CLIMATIC REGIONING OF LITHUANIA FROM THE POINT OF VIEW OF WINTER ROAD MAINTENANCE

Tomas Ratkevičius
Vilnius Gediminas technical university
PhD student
tomas.ratkevicius@vgtu.lt

Other Authors:
Prof Dr Alfredas Laurinavičius
Prof Dr Donatas Čygas
Assoc Prof Dr Audrius Vaitkus

XIV CONGRÉS INTERNACIONAL DE VIABILITAT INVERNAL
Andorra, 4-7 de febrer 2014

MAIN PARTS OF THE PRESENTATION

1. INTRODUCTION
2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA
3. CONCLUSIONS

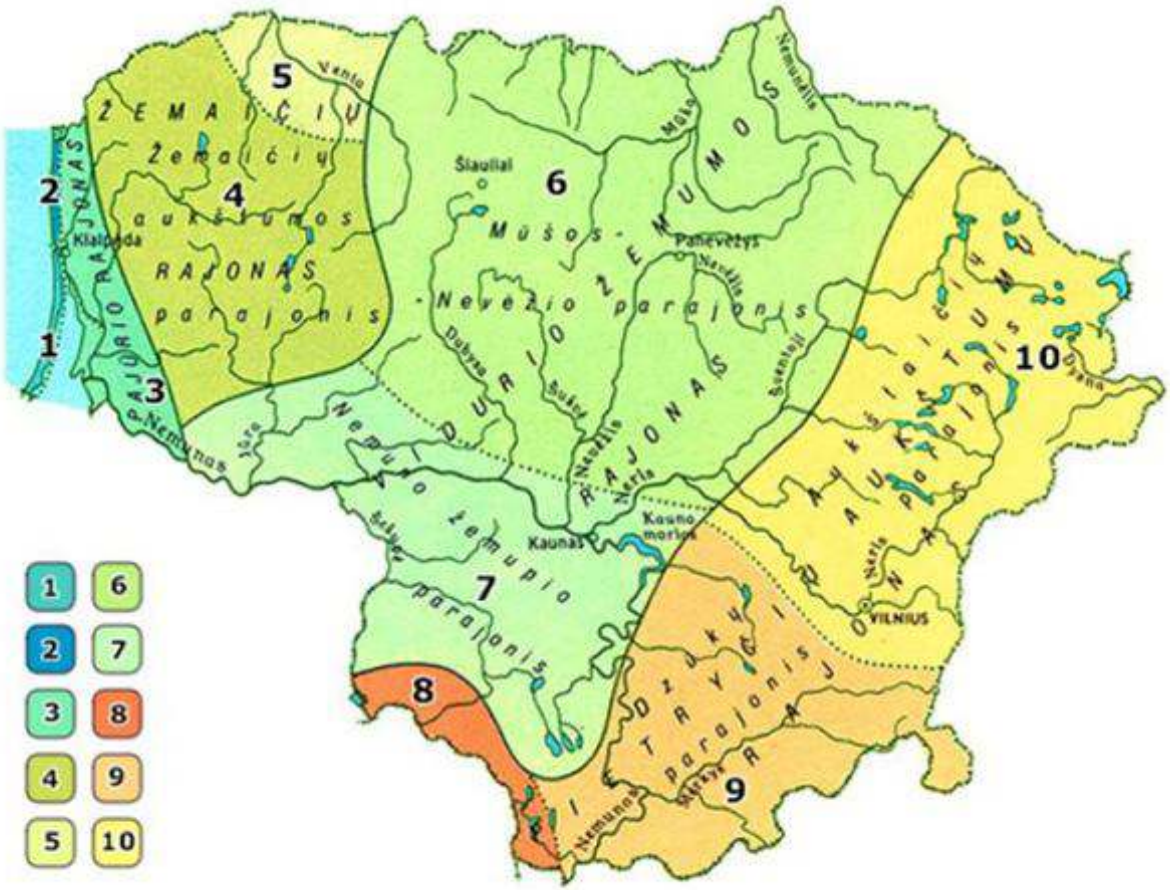
1. INTRODUCTION

Location of Lithuania in the world map

1. INTRODUCTION

Winter Road Maintenance

1. INTRODUCTION



1. Curonian Spit
2. Seashore
3. Coastal Lowlands
4. Samogitian Highlands
5. Venta Midstream Lowlands
6. Mūša – Nevėžis
7. The Lower Reaches of Nemunas
8. Sudovia
9. Dzūkija
10. Higher Lithuania

