MUNI
SCI

01 Seminar - ENSO

Ladislava Řezníčková, MSc, PhD

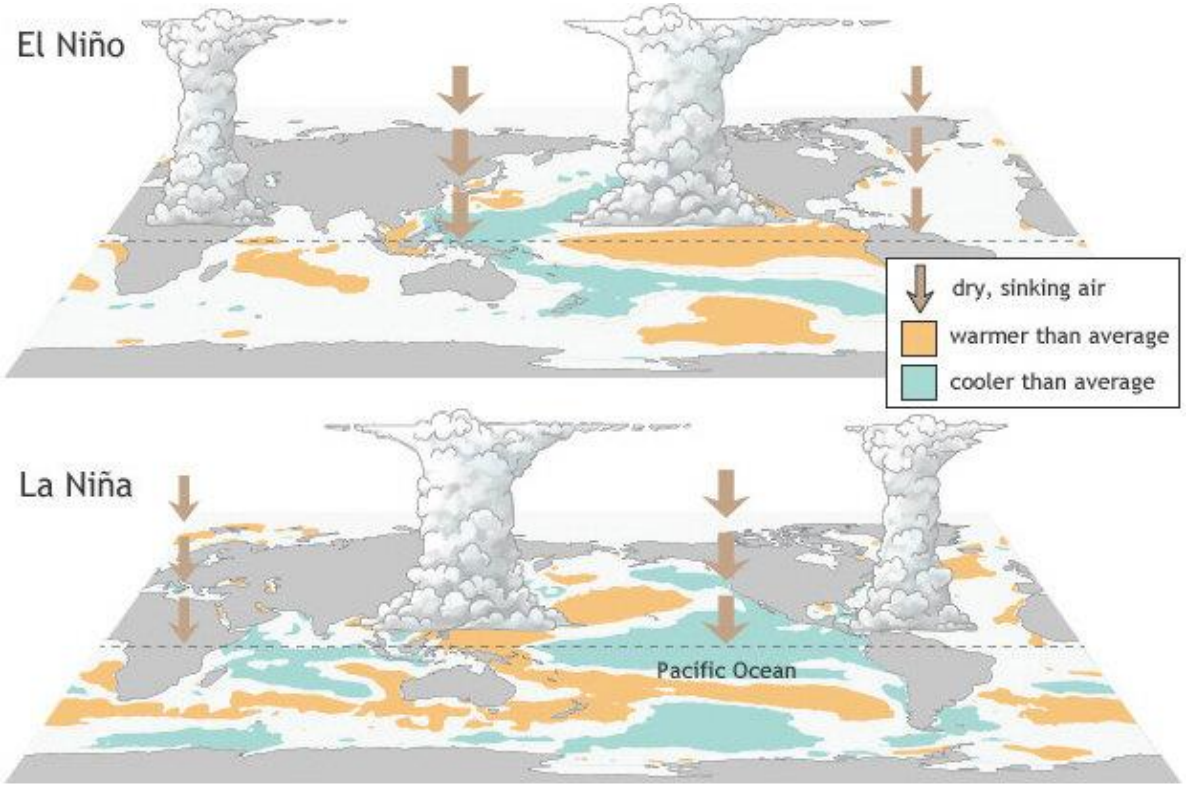
Content

1. **basic information about ENSO (El Niño–Southern Oscillation)**
   - definition and impact to world climate
2. **task assignment**

ENSO (El Niño–Southern Oscillation)

- one of the **most important climate phenomena on Earth** due to its **ability to change the global atmospheric circulation**
- **influences temperature and precipitation across the globe**

1. El Niño: A warming of the ocean surface, or above-average sea surface temperatures (SST), in the central and eastern tropical Pacific Ocean. Over Indonesia, rainfall tends to become reduced while rainfall increases over the tropical Pacific Ocean. The low-level surface winds, which normally blow from east to west along the equator ("easterly winds"), instead weaken or, in some cases, start blowing the other direction (from west to east or "westerly winds").
2. La Niña: A cooling of the ocean surface, or below-average sea surface temperatures (SST), in the central and eastern tropical Pacific Ocean. Over Indonesia, rainfall tends to increase while rainfall decreases over the central tropical Pacific Ocean. The normal easterly winds along the equator become even stronger.
3. Neutral: Neither El Niño or La Niña. Often tropical Pacific SSTs are generally close to average. However, there are some instances when the *ocean* can look like it is in an El Niño or La Niña state, but the atmosphere is not playing along (or vice versa).

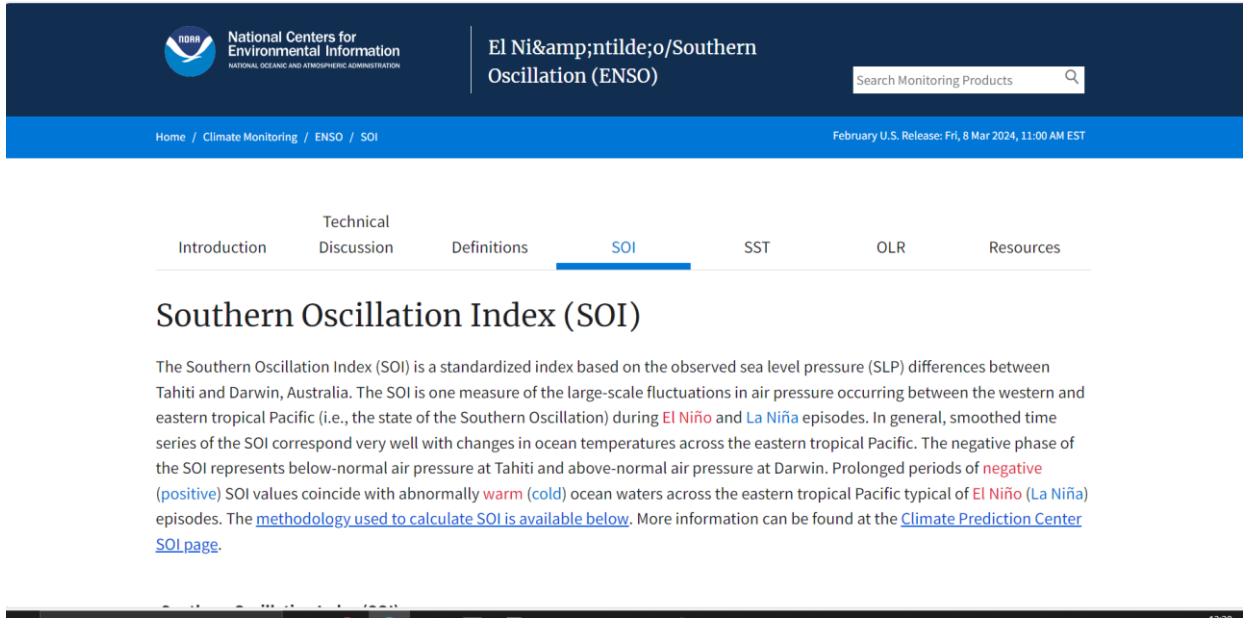


Task assignment

- in the first part of the assignment, you will create a **bar graph in Excel** according to the instructions
- according to the resulting graph, you write **in which years El-Nino and La-Nina occurred**
- in the second part of the assignment, you will try to find out **how ENSO affects temperature and precipitation in your country**

