

CEE 274: CLIMATE DATA ANALYSIS

Homework 1

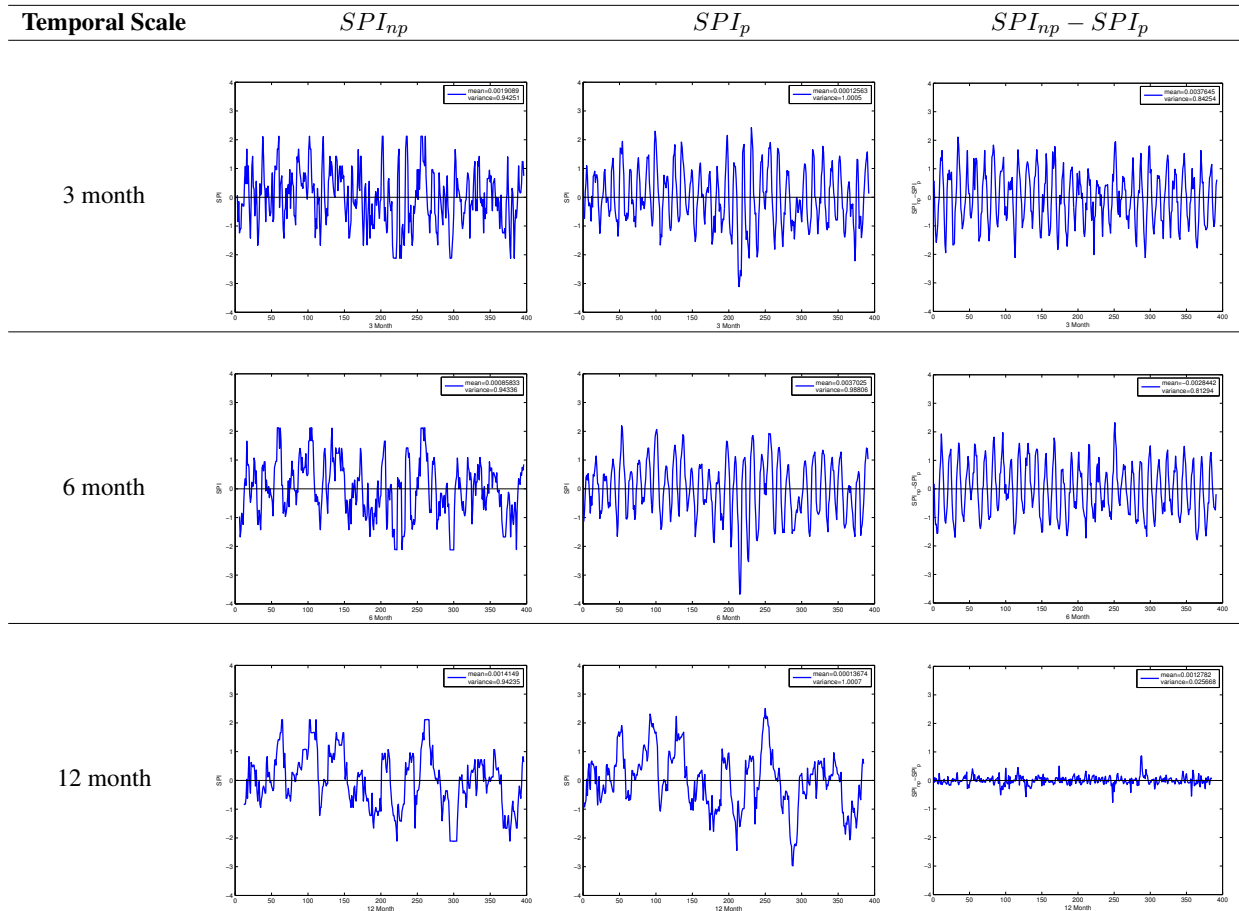
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Problem 1:

The Standard Precipitation Index (SPI) calculated at different temporal scales 3 month, 6 month and 12 month) with parametric and non-parametric methods are listed in the first two columns of Table 1. Their differences are shown in the third column.