2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA

Winter Severity Index (WSI) in Lithuania

$$WSI = a\frac{K_{fakt.}}{K_{aver.}} + b\frac{P_{fakt.}}{P_{aver.}} + c\frac{T_{0\,fakt.}}{T_{0\,aver.}} + d\frac{L_{fakt.}}{L_{aver.}},$$

where

$K_{fact.}$ – factual amount of precipitation in a considered period, mm;

$K_{aver..}$ – average multi-year amount of precipitation, mm;

$P_{fact.}$ – factual number of days with blizzards and blowing snow;

$P_{aver.}$ – average multi-year number of days with blizzards and blowing snow;

$T_{0\ fact.}$ – factual number of days with air temperature transitions over;

$T_{0\ aver.}$ – average multi-year number of days with air temperature transitions over *0° C*;

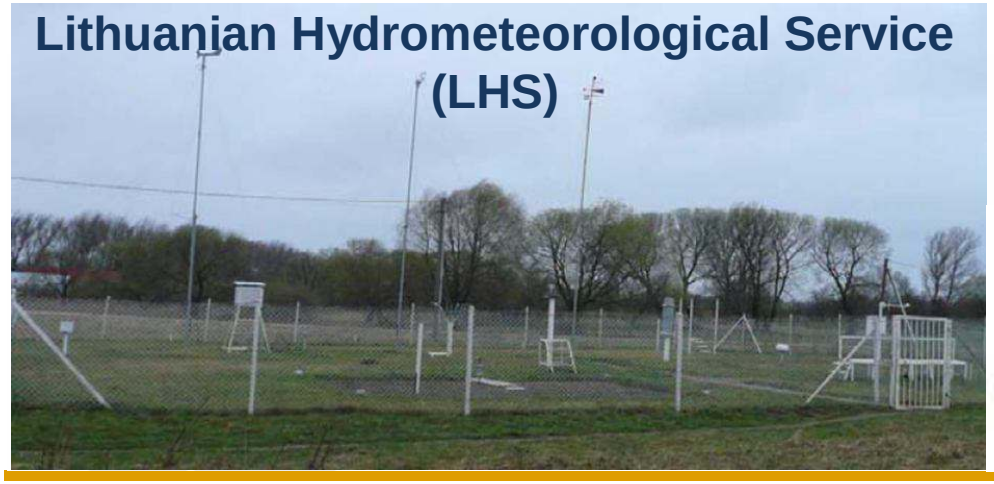
$L_{fact.}$ – factual number of days with freezing rain;

$L_{aver.}$ – average multi-year number of days with freezing rain;

a, b, c, d, – weighing coefficients.

2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA

Analysis of *LHS* and *RWIS* Data 1999-2012 period



Climatic coefficient k_i:

$$k_i = \frac{a_i}{a_v},$$

Where

a_v – the average value of the characteristic to be determined;

a_i – the value of the characteristic to be determined in particular region (zone).