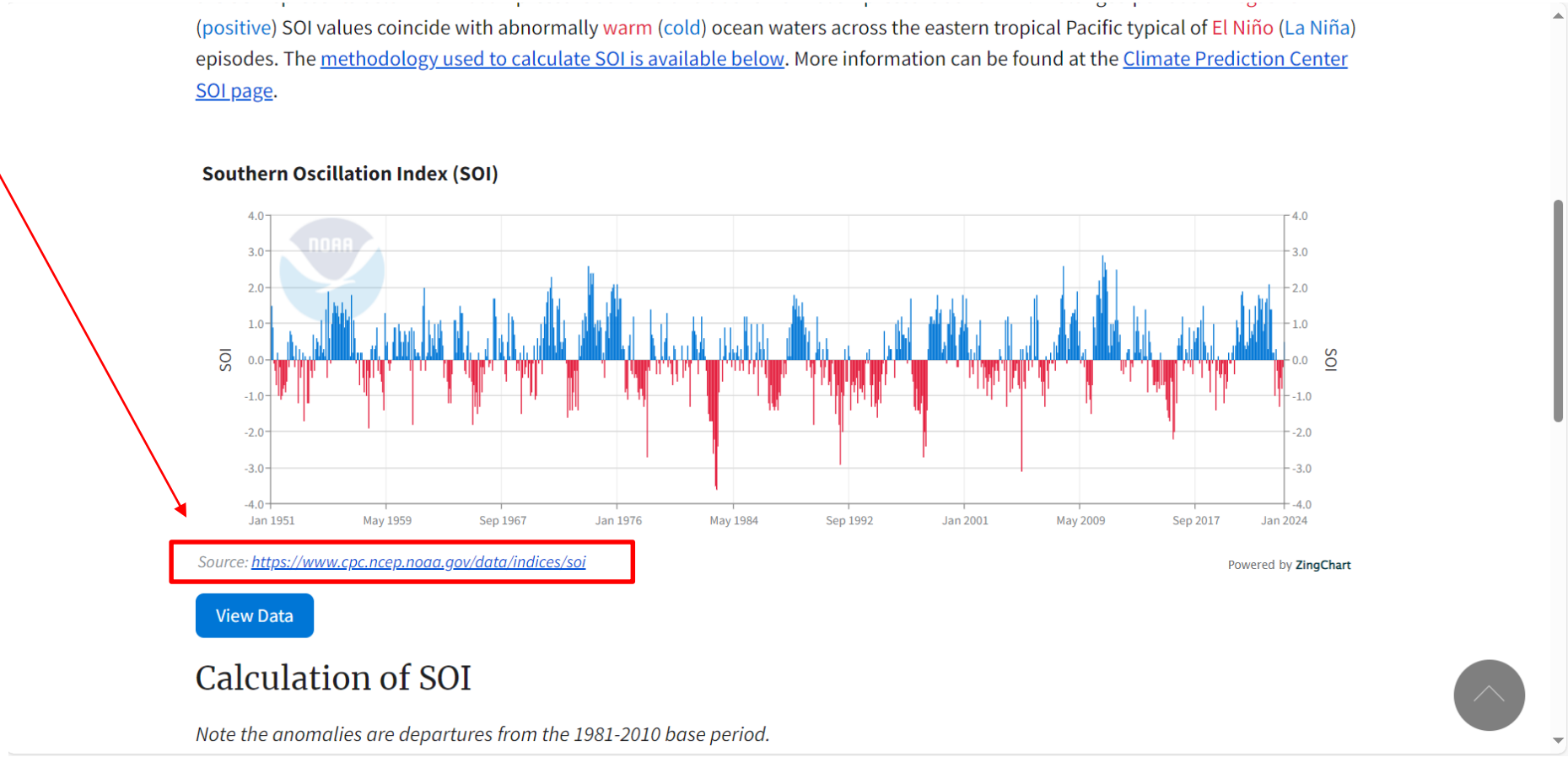
First part of the assignment

- the **Southern Oscillation Index (SOI)** can be used to assess whether El-Nino or La-Nina is occurring
- the SOI is a standardized index based on observed **sea level pressure (SLP) differences between Tahiti and Darwin, Australia**
- data and more information on the index can be found at this link: https://www.ncei.noaa.gov/access/monitoring/enso/soi
- after clicking on the link, this page will open