Table 1: SPI Calculation



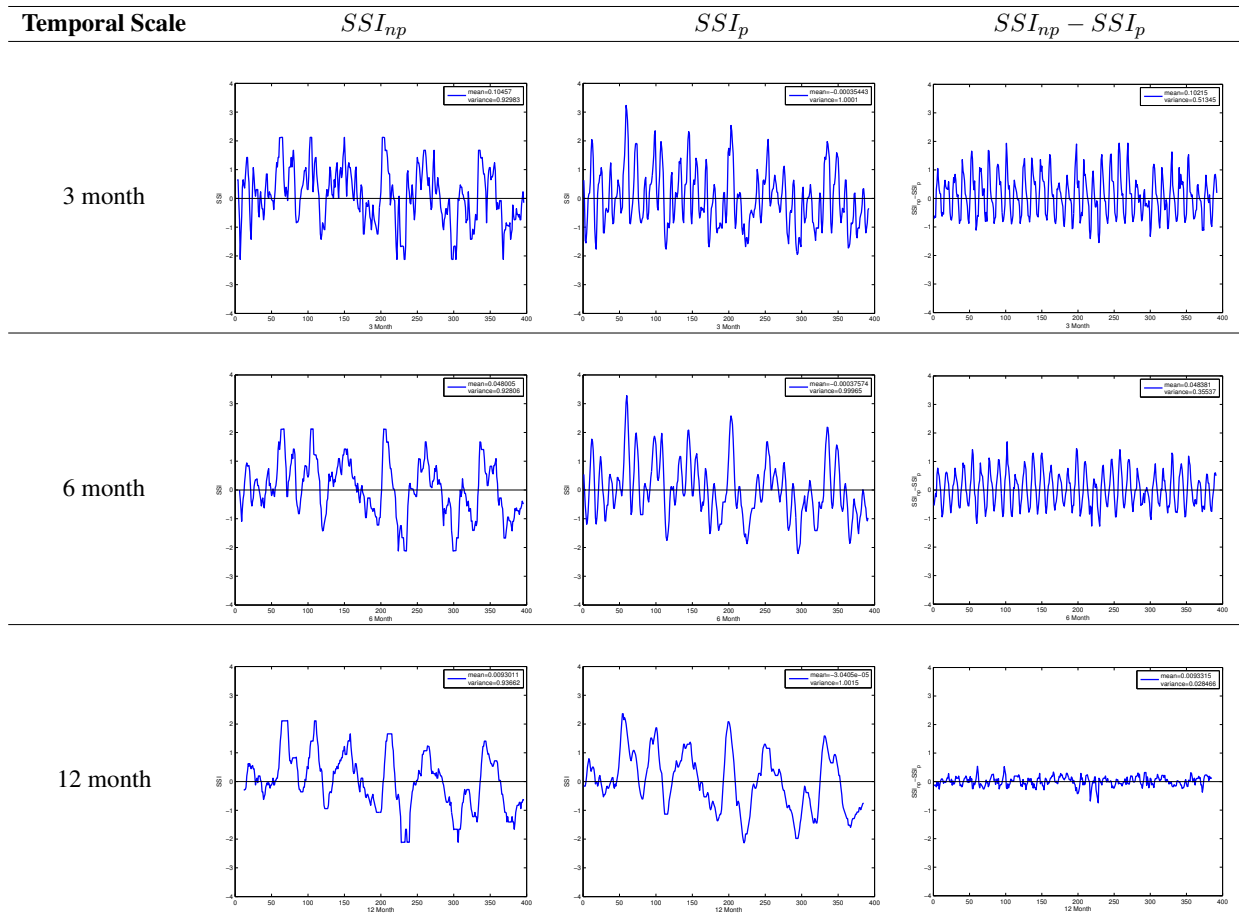
The statistics showed that the difference between the two methods decreases with temporal scales.

SPI calculated with larger scale data series can capture the general pattern that were reflected in that generated by smaller scales, but missed the details.

Problem 2:

The 3-month, 6-month and 12-month Standardized Soil Moisture Index (SSI) calculated with parametric and non-parametric method were listed as follows. Their differences are shown in the third column.