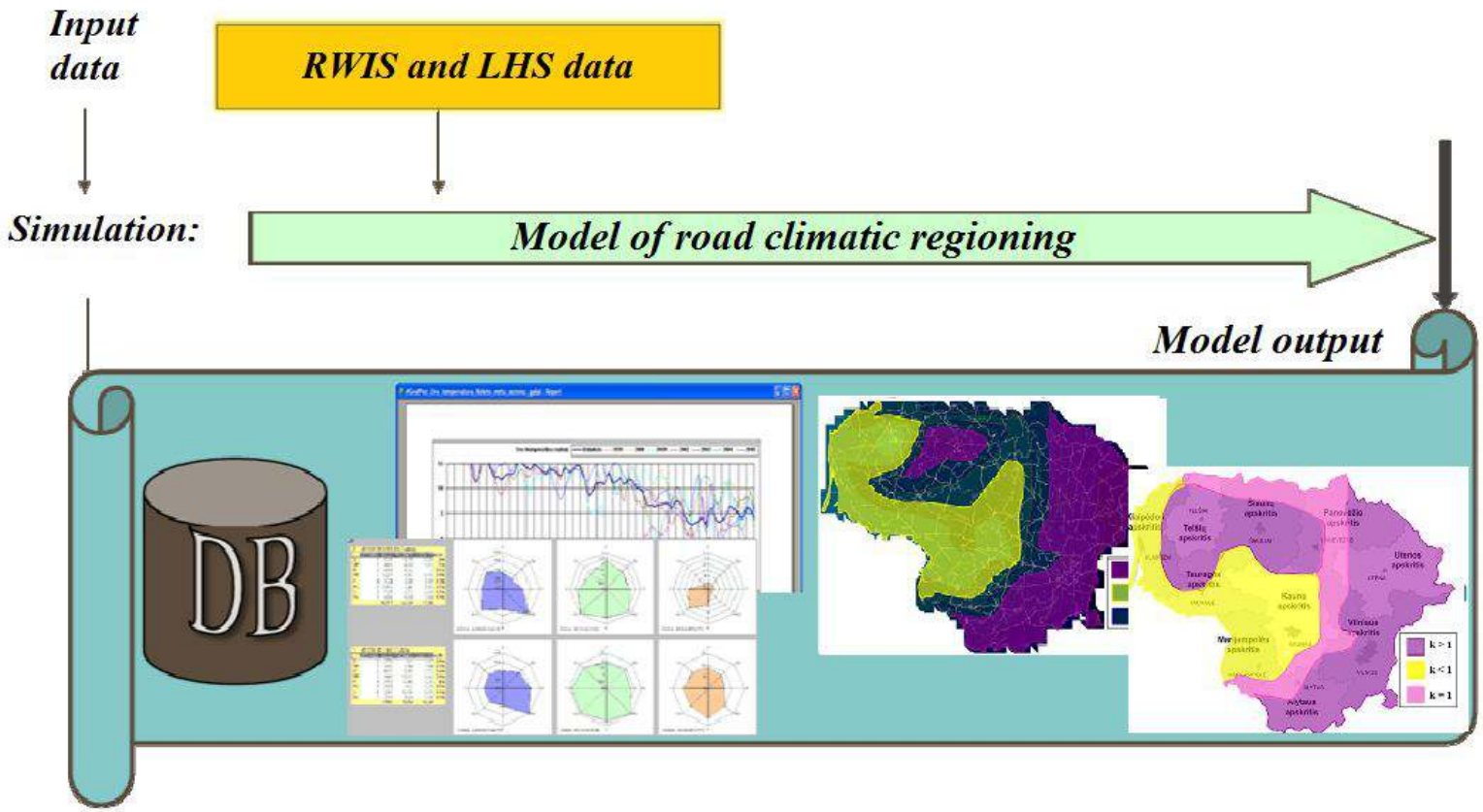
The average value of each characteristic:

$$a_v = \frac{\sum_{i=1}^{n} a_i}{n}$$

where

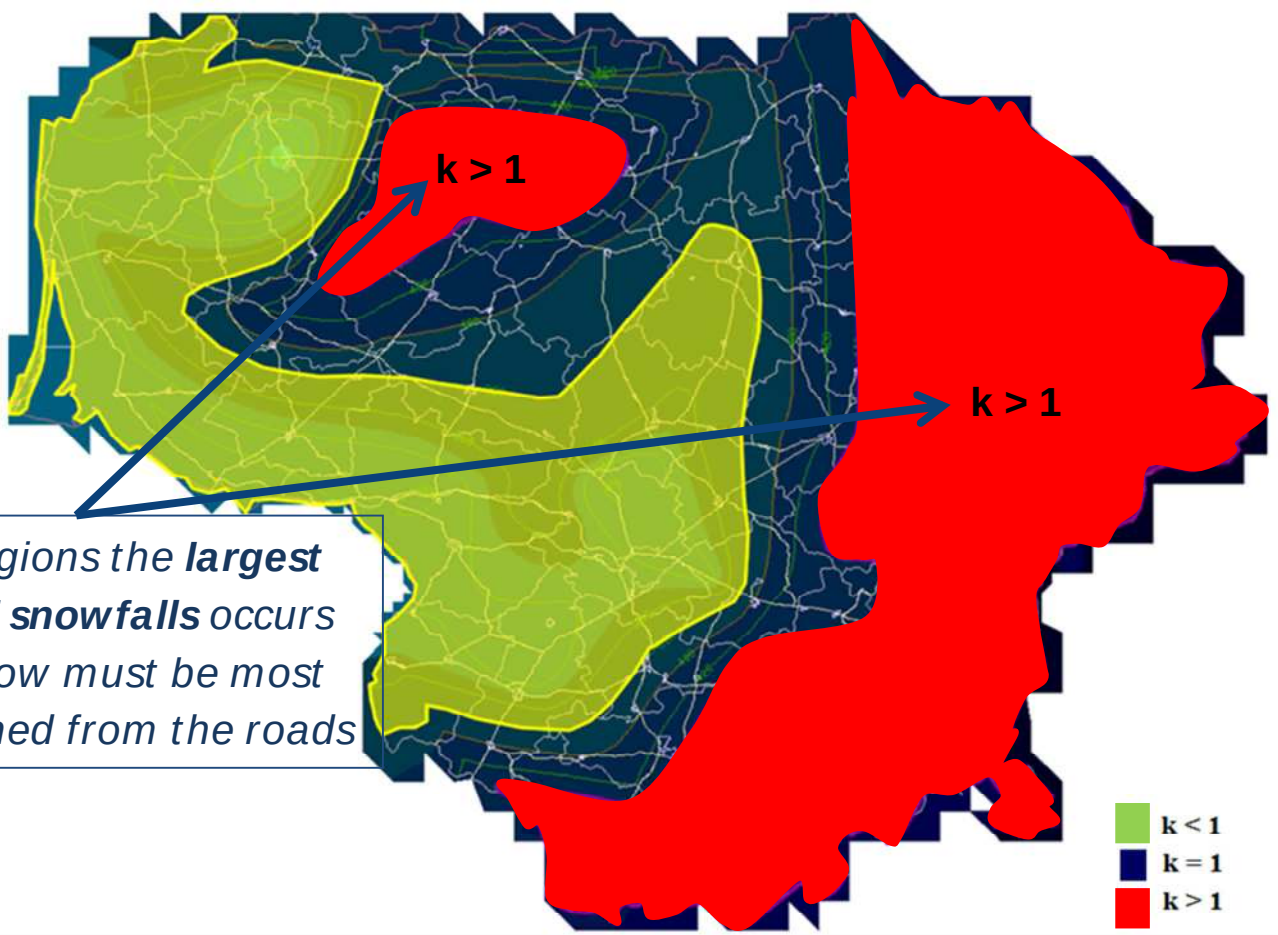
n – number of regions (zones) considered.