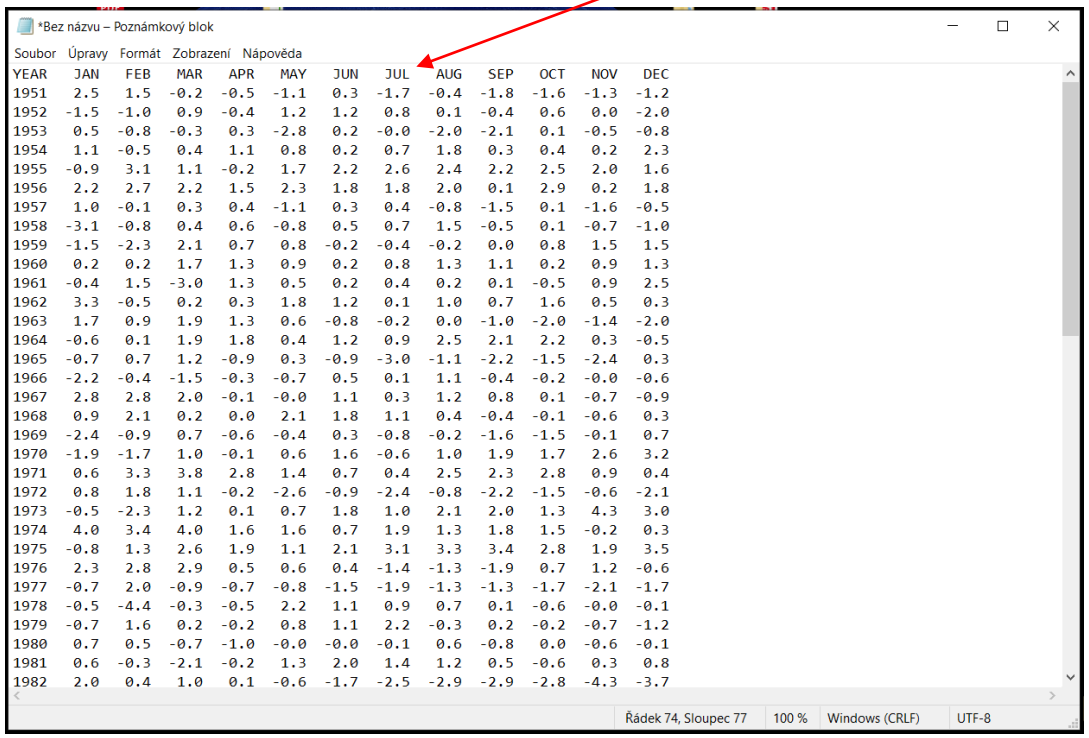
First part of the assignment

- on the page that opens, scroll down and click on the link as shown in the image



First part of the assignment

- a data page will then open
- **highlight** these dates for the period 1951–2023 and **copy** to a **Notepad (*.txt)**
- **save** this file



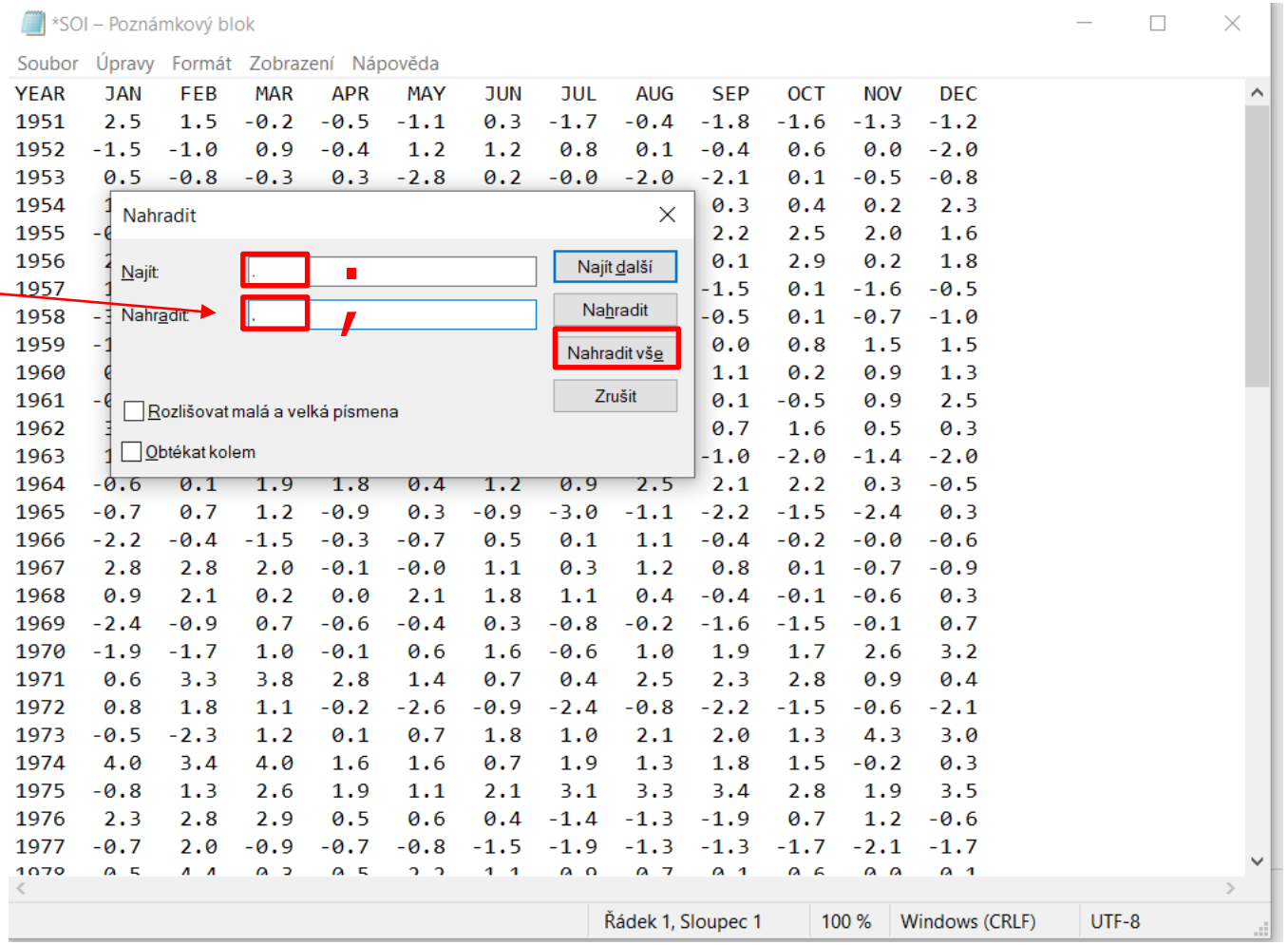
(STAND TAHITI - STAND DARWIN) SEA LEVEL PRESS ANOMALY