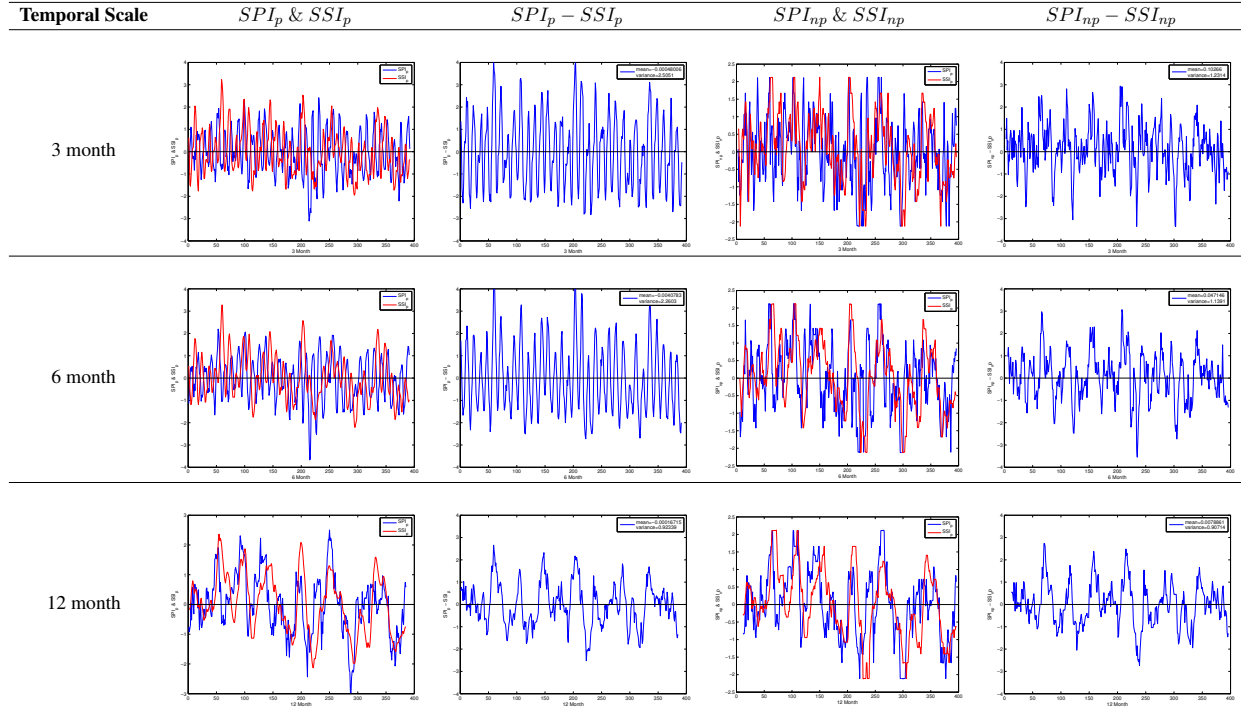
Table 2: SSI Calculation



Problem 3:

The 3-month, 6-month and 12-month Standard Precipitation Index (SPI) and Standardized Soil Moisture Index (SSI) calculated with parametric and non-parametric method were listed as follows:

Table 3: Difference between SPI and SSI



Results showed that SPI and SSI are generally in accordance with each other, but compared to SPI, SSI was more auto-correlated with its former values and its turbulence is smaller. SSI calculated with large temporal scale data series showed hysteric pattern compared to SPI. These features are supposed to due to the storage function of soil moisture.

Problem 4:

The global drought map for July 2009 based on 6-month SPI was drawn as follow:

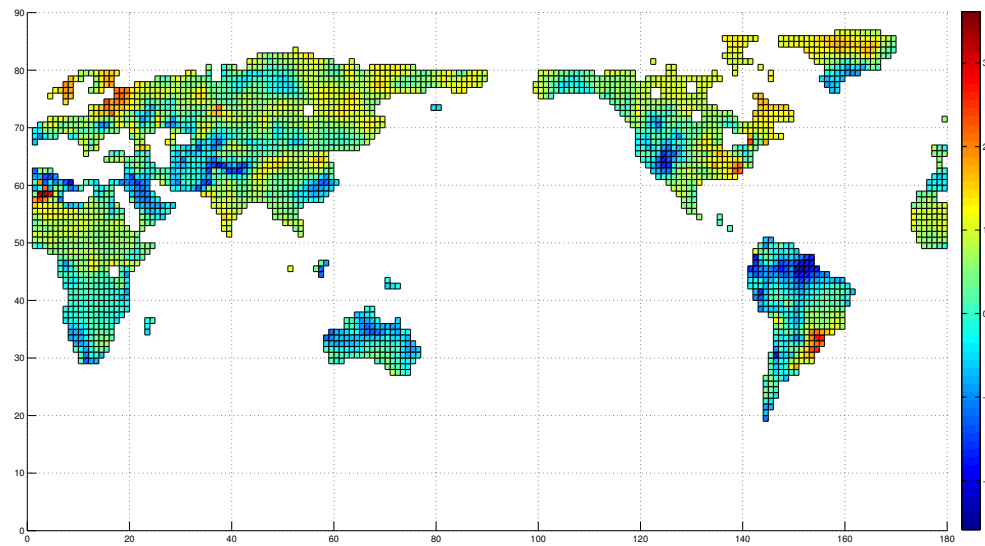
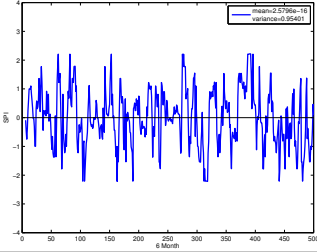
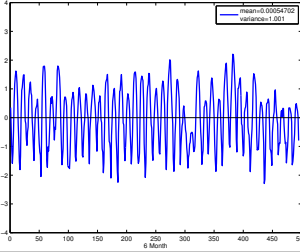
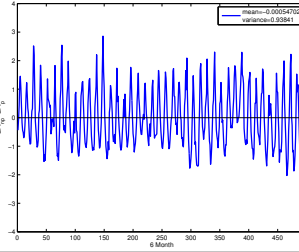


Figure 1: Global Drought Map for July 2009 Based on 6-month SPI

Problem 5:

The 6 month SPI using the parametric and nonparametric methods are shown as follows.