Model of climatic regioning



2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA

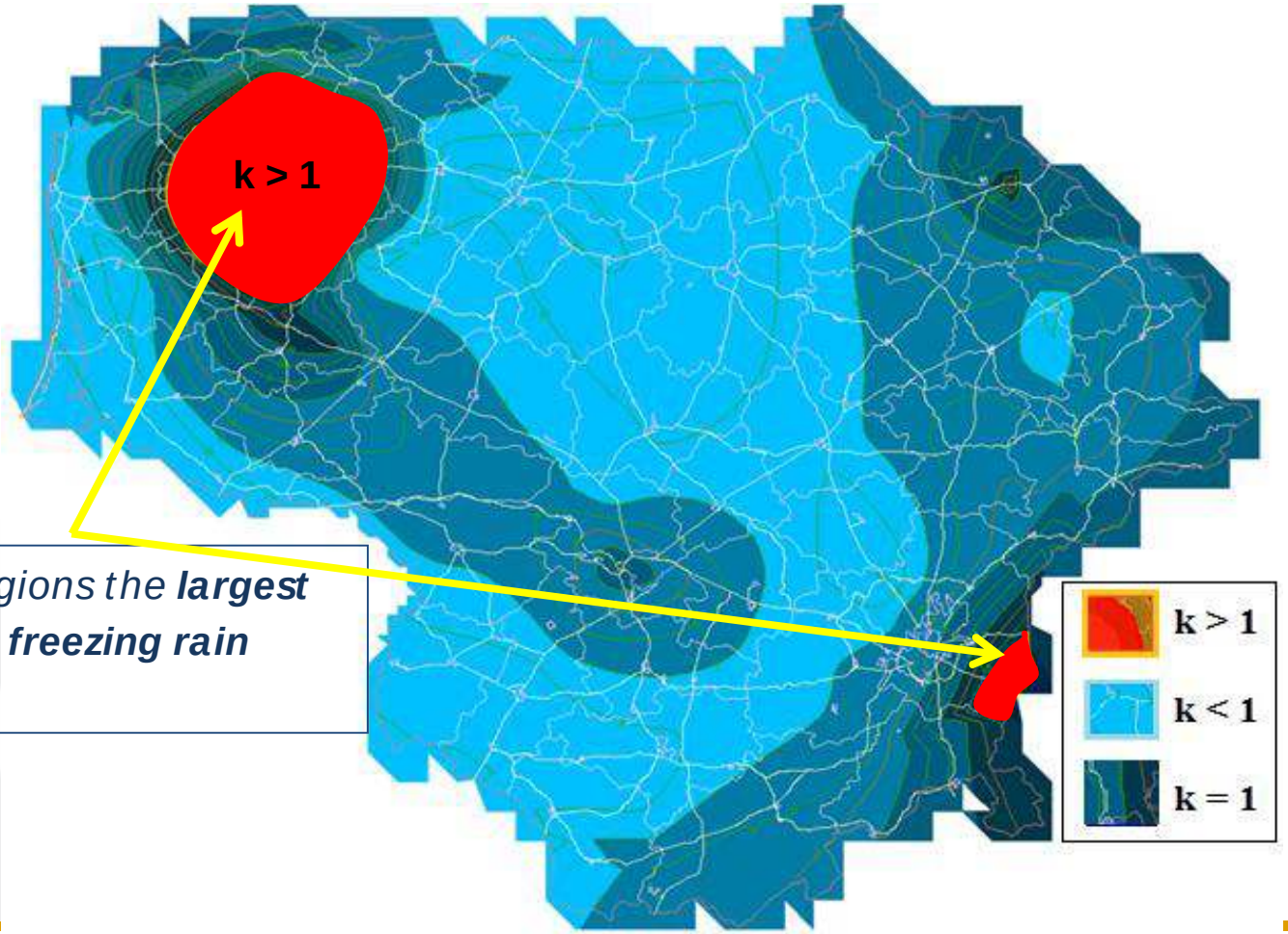
Distribution zones by the coefficient of average **snowfall duration** (in hours), per year



*In those regions the **largest amount of snowfalls** occurs and the snow must be most often cleaned from the roads*