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	2.5	1.5	-0.2	-0.5	-1.1	0.3	-1.7	-0.4	-1.8	-1.6	-1.3	-1.2
1952	-1.5	-1.0	0.9	-0.4	1.2	1.2	0.8	0.1	-0.4	0.6	0.0	-2.0
1953	0.5	-0.8	-0.3	0.3	-2.8	0.2	-0.0	-2.0	-2.1	0.1	-0.5	-0.8
1954	1.1	-0.5	0.4	1.1	0.8	0.2	0.7	1.8	0.3	0.4	0.2	2.3
1955	-0.9	3.1	1.1	-0.2	1.7	2.2	2.6	2.4	2.2	2.5	2.0	1.6
1956	2.2	2.7	2.2	1.5	2.3	1.8	1.8	2.0	0.1	2.9	0.2	1.8
1957	1.0	-0.1	0.3	0.4	-1.1	0.3	0.4	-0.8	-1.5	0.1	-1.6	-0.5
1958	-3.1	-0.8	0.4	0.6	-0.8	0.5	0.7	1.5	-0.5	0.1	-0.7	-1.0
1959	-1.5	-2.3	2.1	0.7	0.8	-0.2	-0.4	-0.2	0.0	0.8	1.5	1.5
1960	0.2	0.2	1.7	1.3	0.9	0.2	0.8	1.3	1.1	0.2	0.9	1.3
1961	-0.4	1.5	-3.0	1.3	0.5	0.2	0.4	0.2	0.1	-0.5	0.9	2.5
1962	3.3	-0.5	0.2	0.3	1.8	1.2	0.1	1.0	0.7	1.6	0.5	0.3
1963	1.7	0.9	1.9	1.3	0.6	-0.8	-0.2	0.0	-1.0	-2.0	-1.4	-2.0
1964	-0.6	0.1	1.9	1.8	0.4	1.2	0.9	2.5	2.1	2.2	0.3	-0.5
1965	-0.7	0.7	1.2	-0.9	0.3	-0.9	-3.0	-1.1	-2.2	-1.5	-2.4	0.3
1966	-2.2	-0.4	-1.5	-0.3	-0.7	0.5	0.1	1.1	-0.4	-0.2	-0.0	-0.6
1967	2.8	2.8	2.0	-0.1	-0.0	1.1	0.3	1.2	0.8	0.1	-0.7	-0.9
1968	0.9	2.1	0.2	0.0	2.1	1.8	1.1	0.4	-0.4	-0.1	-0.6	0.3
1969	-2.4	-0.9	0.7	-0.6	-0.4	0.3	-0.8	-0.2	-1.6	-1.5	-0.1	0.7
1970	-1.9	-1.7	1.0	-0.1	0.6	1.6	-0.6	1.0	1.9	1.7	2.6	3.2
1971	0.6	3.3	3.8	2.8	1.4	0.7	0.4	2.5	2.3	2.8	0.9	0.4
1972	0.8	1.8	1.1	-0.2	-2.6	-0.9	-2.4	-0.8	-2.2	-1.5	-0.6	-2.1
1973	-0.5	-2.3	1.2	0.1	0.7	1.8	1.0	2.1	2.0	1.3	4.3	3.0
1974	4.0	3.4	4.0	1.6	1.6	0.7	1.9	1.3	1.8	1.5	-0.2	0.3
1975	-0.8	1.3	2.6	1.9	1.1	2.1	3.1	3.3	3.4	2.8	1.9	3.5
1976	2.3	2.8	2.9	0.5	0.6	0.4	-1.4	-1.3	-1.9	0.7	1.2	-0.6
1977	-0.7	2.0	-0.9	-0.7	-0.8	-1.5	-1.9	-1.3	-1.3	-1.7	-2.1	-1.7
1978	-0.5	-4.4	-0.3	-0.5	2.2	1.1	0.9	0.7	0.1	-0.6	-0.0	-0.1
1979	-0.7	1.6	0.2	-0.2	0.8	1.1	2.2	-0.3	0.2	-0.2	-0.7	-1.2
1980	0.7	0.5	-0.7	-1.0	-0.0	-0.0	-0.1	0.6	-0.8	0.0	-0.6	-0.1
1981	0.6	-0.3	-2.1	-0.2	1.3	2.0	1.4	1.2	0.5	-0.6	0.3	0.8
1982	2.0	0.4	1.0	0.1	-0.6	-1.7	-2.5	-2.9	-2.9	-2.8	-4.3	-3.7
1983	-5.8	-6.0	-4.0	-1.5	1.0	0.1	-1.0	0.2	1.4	0.7	-0.2	0.0
1984	0.3	1.4	-0.4	0.6	0.3	-0.6	0.3	0.7	0.2	-0.5	0.4	-0.2
1985	-0.5	2.0	1.3	1.9	0.7	-0.6	-0.2	1.6	0.0	-0.6	-0.3	0.4
1986	1.6	-1.7	0.8	0.5	-0.4	1.6	0.5	-0.6	-0.8	1.1	-2.0	-2.4
1987	-1.1	-2.1	-2.1	-2.3	-2.1	-1.8	-2.2	-1.5	-1.7	-0.6	-0.0	-0.8
1988	-0.2	-0.6	1.1	0.2	1.5	0.1	1.7	2.5	3.0	2.3	2.8	2.0
1989	2.5	2.0	1.8	2.7	2.0	1.2	1.5	-0.5	0.8	1.3	-0.4	-0.9
1990	-0.1	-3.0	-0.7	0.3	2.0	0.5	0.9	-0.3	-1.2	0.4	-0.8	-0.4
1991	1.0	0.4	-1.1	-1.0	-1.7	-0.2	0.0	-0.7	-2.5	-1.7	-1.1	-2.9
1992	-4.7	-1.5	-3.3	-1.7	0.4	-1.0	-1.0	0.6	0.1	-2.3	-1.1	-0.9

First part of the assignment

If your Excel works with decimal comma (not decimal points), you need to **replace the points with commas** in your *.txt file:

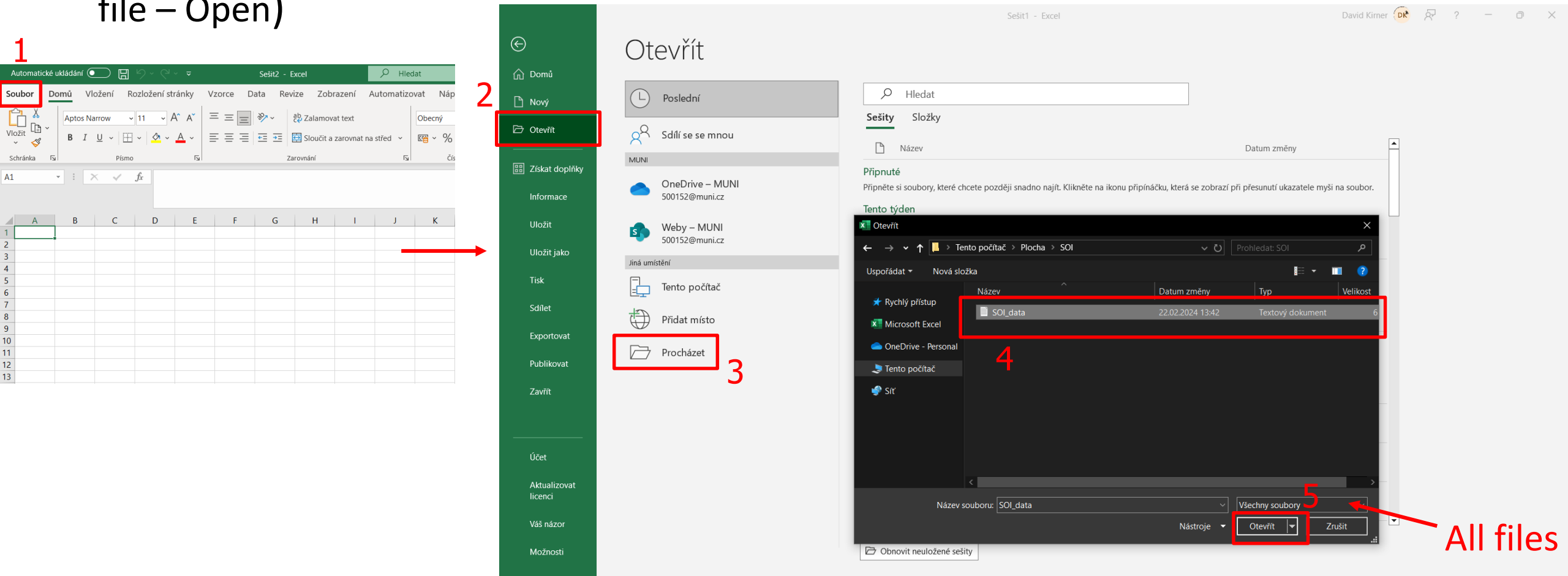
1. Open your ***.txt** file
2. Replace: CTRL+H
3. Save the file



YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	2.5	1.5	-0.2	-0.5	-1.1	0.3	-1.7	-0.4	-1.8	-1.6	-1.3	-1.2
1952	-1.5	-1.0	0.9	-0.4	1.2	1.2	0.8	0.1	-0.4	0.6	0.0	-2.0
1953	0.5	-0.8	-0.3	0.3	-2.8	0.2	-0.0	-2.0	-2.1	0.1	-0.5	-0.8
1954	1								0.3	0.4	0.2	2.3
1955	-0								2.2	2.5	2.0	1.6
1956	2								0.1	2.9	0.2	1.8
1957	1								-1.5	0.1	-1.6	-0.5
1958	-1								-0.5	0.1	-0.7	-1.0
1959	-1								0.0	0.8	1.5	1.5
1960	0								1.1	0.2	0.9	1.3
1961	-0								0.1	-0.5	0.9	2.5
1962	1								0.7	1.6	0.5	0.3
1963	1								-1.0	-2.0	-1.4	-2.0
1964	-0.6	0.1	1.9	1.8	0.4	1.2	0.9	2.5	2.1	2.2	0.3	-0.5
1965	-0.7	0.7	1.2	-0.9	0.3	-0.9	-3.0	-1.1	-2.2	-1.5	-2.4	0.3
1966	-2.2	-0.4	-1.5	-0.3	-0.7	0.5	0.1	1.1	-0.4	-0.2	-0.0	-0.6
1967	2.8	2.8	2.0	-0.1	-0.0	1.1	0.3	1.2	0.8	0.1	-0.7	-0.9
1968	0.9	2.1	0.2	0.0	2.1	1.8	1.1	0.4	-0.4	-0.1	-0.6	0.3
1969	-2.4	-0.9	0.7	-0.6	-0.4	0.3	-0.8	-0.2	-1.6	-1.5	-0.1	0.7
1970	-1.9	-1.7	1.0	-0.1	0.6	1.6	-0.6	1.0	1.9	1.7	2.6	3.2
1971	0.6	3.3	3.8	2.8	1.4	0.7	0.4	2.5	2.3	2.8	0.9	0.4
1972	0.8	1.8	1.1	-0.2	-2.6	-0.9	-2.4	-0.8	-2.2	-1.5	-0.6	-2.1
1973	-0.5	-2.3	1.2	0.1	0.7	1.8	1.0	2.1	2.0	1.3	4.3	3.0
1974	4.0	3.4	4.0	1.6	1.6	0.7	1.9	1.3	1.8	1.5	-0.2	0.3
1975	-0.8	1.3	2.6	1.9	1.1	2.1	3.1	3.3	3.4	2.8	1.9	3.5
1976	2.3	2.8	2.9	0.5	0.6	0.4	-1.4	-1.3	-1.9	0.7	1.2	-0.6
1977	-0.7	2.0	-0.9	-0.7	-0.8	-1.5	-1.9	-1.3	-1.3	-1.7	-2.1	-1.7
1978	0.5	4.4	0.3	0.5	2.2	1.1	0.9	0.7	0.1	0.6	0.0	0.1

