

Analysis of Drought Periods in Regions of Žilina, Bánska Bystrica, Košice and Prešov

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1 Motivation

Throughout the years temperatures have risen, which also rapidly increased wildfire occurrences across the world. Most of them happen in places that are close to the equator, however even here in Slovakia we are not free of the risks of wildfires. In year 2010 Slovakia lost 5.38 kha of forest land due to wildfire.

Main motivation behind our analysis is to raise awareness of the problem we are facing in the near future and also providing a building block from which we can learn, which places are most vulnerable to wildfires.

2 Introduction

This project consist of analysing 71 years of continuous precipitation measurements provided by IBL weather software solutions through API. Dataset that was used in this project is called ERA5-Land Historical Monthly Means by Hour of Day. Main goal is to use this data only from specific regions that have great masses of forest land and measure the concentration of lowest precipitation values throughout the 71 years of data. Region with the highest percentage of drought days in the hottest months of the year is considered as more likely to develop wildfire.

3 Analysis

3.1 Selection of regions

Regions which we have analysed was chosen based on the map of forest concentration in Slovakia which you can see in the figure 1. With the map we can determine and estimate that the highest forest concentration lies in the region of Zilina, region of Banska Bystrica and between the regions of Kosice and Presov. The ERA5-Land dataset allows us to select rectangular regions of land in which we can measure weather parameters with some resolution. That

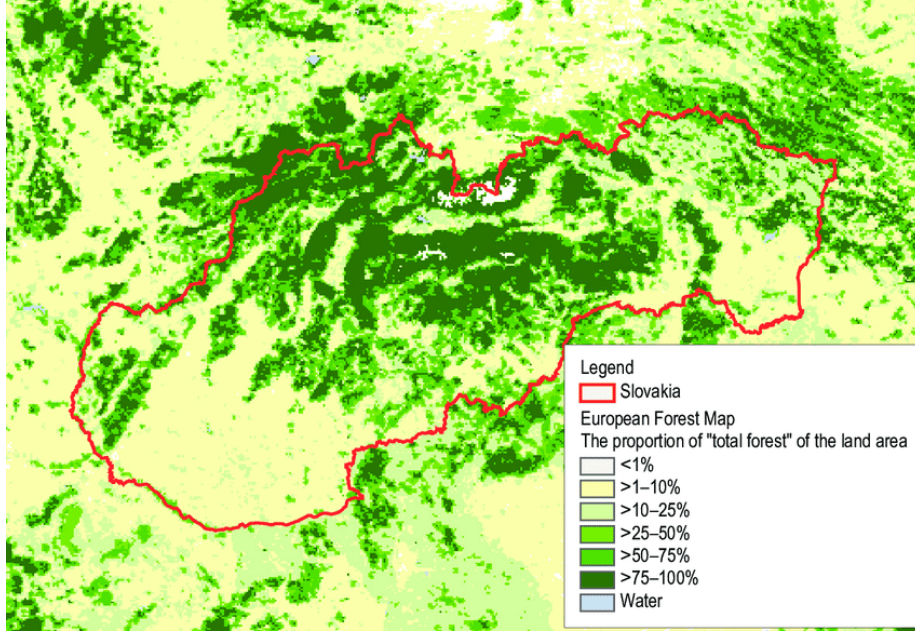


Figure 1: Forest land concentration across Slovakia

is why we have chosen to create three main rectangular areas which cover most of the forest land. You can see the rectangular areas in Figure 2

3.2 Collection of Data

As it was mentioned earlier we used IBL ERA5-Land Historical dataset which provides data from 1950 till 2023 of multiple weather parameters. We have chosen total precipitation which measures the flux of water equivalent (rain or snow) reaching the land surface measured in mm of water. We will measure periods of lowest rain fall concentration.

The rectangles have various resolutions to match the amount of region they cover. thus every rectangle represent tens of coordinations thus tens of precipitation measurements. Region of Zilina has resolution of 10x10, region of Banska Bystrica 6x4 and region of Kosice and Presov 7x3. Data is retrieved for every day in every month of every year from 1950 till 2021. This has produced 3 datasets. Which you can see a plot of in the Figures 3, 4 and 5.

The Middle line represents the polynomial fit of the whole dataset.

3.3 Analysis and Results

Next and last comes the analysis, the procedure of what we done is as follows. First we have extracted all values in the hottest months of every year which is