2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA

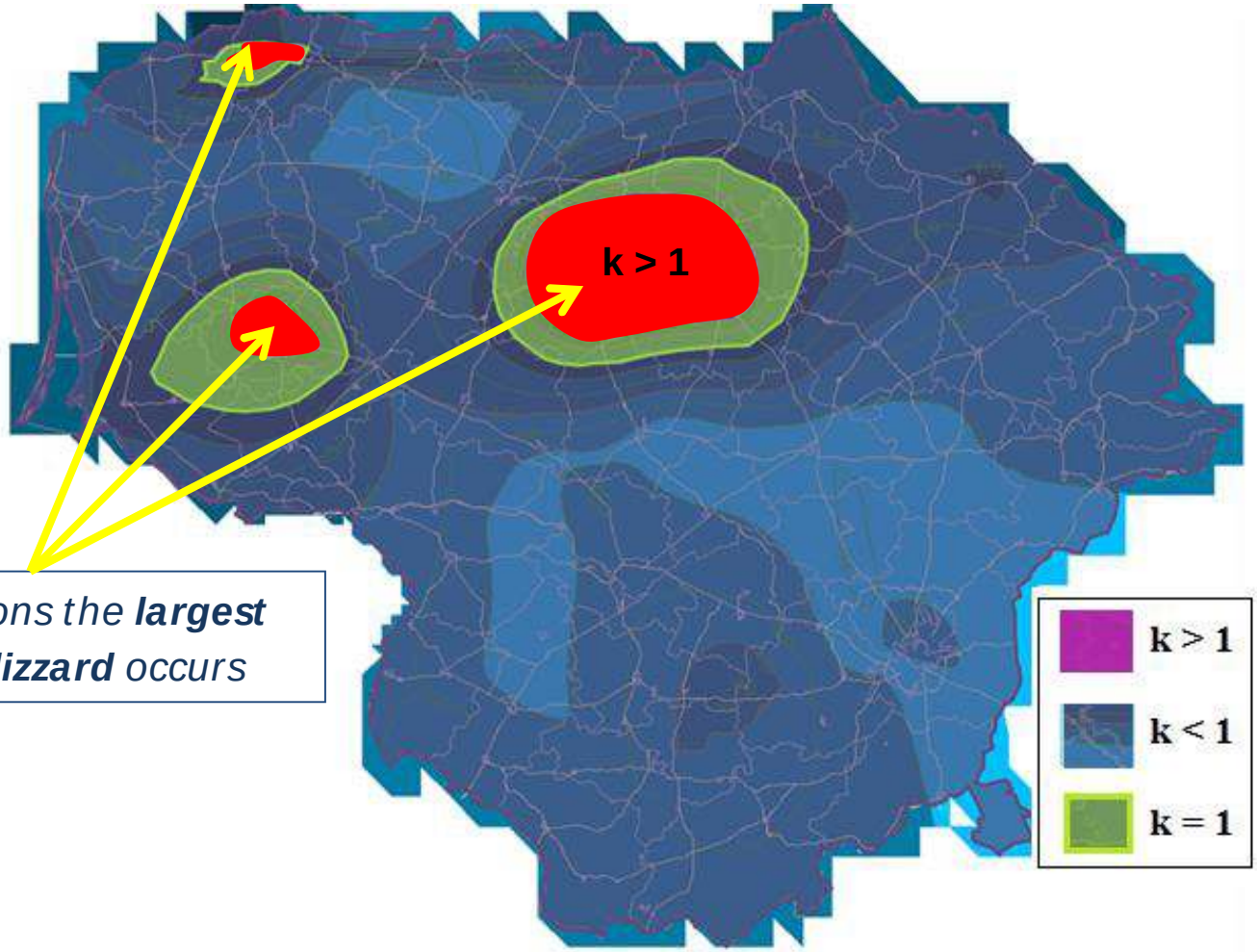
Distribution zones by the coefficient of average **freezing rain duration** in hours, per year



