

# The Hungarian CRIGiS Project

## Vulnerability and Impact Studies with a focus on Tourism and Critical Infrastructures

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# CRIGiS in the NAGiS system



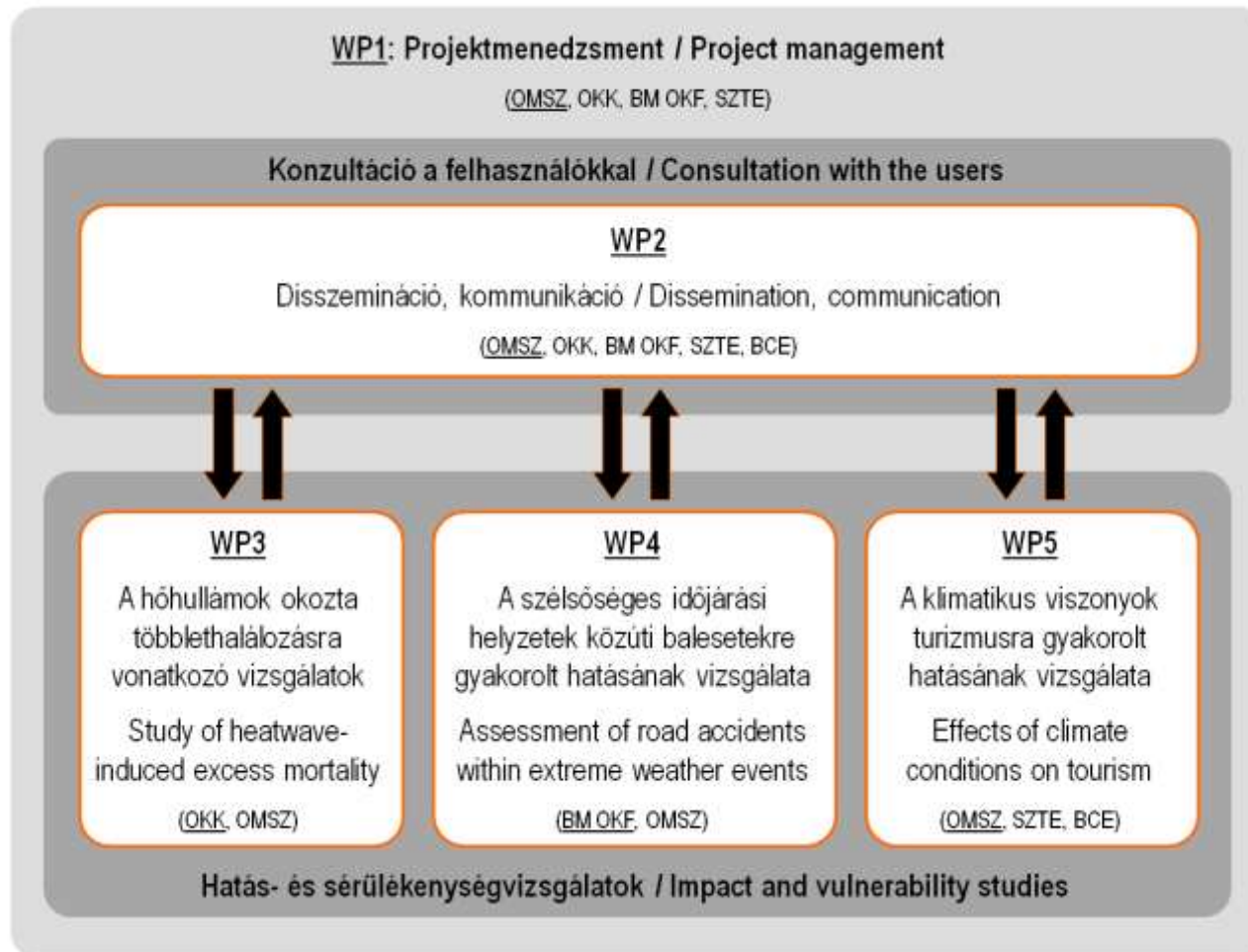
- Agreement between Hungary and European Economic Area (EEA) to implement Program 'Adapting to climate change in Hungary'
- CRIGiS (and 2 other projects) were initiated to extend the NAGiS to further sectors
- Main objectives
  - To develop methodology for quantifying the effects of climate change in various sectors
  - Integration of produced data layers into NAGiS database
- KRIGiS focused on three main areas:
  - healthcare, critical infrastructure and tourism

# OMSZ contribution to the NAGiS system



- Gridded data based on observation (MASH-MISH)
  - 1961-2010
  - Daily data: maximum and minimum temperature, precipitation, global radiation
  - Seasonal data: relative humidity
  - Annual data: wind speed
- Gridded data based on climate models (ALADIN-Climate 4.5 and RegCM)
  - 1961-1990, 2021-2050, 2071-2100
  - Daily data: maximum, minimum and mean temperature, precipitation, global radiation, wind speed (2, 10 m)
  - Monthly data: relative humidity
  - SPI for 3, 6, 12 months