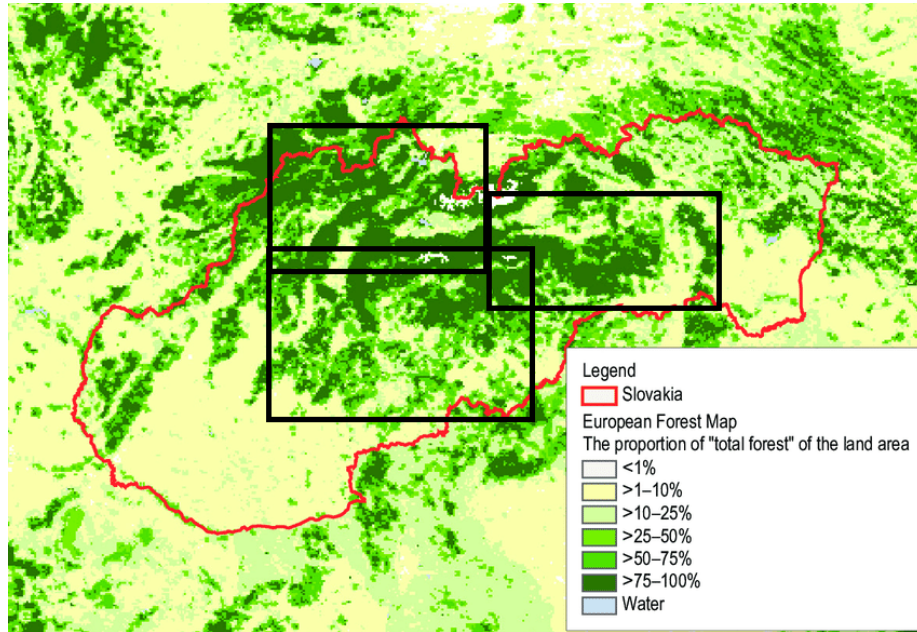


Figure 2: Rectangular ares covering forest land

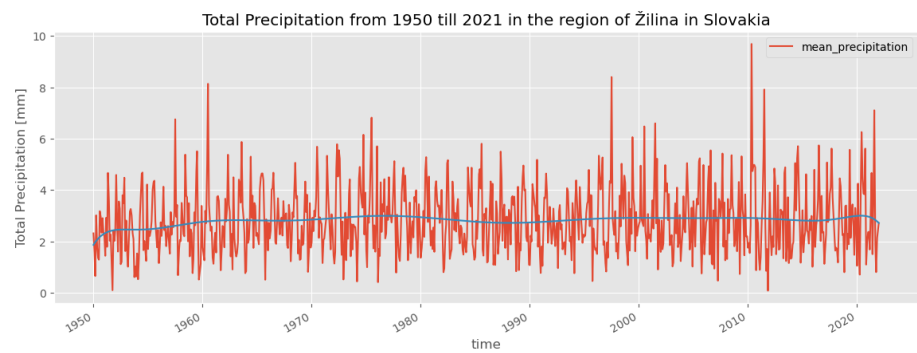


Figure 3: Total precipitation from 1950 till 2021 in the region of Žilina

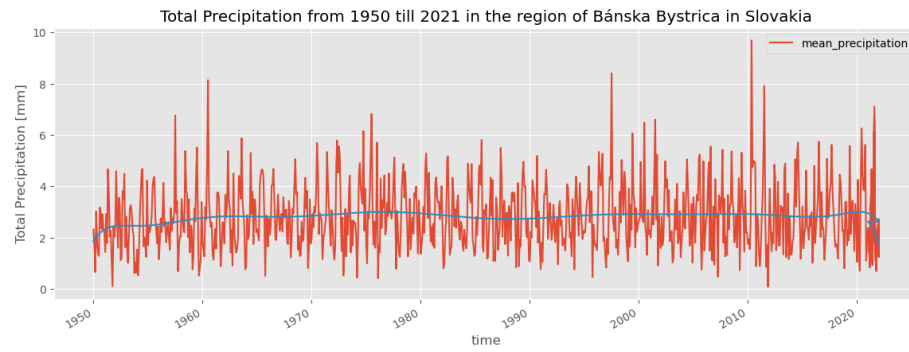


Figure 4: Total precipitation from 1950 till 2021 in the region of Banská Bystrica

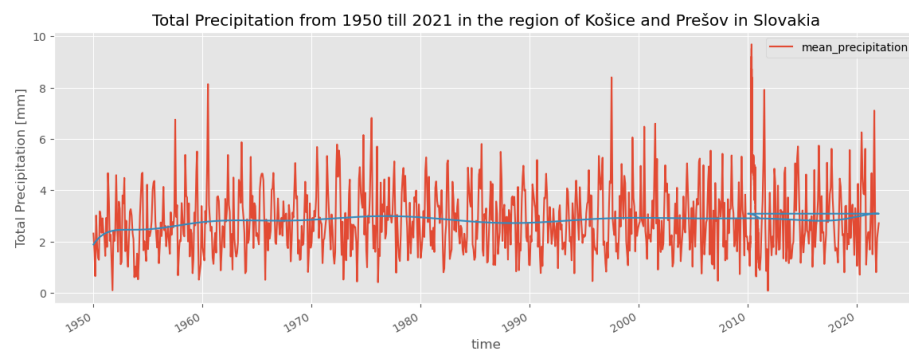


Figure 5: Total precipitation from 1950 till 2021 in the region of Košice and Prešov

Month	Min (C)	Max (C)	Mean (C)
January	-4.7	0.7	-2
February	-3.5	3.5	0
March	0	9.6	4.8
April	5	16.2	10.6
May	9.4	20.8	15.1
June	13.2	24.5	18.8
July	14.8	26.3	20.6
August	14.6	26.5	20.6
September	10	14.5	15.4
October	5.3	14.5	9.9
November	1.2	7.8	4.5
December	-3.2	14.5	9.8

Table 1: Temeperatures over the years 1991-2020 in Košice

IDK	Precipitation ≥ 2 mm [%]
Žilina	6.2
Bánska Bystrica	6.4
Košice/Prešov	6.1

Table 2: Percentage of low precipitation in hottest months in every year

May, June, July and August, we can verify that this is true based on the table 1 from <https://www.climatestotravel.com/climate/slovakia>.

Thus after filtering only the data from the four months next step is to determine the threshold for which values of precipitation we would consider a low amount of rain. Based on the web-page SHMU.sk, Precipitation and wildfire and the observations of other data we have estimated that daily 2 mm precipitation can be a cause or a sign of incoming wildfire. Based on that we have compared the amount of values that are below the threshold and the amount of data of the hottest months in every region which produced the percentage of low precipitation in hottest months, see 2.

In the Table we can see that the highest percentage (6.4%) of low precipitation days has region of Bánska Bystrica, which could indicate a higher chance of wildfire occurring. However all this is just an estimation, everything needs more basis from multiple parameters.