*In those regions the **largest amount of freezing rain** occurs.*

2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA

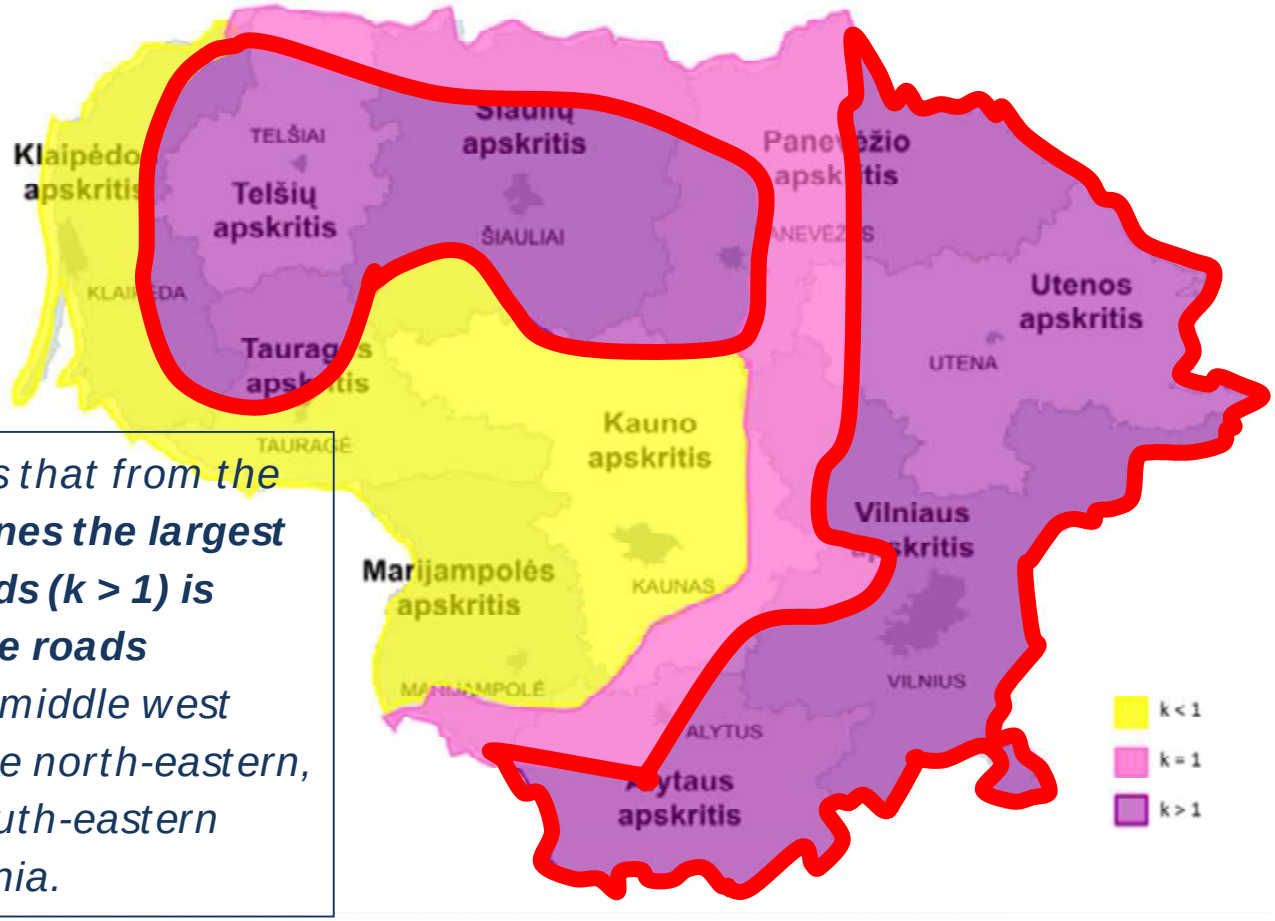
Distribution zones by the coefficient of average **blizzard duration** in hours, per year



*In those regions the **largest amount of blizzard** occurs*

2. DETERMINATION OF THE COMPLEX CLIMATIC ROAD MAINTENANCE INDICES FOR DIFFERENT CLIMATIC ZONES IN LITHUANIA

General Map of <u>All Climatic Factors</u>



The map shows that from the ***red marked zones the largest amount of funds (k > 1) is required for the roads*** *situated in the middle west Lithuania, in the north-eastern, eastern and south-eastern parts of Lithuania.*

3. CONCLUSIONS (1)

1. From geographical point of view Lithuania is divided into regions according to the most characteristic weather conditions where regions are not related by one or another climatic index. When designing, building or **maintaining roads** it is necessary to take into consideration **not only the average climatic indices** of the whole Lithuania **but also to study in detail the *LHS* and *RWIS* data** mostly close to the certain road.
2. When analyzing probability for the occurrence of meteorological factors having the largest effect on road users, first of all, it is necessary to determine the time of winter season when bad and extremely bad traffic conditions could be caused by the following factors – blizzard, glazed ice, snow, fog, wind, low temperature and large air humidity or their combinations.

3. CONCLUSIONS (2)

3. **A climatic coefficient (s) has been suggested** (of snowfall cases and duration, freezing rain cases and duration, blizzard cases and duration) **which would help to revise the quantity of maintenance works and their costs in winter.** The zone where the value of climatic coefficient is higher than 1 represents the most frequent unfavourable weather conditions for road maintenance

4. **Climatic coefficient would help to calculate in more detail the *Winter Severity Index* which shows the main climatic characteristics of the zone related to road maintenance**.

3. CONCLUSIONS (2)

5. ***The Winter Severity Index***, currently used for winter road maintenance, include the most important climatic parameters which affect road maintenance, however, **it is suggested to improve it by adding several factors that are also important, e. g. to determine air humidity and negative temperature of road surface since a negative temperature or the transitions of air temperature over 0°C, when there is no certain humidity and precipitation, have no significant effect.** Besides, **this would increase the number of weighing coefficients, and calculations would be more accurate**

THANK YOU FOR ATTENTION