# Structure of the CRIGiS project



# Main data of the project



- Duration of the project: 30.04.2015-31.12.2015
- Consortium:
  - Hungarian Meteorological Service (OMSZ), lead partner
    - Climate data, tourism
  - National Public Health Centre (OKK)
    - heatwave
  - National Directorate General for Disaster Management (BM OKF)
    - Road accidents
  - University of Szeged, Department of Climatology and Landscape Ecology (SZTE)
    - tourism

# Methodology



- Determination of climate and impact indicators
- Calculation of climate indicators on the base of observed data for the NAGiS grid
- Determination of a connection between the climate and impact indicators, test for some pilot region
- Determination of climate indicators in the future (2021-2050, 2071-2100) for the NAGIS grid
- Establishment of the impact indicators in the future on the base of the disclosed connections
- Analysis of the changes

# Climate data



- Data in the NAGiS
  - Observed data: 1961-2010
  - Climate model outputs: 1961-1990, 2021-2050, 2071-2100
- New parameters excluded from NAGiS (eg daily wind speed, relative humidity and cloudiness)
- New periods according to impact indicators (observed and model outputs)
- Calculation of climate indicators for the NAGiS grid and other points (road network) and statistical regions

# Study of the excess mortality related to heatwaves



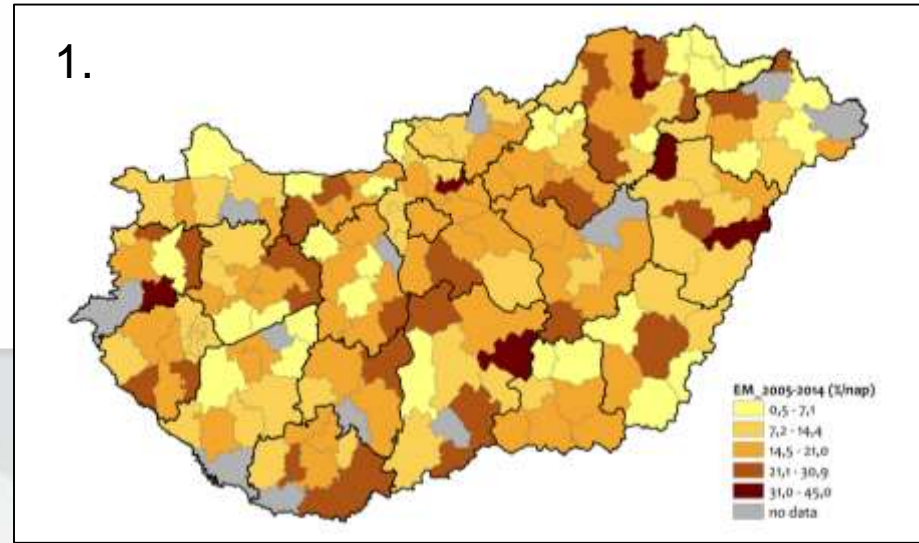
- Input data:
  - Daily mean temperature averaged for NUTS4 statistical regions
    - Observed data: 1961-1990, 2005-2014
    - Climate model outputs: 1961-1990, 1991-2020, 2021-2050, 2071-2100
  - Mortality data for NUTS4 statistical regions
- Days with heatwaves: days with temperature exceeding the 90% percentile of daily mean temperature
- Determination of the excess mortality related to heatwaves in the reference period
- Determination of expected degree of the excess mortality related to heatwaves in the periods 2021-2050, 2071-2100