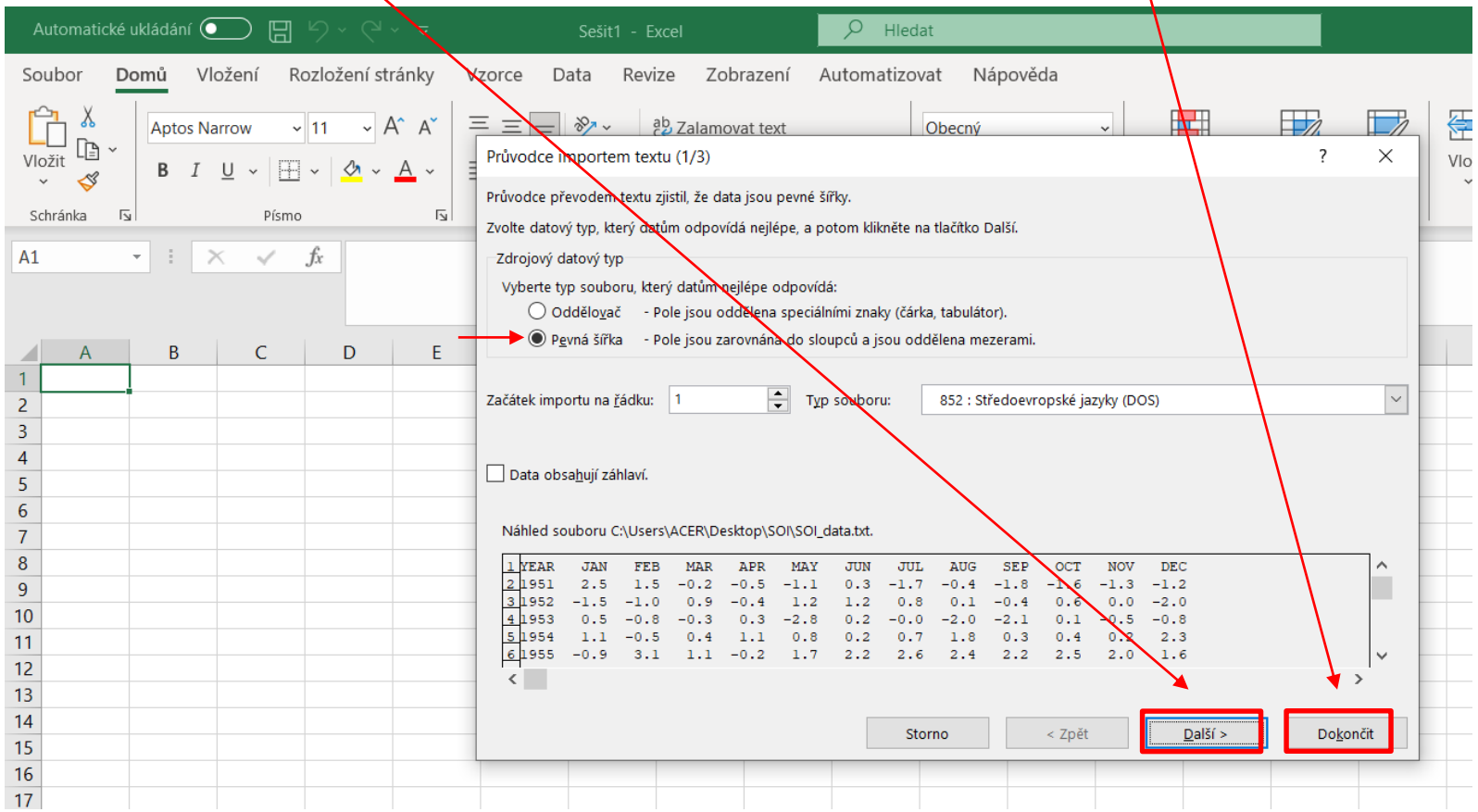
First part of the assignment

- open the **Excel** program and **upload** the saved data to Excel according to the images (File – Open – Browse – All files – select your *.txt file – Open)



