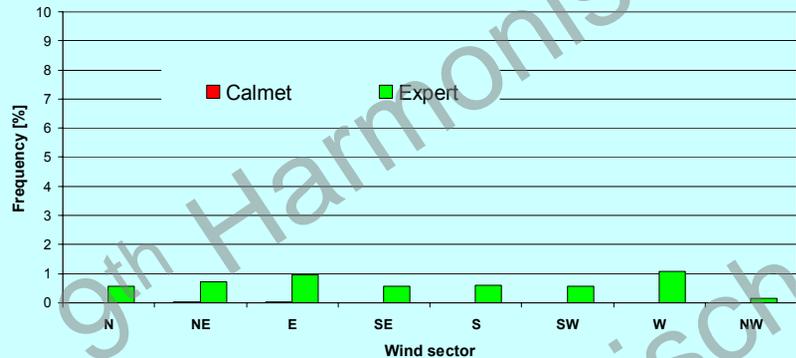
# Results – rose Přerov 2002



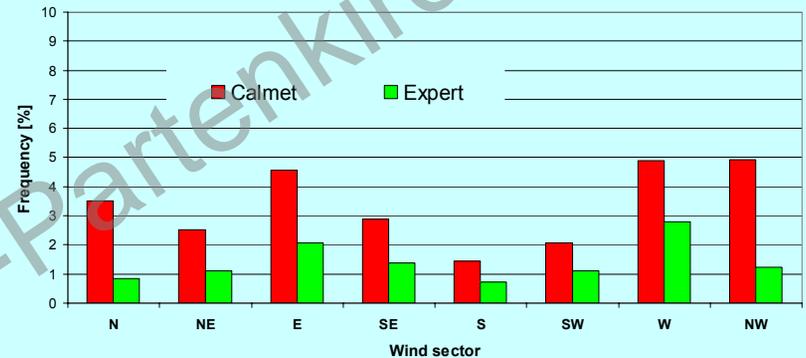
# Results – roses Tušimice, split by stability

## Superstable and stable class

Calmet and expert assessment compared only, stability data for Tušimice not yet completed (RASS?)



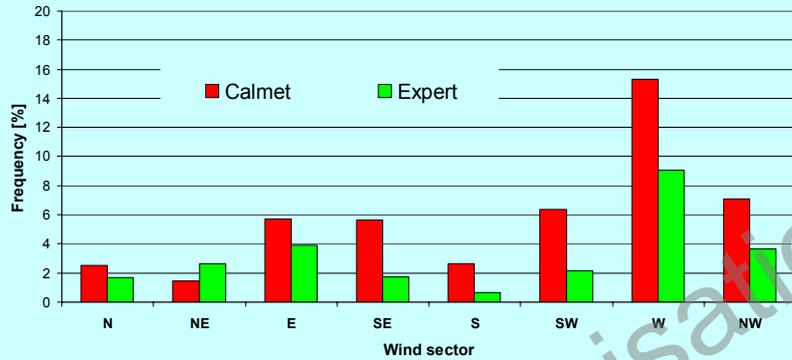
Superstable



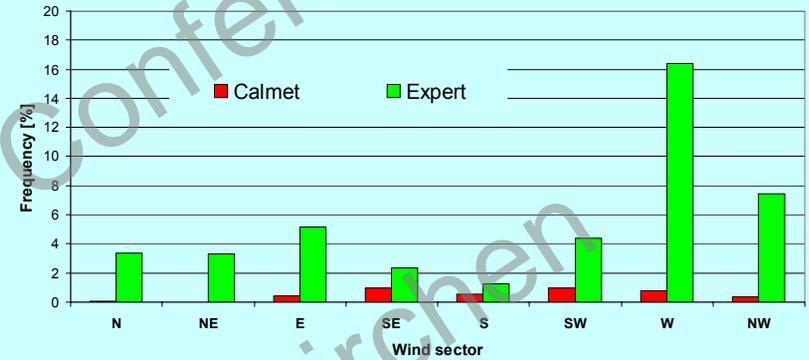
Stable

# Results – roses Tušimice, split by stability

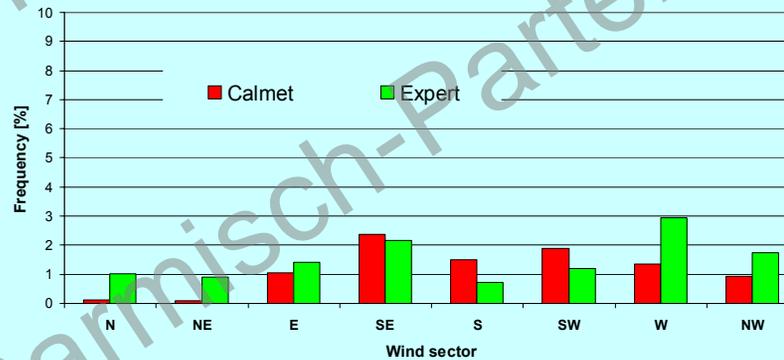
## Isothermal, neutral and convective class



Isothermal



Neutral



Convective

# Conclusions and scope of future work

- Objective method of stability-segmented wind roses proposed, based on Calmet preprocessor
- Tested on the data from stations located in non-uniform terrain
- The method provides reasonable results, not worse if compared with expert assessment applied so far (for roses without stability splitting)
- Significant differences between expert and model results determined in Tušimice for particularly for stability classes III and IV – who is right?
- Further tests on measured data and method improvements prepared
- Final stage – sw package for wind roses construction