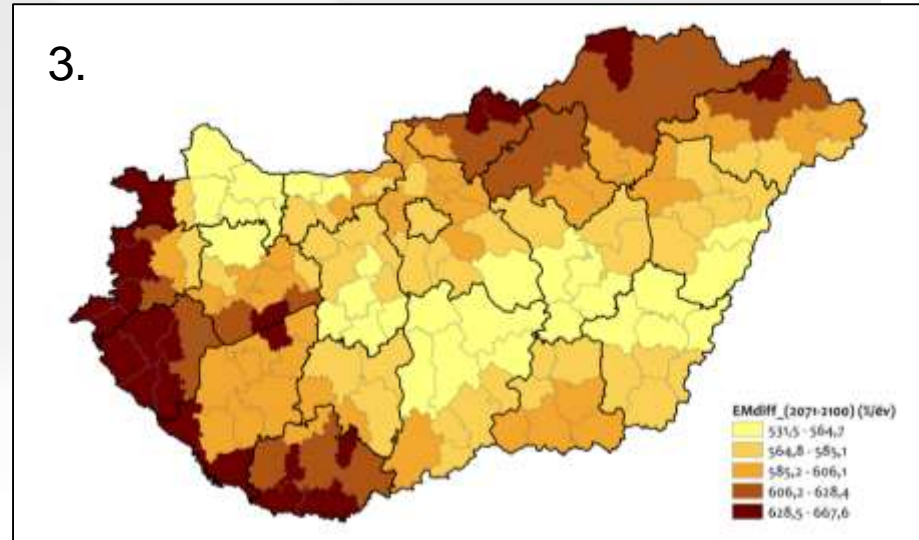
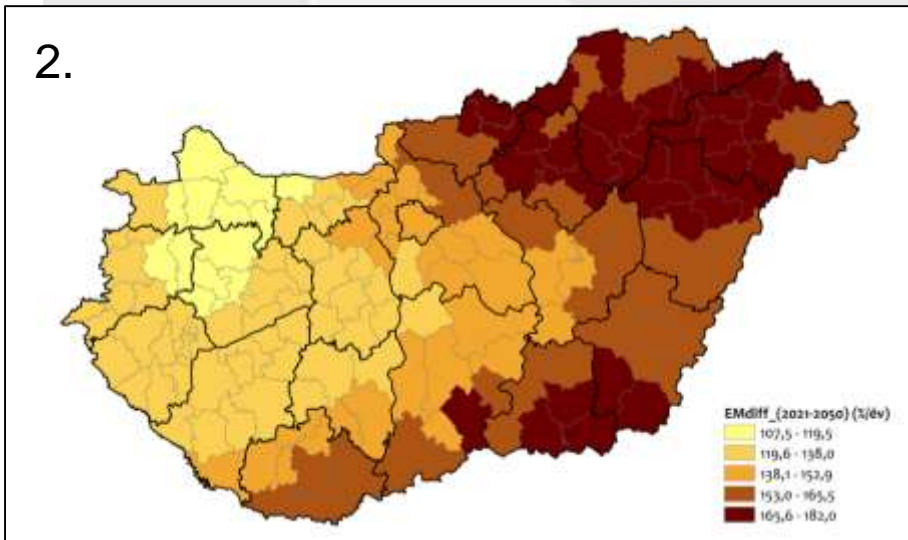
1. Excess mortality on days above threshold temperature (%/days), 2005–2014

2. Additional excess mortality due to climate change (%/year) at NUTS4 level, 2021–2050

3. Additional excess mortality due to climate change (%/year) at NUTS4 level, 2071–2100



	Range of excess mortality (%)	Country-wide number of death cases
2005-2014	0-45	783/year
2021-2050	107-182	2030/year
2071-2100	531-668	5800/year