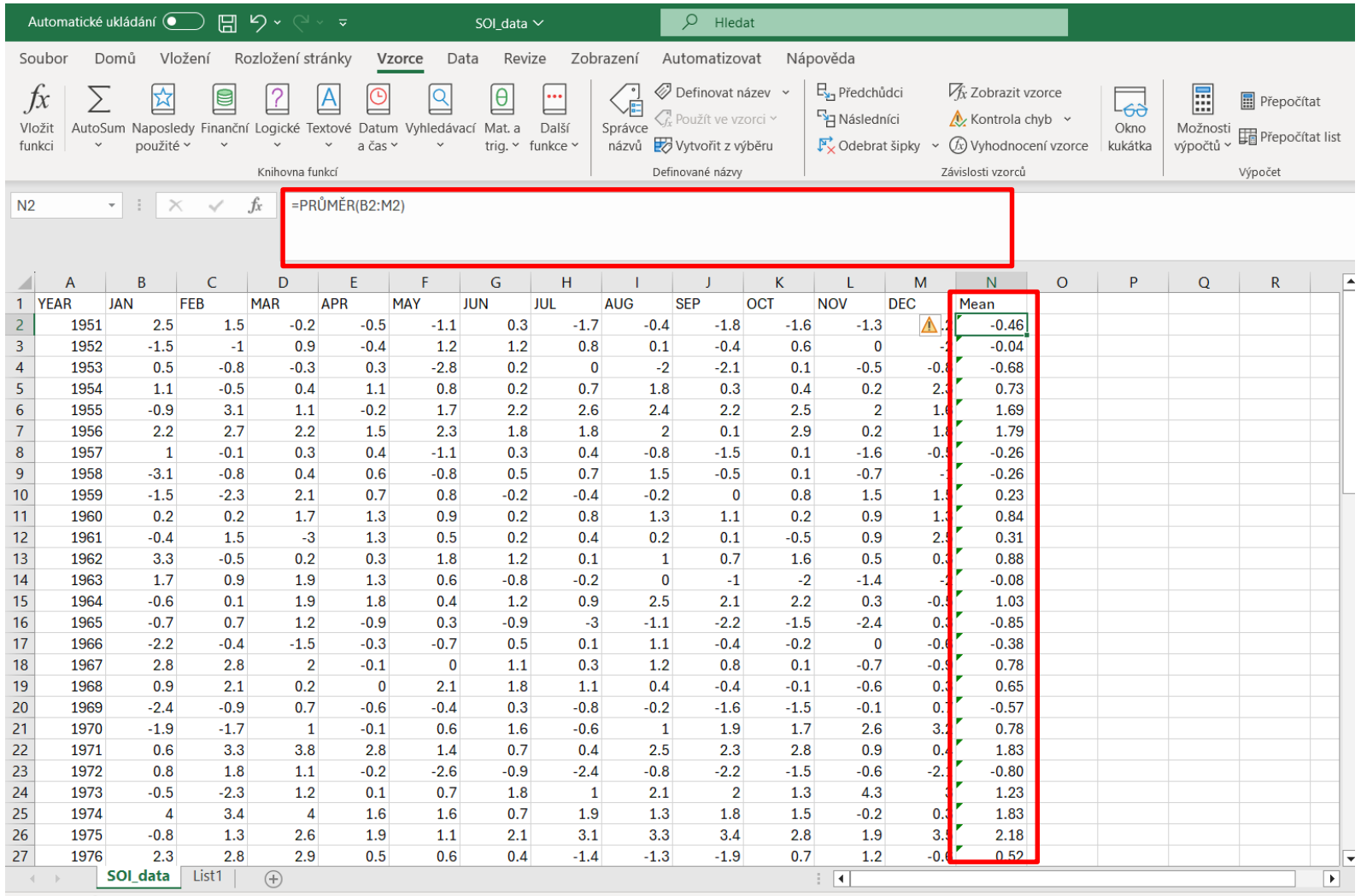
First part of the assignment

- now **click** next few times and then **finish**



First part of the assignment

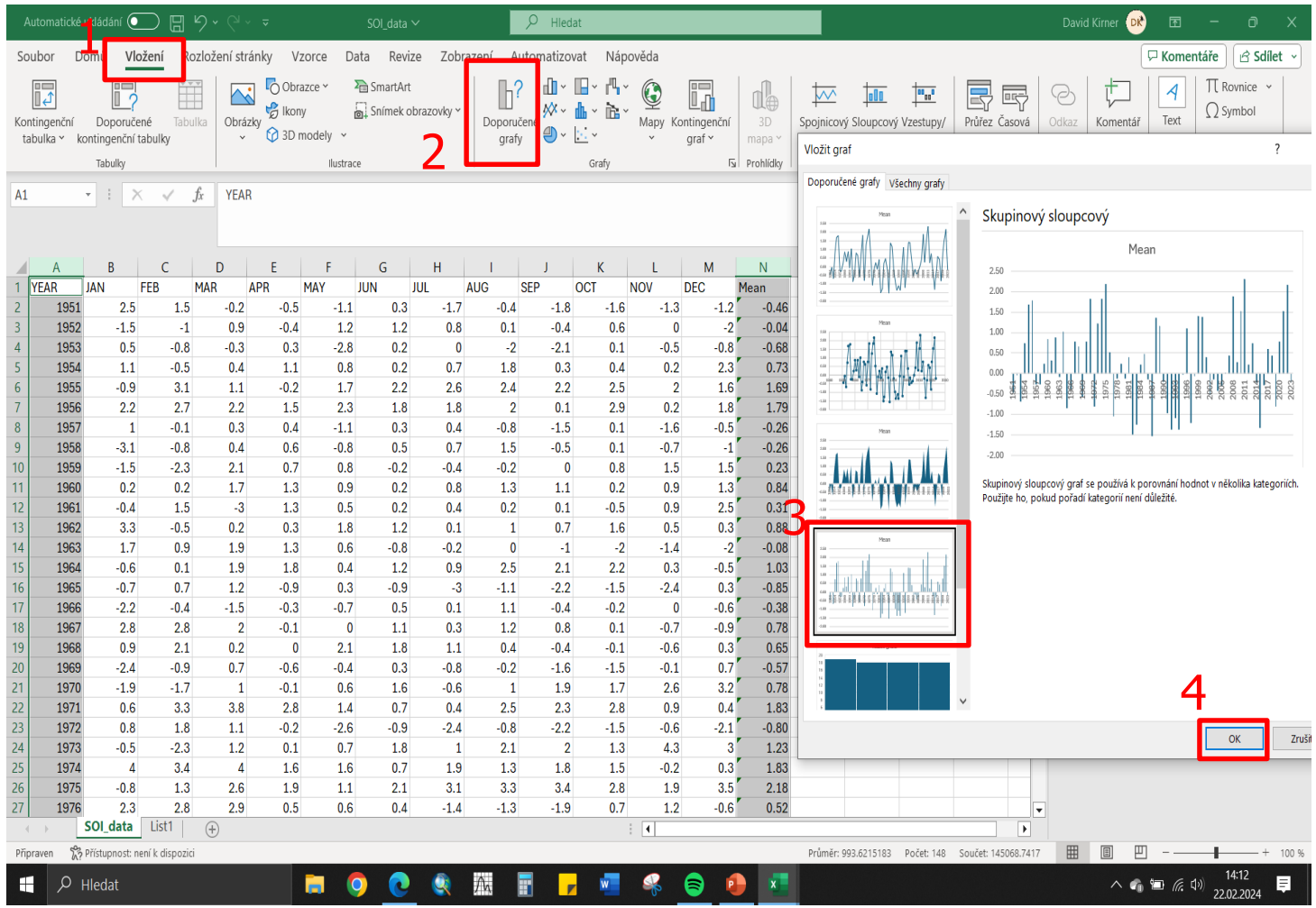
- after uploading the data to Excel, calculate the **annual SOI averages (Mean)** as shown in the image



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean
2	1951	2.5	1.5	-0.2	-0.5	-1.1	0.3	-1.7	-0.4	-1.8	-1.6	-1.3	.2	-0.46
3	1952	-1.5	-1	0.9	-0.4	1.2	1.2	0.8	0.1	-0.4	0.6	0	-.	-0.04
4	1953	0.5	-0.8	-0.3	0.3	-2.8	0.2	0	-2	-2.1	0.1	-0.5	-0.	-0.68
5	1954	1.1	-0.5	0.4	1.1	0.8	0.2	0.7	1.8	0.3	0.4	0.2	2.	0.73
6	1955	-0.9	3.1	1.1	-0.2	1.7	2.2	2.6	2.4	2.2	2.5	2	1.	1.69
7	1956	2.2	2.7	2.2	1.5	2.3	1.8	1.8	2	0.1	2.9	0.2	1.	1.79
8	1957	1	-0.1	0.3	0.4	-1.1	0.3	0.4	-0.8	-1.5	0.1	-1.6	-0.	-0.26
9	1958	-3.1	-0.8	0.4	0.6	-0.8	0.5	0.7	1.5	-0.5	0.1	-0.7	-	-0.26
10	1959	-1.5	-2.3	2.1	0.7	0.8	-0.2	-0.4	-0.2	0	0.8	1.5	1.	0.23
11	1960	0.2	0.2	1.7	1.3	0.9	0.2	0.8	1.3	1.1	0.2	0.9	1.	0.84
12	1961	-0.4	1.5	-3	1.3	0.5	0.2	0.4	0.2	0.1	-0.5	0.9	2.	0.31
13	1962	3.3	-0.5	0.2	0.3	1.8	1.2	0.1	1	0.7	1.6	0.5	0.	0.88
14	1963	1.7	0.9	1.9	1.3	0.6	-0.8	-0.2	0	-1	-2	-1.4	-.	-0.08
15	1964	-0.6	0.1	1.9	1.8	0.4	1.2	0.9	2.5	2.1	2.2	0.3	-0.	1.03
16	1965	-0.7	0.7	1.2	-0.9	0.3	-0.9	-3	-1.1	-2.2	-1.5	-2.4	0.	-0.85
17	1966	-2.2	-0.4	-1.5	-0.3	-0.7	0.5	0.1	1.1	-0.4	-0.2	0	-0.	-0.38
18	1967	2.8	2.8	2	-0.1	0	1.1	0.3	1.2	0.8	0.1	-0.7	-0.	0.78
19	1968	0.9	2.1	0.2	0	2.1	1.8	1.1	0.4	-0.4	-0.1	-0.6	0.	0.65
20	1969	-2.4	-0.9	0.7	-0.6	-0.4	0.3	-0.8	-0.2	-1.6	-1.5	-0.1	0.	-0.57
21	1970	-1.9	-1.7	1	-0.1	0.6	1.6	-0.6	1	1.9	1.7	2.6	3.	0.78
22	1971	0.6	3.3	3.8	2.8	1.4	0.7	0.4	2.5	2.3	2.8	0.9	0.	1.83
23	1972	0.8	1.8	1.1	-0.2	-2.6	-0.9	-2.4	-0.8	-2.2	-1.5	-0.6	-2.	-0.80
24	1973	-0.5	-2.3	1.2	0.1	0.7	1.8	1	2.1	2	1.3	4.3	3	1.23
25	1974	4	3.4	4	1.6	1.6	0.7	1.9	1.3	1.8	1.5	-0.2	0.	1.83
26	1975	-0.8	1.3	2.6	1.9	1.1	2.1	3.1	3.3	3.4	2.8	1.9	3.	2.18
27	1976	2.3	2.8	2.9	0.5	0.6	0.4	-1.4	-1.3	-1.9	0.7	1.2	-0.	0.52

