TEMPORAL VARIABILITY OF SOIL TEMPERATURE AT DIFFERENT DEPTHS

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During the past decades there have been considerable studies on climate changes and its impact exchanges of energy and water between the atmosphere and the Earth's surface. The rates of these exchanges depend on several climatic factors including soil temperature and moisture availability. The main cause for climate change is the continuous increase of the concentration of green house gases like carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

An analysis and projection of the global air temperature variation confirmed global warming trend in all parts of the world. Most of empirical researches, have found that developing countries are more vulnerable to climate change because of their reliance on low-capital agriculture. However, all studies with respect to climate change in Sri Lanka have been limited to rainfall and air temperature.

Investigation of soil temperature variation is very important for Sri Lanka. Soil temperature at various depths affects the atmospheric circulation, and it directly affects growth and yield of agricultural crops. Therefore the objectives of this study are investigate and analysis temporal variability of annual and seasonal variation of soil temperature at different depths.

Soil temperature data at six depths (5cm, 10cm, 20cm, 30cm, 60cm and 120cm) from 1977 to 2004 from the Coconut Research Institute of Sri Lanka (CRISL), Lunuwilla was analysed at two different temporal scales (annually basis and quarterly basis).

Annual soil temperature at all depths showed an increasing trend ($p<0.005$). The increasing rates decrease as the soil depth increases. The lower variability was shown for soil depth at 5cm and 10cm (CV = 27%). Percentage increases of mean temperature after 1990 with respect to mean temperature prior to 1990 was more than 5.4% for all depths. As for global temperature trend, the highest soil temperatures at all depths were found in 1990. The rates of annual soil temperature increases for before 1990 and after1990 were not statistically significant.

The results of PCA confirmed that due to very strong multi-co-linearity among annual temperatures ($p<0.05$) at different depths, the compound variability of all the six temperature levels can be replaced by a single factor consist of all depths which explains 95% of total variability of the original six variables. The loadings of the six temperatures on the compound variate were almost same. It can be confirmed that the arithmetic mean of the six temperatures can be used as a proxy variable in climate studies rather than analysing all six variables separately.

Soil temperature of the four seasons, Jan-Mar, Apr-Jun, Jul-Sep and Oct-Dec have shown significant ($p<0.01$) increasing trend. The rate of increases is higher in Jul-Sep season comparing to other seasons at all depths. The warmest season is Apr-Jun season and the coolest season is Oct-Dec season. The most influenced period on the annual soil temperature was April – June season.

The results obtained from this study can be used to find the long-term temperature increases effect on coconut plantation at Bandiruppuwa Estate.