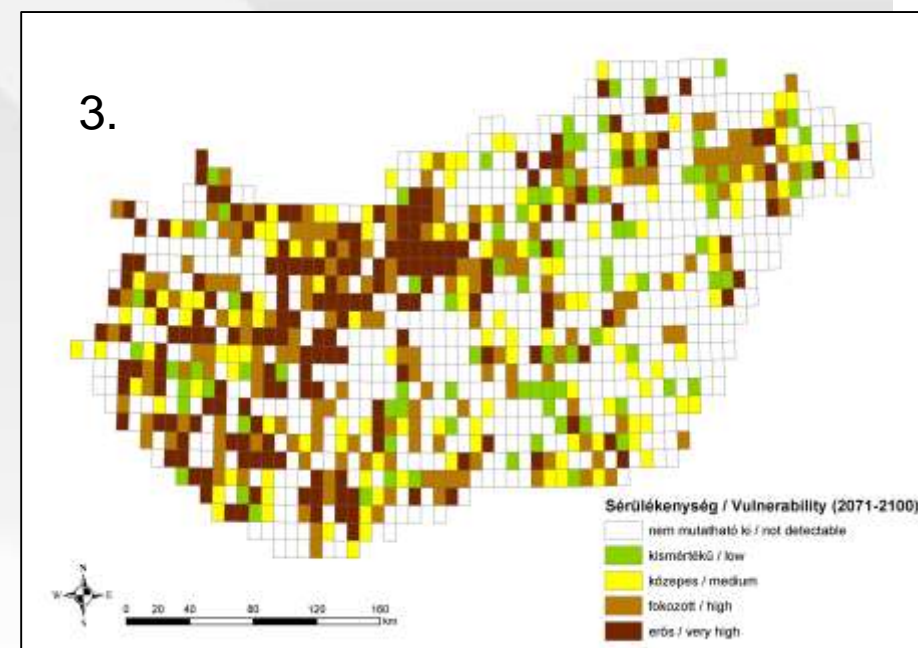
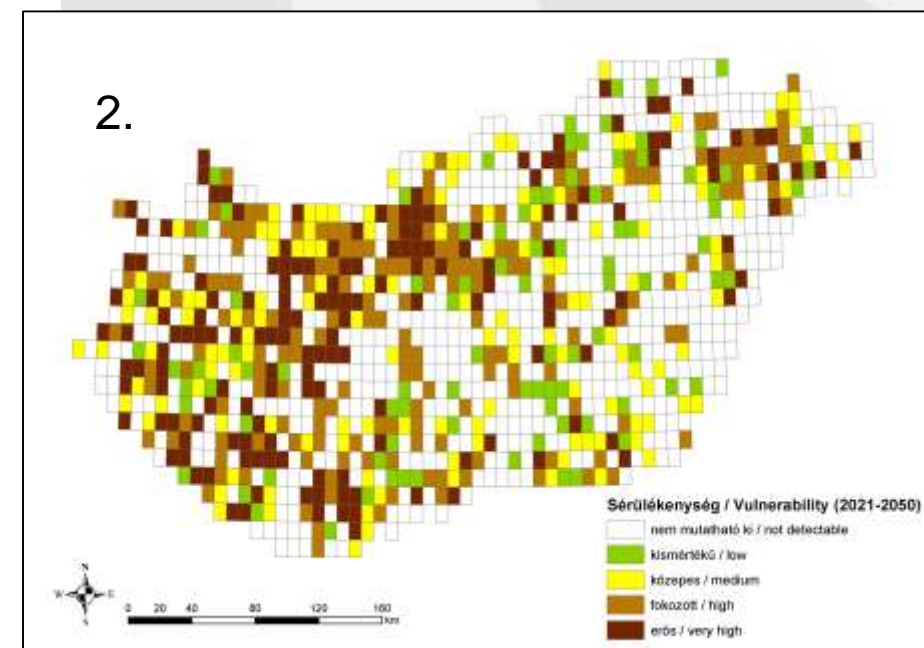
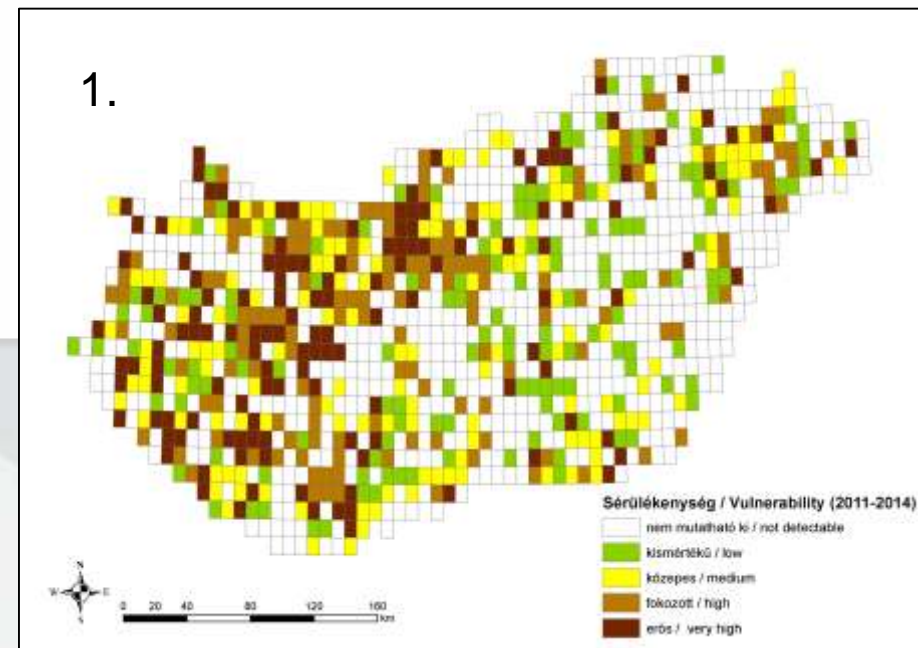
# Impact and vulnerability assessment of road accidents within extreme weather events

- Input data:
  - Number of road accidents recorded at the National Directorate General for Disaster Management (2011-2014)
  - Heat days
  - Days with precipitation in winter
- Excess number of accidents related to the countrywide average
- Calculation of climate indicators for the future, determination of expected number of road accidents
- Analysis of the changes