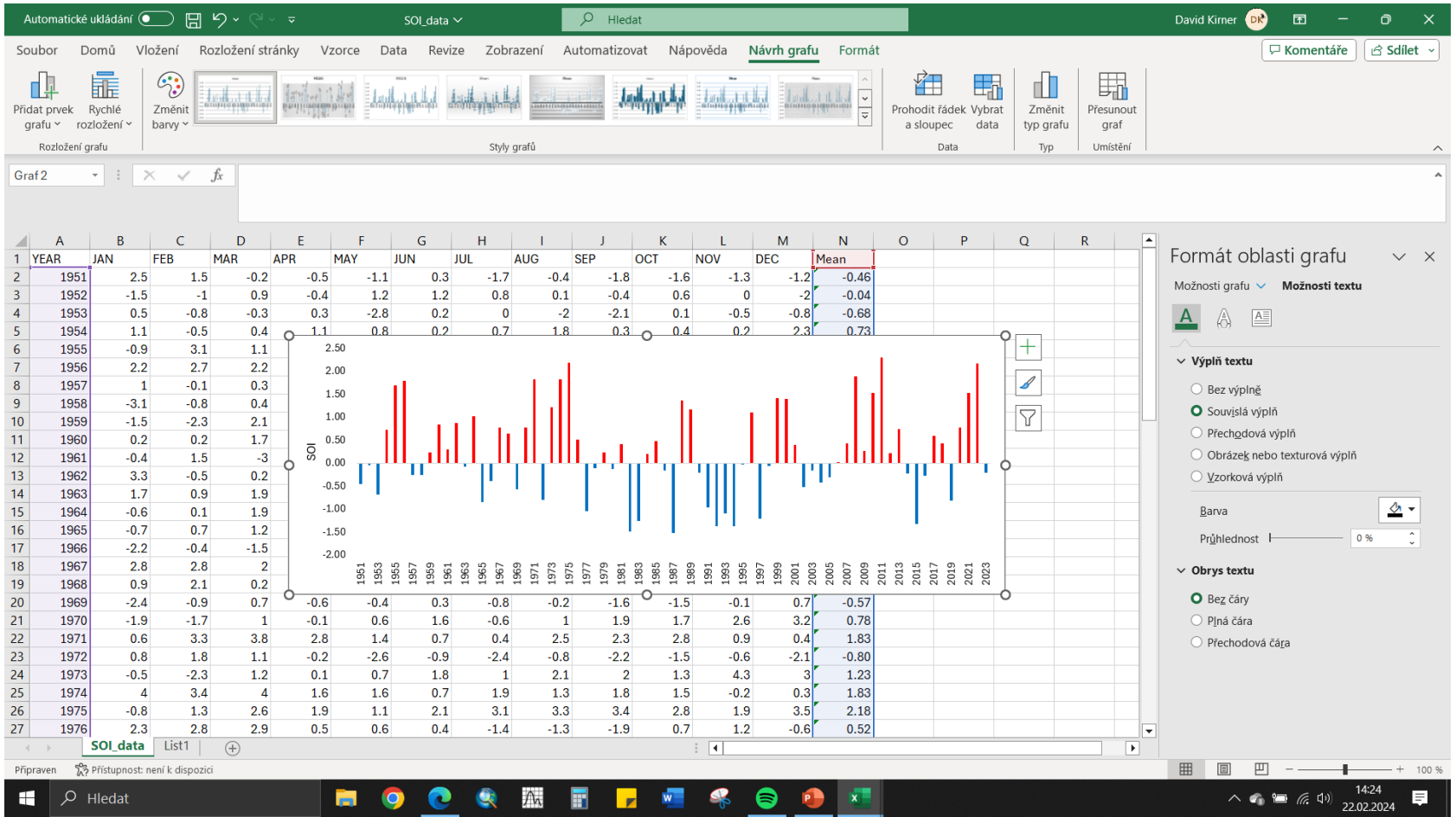
First part of the assignment

- **highlight** the column with **annual averages (Mean)** and **years** (via Ctrl) and then follow the steps in the image



First part of the assignment

- now you have a **graph** that you can **modify** as needed
- by SOI values, determine **in which years El-Nino and La-Nina have occurred since 2000**



Second part of the assignment

- in the second part, you will look at **how ENSO affects temperatures and rainfall in your country** or the region where your country is located
- click this link: https://climexp.knmi.nl/effects.cgi?id=someone@somewhere#temperature
- the **Niño3.4 index** is used here to evaluate ENSO:
  Positive index values indicate ***El-Nino*** and **negative index** values ***La-Nina***
  (this is the opposite of SOI)
- on the page you will find **several maps** with an explanation of the color difference. Write a **short report** on the effect of ENSO on **precipitation** and **temperature** in **your country** or the region where your country is located during each season.

Thank you for your attention