|  |  |
| --- | --- |
| First and Last Name | Date |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Exercises #1**

**- Meteorological reanalysis and time series analysis with linear regression**

Traditional time-series of meteorological observations often exhibit interruptions in historical records and non-homogeneities resulting e.g. from:

- changes in measurement equipment,  
- changes among observers and their biases,  
- changes of observation locations.

The issue of comparability of observational data might become arguable in such cases, especially in areas with a low density of measurement networks.

For this reason, climatological studies are often based on meteorological reanalyses. Reanalysis are gridded product generated as multidimensional datasets based on observational, satellite, measurement buoy, and numerical modeling data. These data are most commonly available in GRIB or NetCDF formats, which potentially will be discussed in the subsequent years of study. Among the most popular products, the American NCEP/NCAR reanalyses (Kalnay et al., 1996) and European reanalyses generated by the ECMWF.

One of the most commonly used indicators for assessing contemporary climate changes is the coefficient of the linear trend. This technique is based on the linear regression method with the time scale considered as a predictor (on the X-axis). Despite a number of statistical assumptions, the popularity of this technique is primarily associated with the ease of its application and the intuitive interpretation of the obtained research results.

**Tasks:**

1. Download monthly observational data available in spreadsheet form on the website: enwo.pl/zrodla2 (the word: “poludnik” in file name means “longitude”)
2. Calculate linear regression coefficients and insert them in the Table 1. Please re-calculate the obtained values to reflect change in typically used in climatological analysis 100 years periods (e.g. +0.5\*C / 100 years)
3. Write a short summary describing the most important findings related to seasonal and zonal aspects of air temperature change.

Table 1. Slope coefficient of calculated trends representing air temperature change, 1948-2017

|  |  |  |  |
| --- | --- | --- | --- |
| Month | Lon = \_\_\_ , Lat = 25.0 | Lon = \_\_\_ , Lat = 50.0 | Lon = \_\_\_ , Lat = 75.0 |
| I |  |  |  |
| II |  |  |  |
| III |  |  |  |
| IV |  |  |  |
| V |  |  |  |
| VI |  |  |  |
| VII |  |  |  |
| VIII |  |  |  |
| IX |  |  |  |
| X |  |  |  |
| XI |  |  |  |
| XII |  |  |  |
| YEAR |  |  |  |