1. Vulnerability of road accidents related to wet winter days in 2011–2014

2. Vulnerability of road accidents related to wet winter days in 2021–2050

3. Vulnerability of road accidents related to wet winter days in 2071–2100

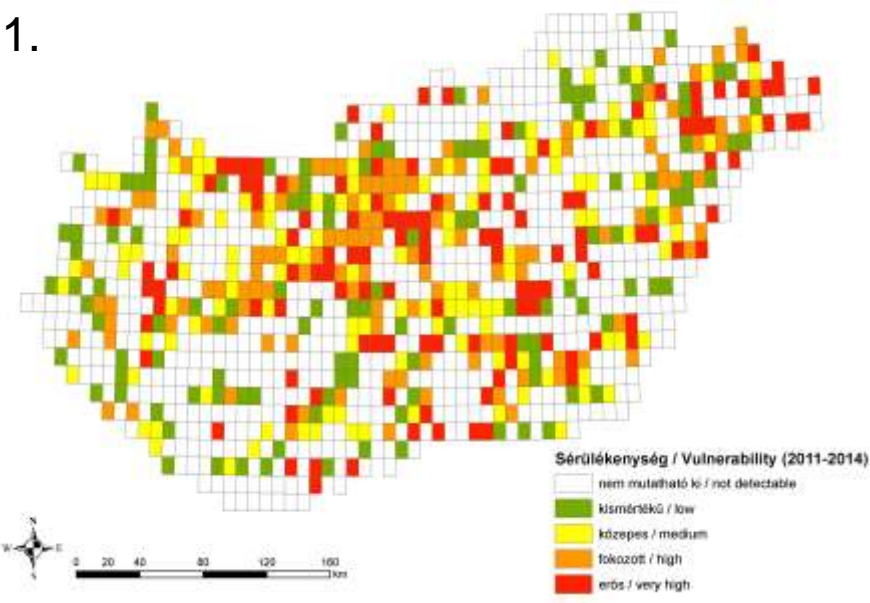


1. Vulnerability of road accidents related to hot days in 2011–2014

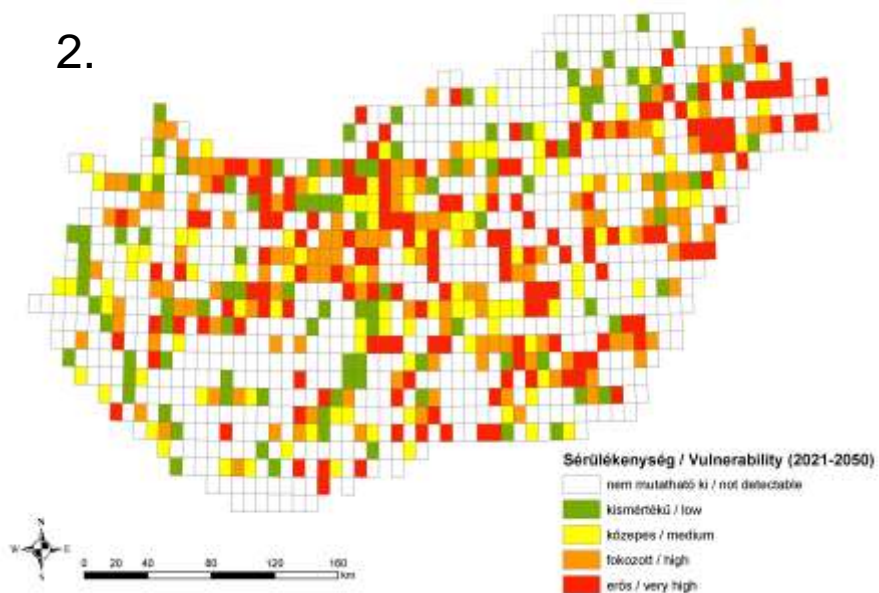
2. Vulnerability of road accidents related to hot days in 2021–2050

3. Vulnerability of road accidents related to hot days in 2071–2100

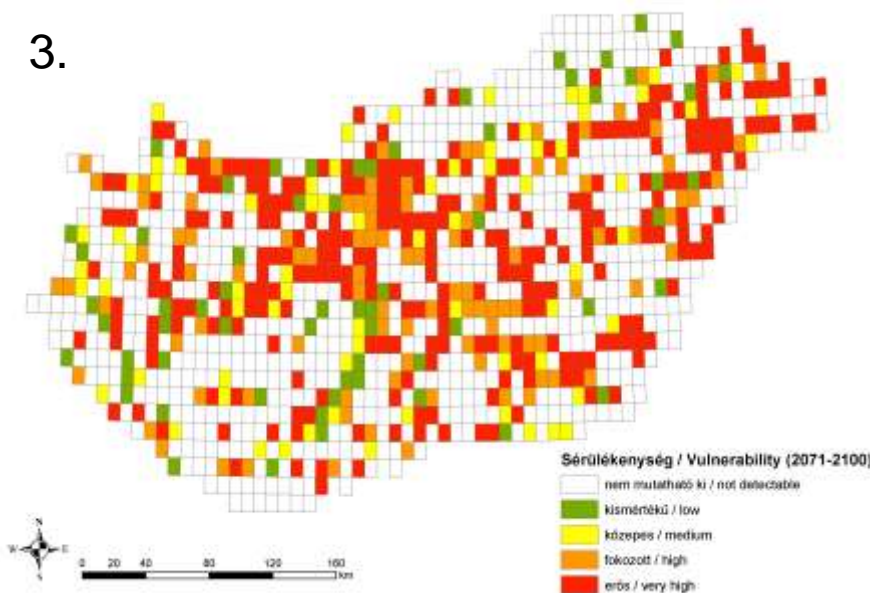
1.



2.