Table 4: SPI Calculated with Full Length Series

Temporal Scale	SPI_{np}	SPI_p	$SPI_{np} - SPI_p$
6 month			

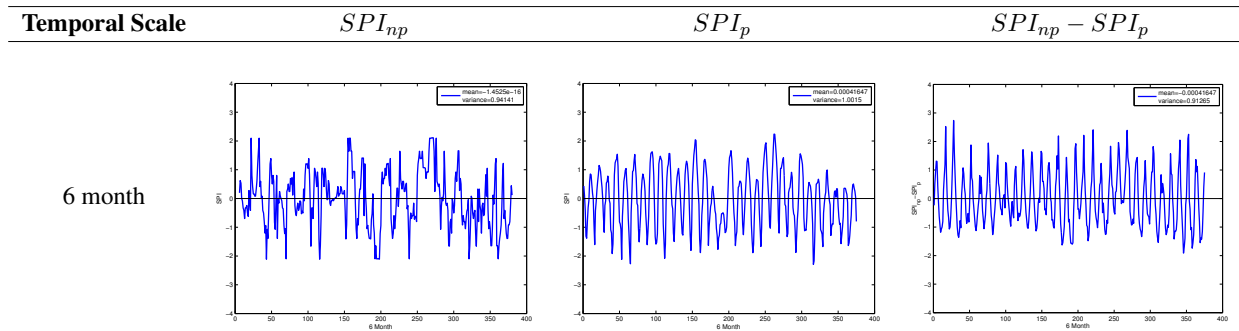
The magnitude of SPI calculated with parametric method is -2.29 , its corresponding return period is 91 years; the magnitude of SPI calculated with non-parametric method is -2.22 , its corresponding return period is 76 years.

The values are different because they use different algorithms to estimate the distribution of SPI . The parametric method is more reasonable when the data length is short; the non-parametric method is more reasonable when the data do not fit into gamma or log normal distribution and the data length is long enough.

Problem 6:

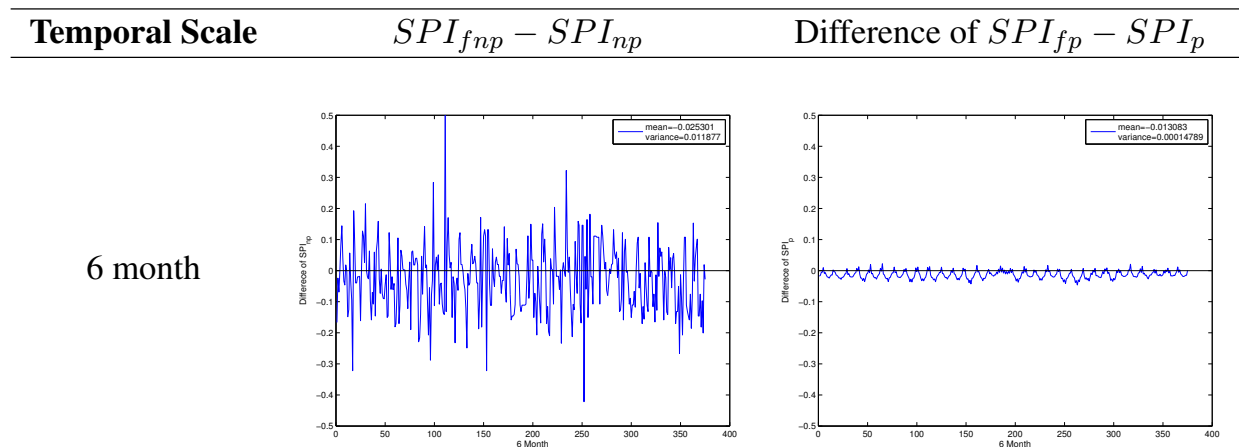
The 6 month SPI using the parametric and nonparametric methods calculated with shortened data are shown as follows.

Table 5: SPI Calculated with Short Data Series



The difference with SPI calculated with full length series are shown as follows.

Table 6: SPI Difference



The magnitude of SPI calculated with parametric method is -2.29 , its corresponding return period is 91 years, it is the same as that calculated with full length series.

The magnitude of SPI calculated with non-parametric method is -2.1 , its corresponding return period is 56 years. It is smaller than that calculated with full length series. This is because the non-parametric method is not stable when the series' length is short.