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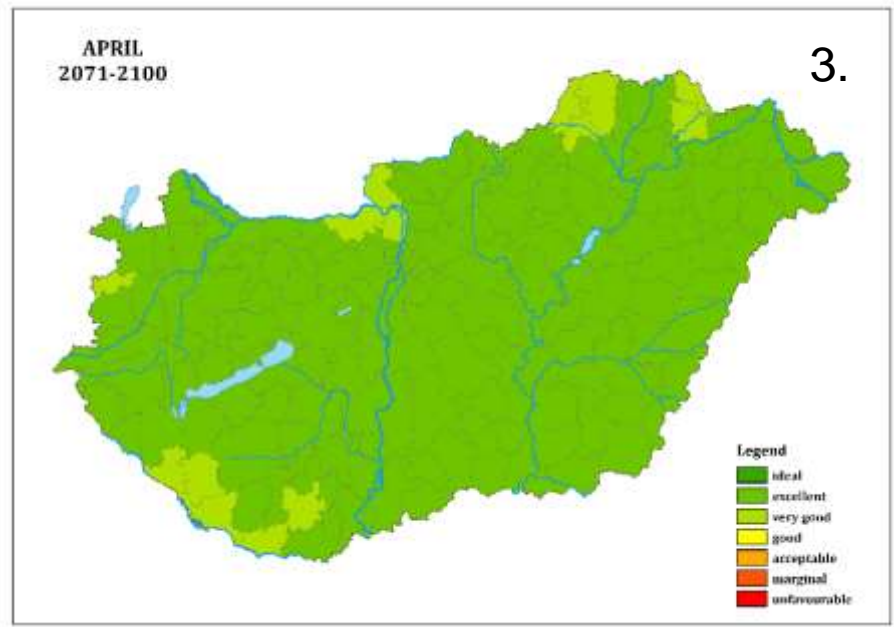
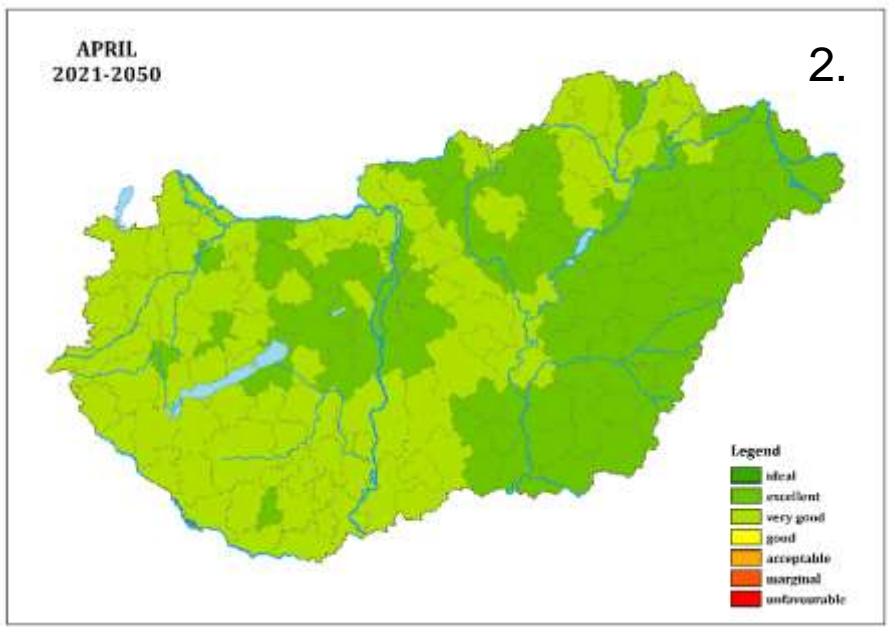
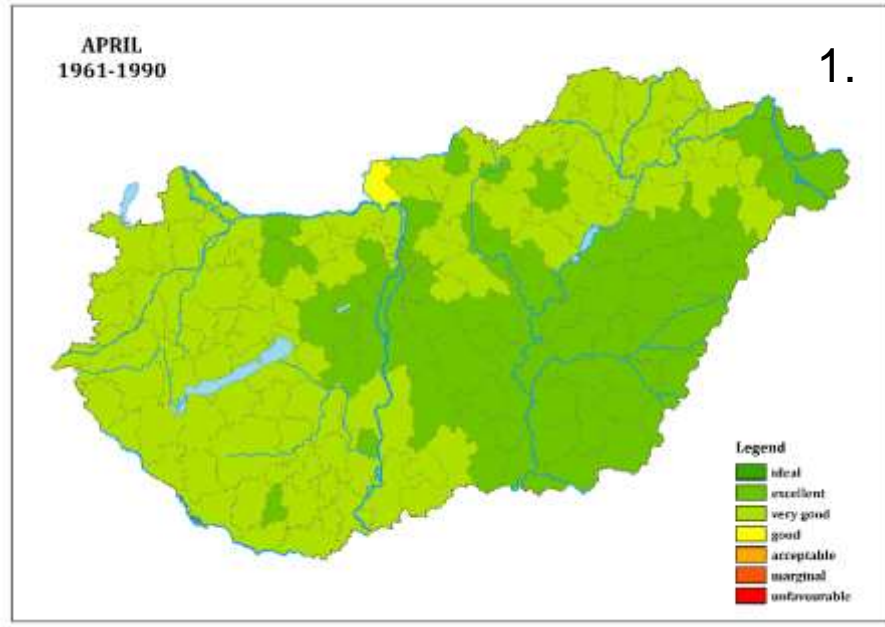


# Effects of climate conditions on tourism

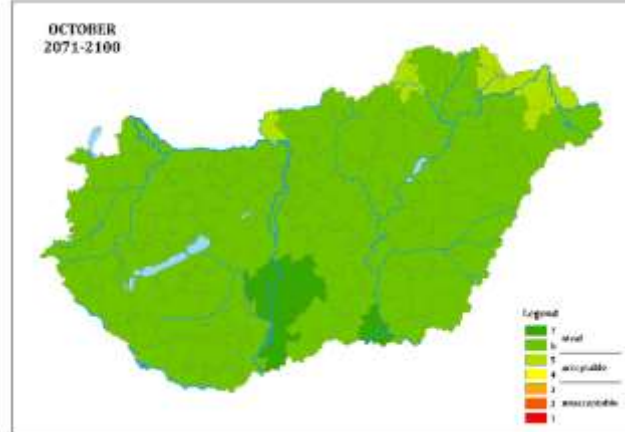
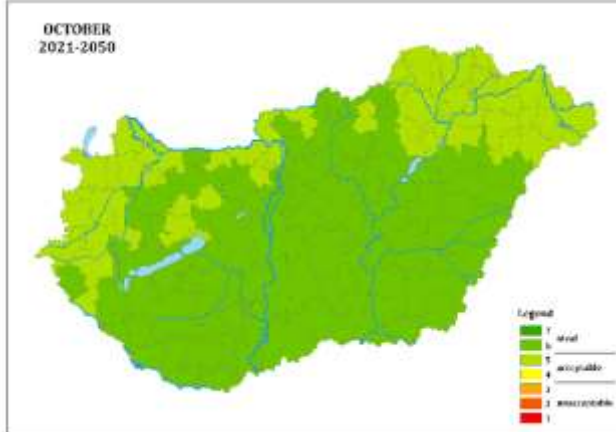
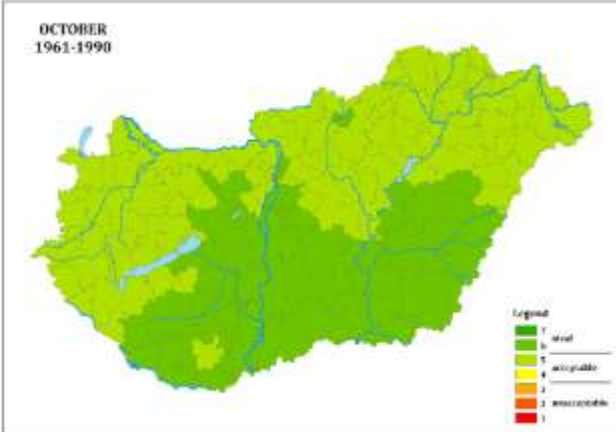
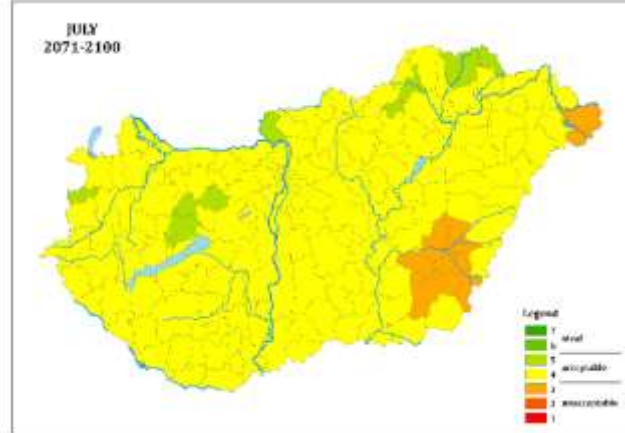
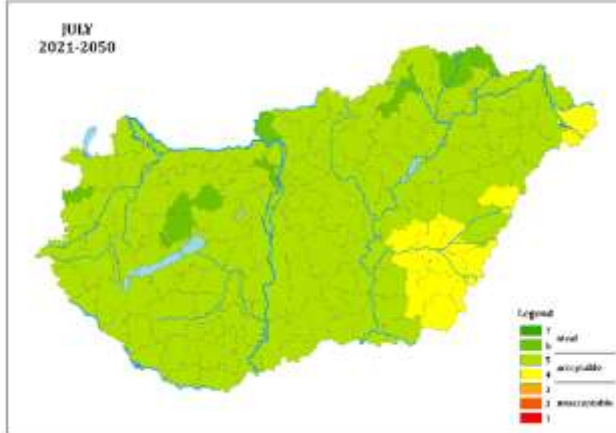
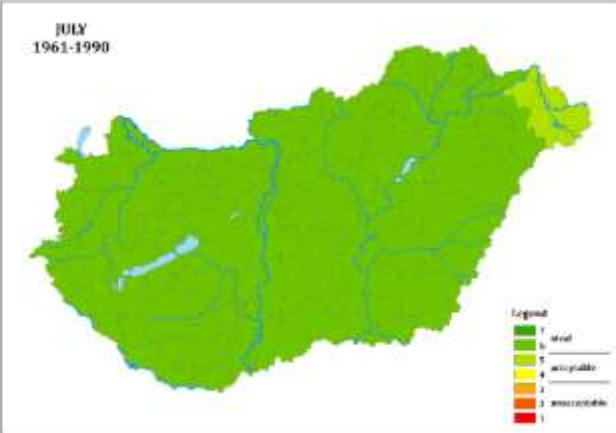


- Examination of tourism climatic indices
  - TCI – Tourism Climatic Index
  - CIT – Climate Index for Tourism
    - for different tourist activities (eg urban, beach and cycling tourism)
- Input data: temperature, relative humidity, wind speed, sunshine duration, precipitation, cloudiness
- Modification of TCI and CIT to the Hungarian conditions
- Determination of original and modified indicators for the NAGiS grid
  - For 1961-1990, 2021-2050 and 2071-2100
- Comparison of indicators and different economic data of tourism (booking, number of ticket to open air events)

1. mTCI categories in April, 1961-1990
2. mTCI categories in April, 2021-2050
3. mTCI categories in April, 2071-2100



# CIT categories for urban tourism in different periods

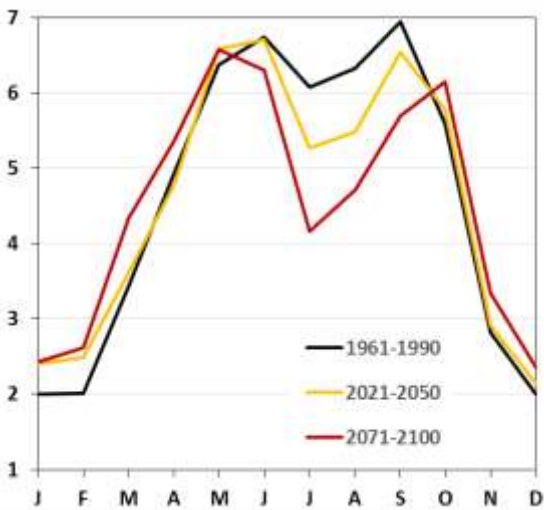
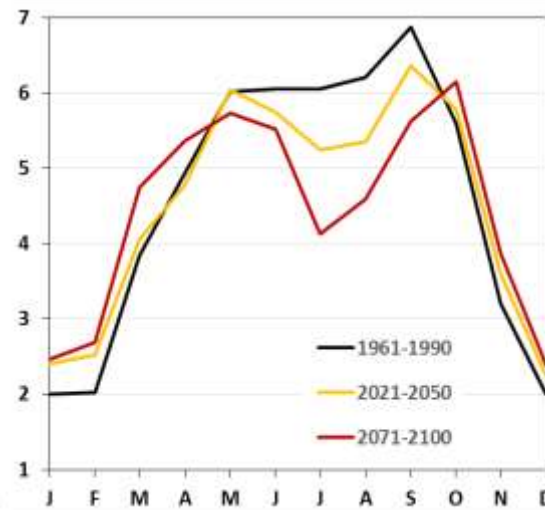
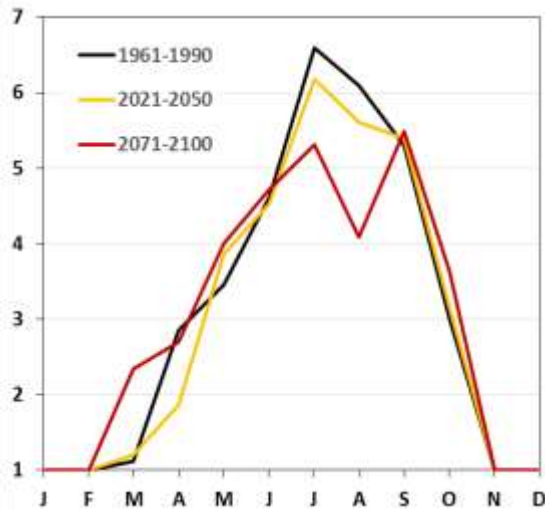


# Annual course of CIT – Siófok

## Beach tourism

## Urban tourism

## Cycling tourism





# Summary



## Prepared data layers



- Excess mortality related to heatwaves
  - 24 data layers
- Effects of extreme weather events on road accidents
  - 17 data layers
- Effects of climate conditions on tourism
  - 180 data layers

# More information



**A KLÍMAVÁLTOZÁS OKOZTA SÉRÜLÉKENYSÉG VIZSGÁLATA, KÜLÖNÖS TEKINTETTEL A TURIZMUSRA ÉS A KRITIKUS INFRASTRUKTÚRÁKRA (KRITÉR)**

**ÖSSZEFOGLALÓ A PROJEKT EREDMÉNYEIRŐL**

**VULNERABILITY/IMPACT STUDIES WITH A FOCUS ON TOURISM AND CRITICAL INFRASTRUCTURES (CRIGIS)**

**SUMMARY OF THE PROJECT RESULTS**

 **Vulnerability/Impact Studies with a focus on Tourism and Critical Infrastructures**

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Project title:  
**Vulnerability/Impact Studies with a focus on Tourism and Critical Infrastructures**

Project acronym: **CRIGIS**

Contract ID number: **EEA-C12-13**

Project duration: **30 April 2015 – 31 December 2015**

**NEWS**

*Final event*  
8 December 2015

The final event of the 'CRIGIS - Vulnerability/Impact Studies with a focus on Tourism and Critical Infrastructures' project was held on **8th December 2015** at the headquarters of the Hungarian Meteorological Service.

Web: [www.kriter.met.hu](http://www.kriter.met.hu)

Summary of the project results

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**Thank you for your attention!**

