World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:11, No:10, 2017

Factors Affecting Air Surface Temperature Variations in the Philippines

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Abstract : Changes in air surface temperature play an important role in the Philippine's economy, industry, health, and food production. While increasing global mean temperature in the recent several decades has prompted a number of climate change and variability studies in the Philippines, most studies still focus on rainfall and tropical cyclones. This study aims to investigate the trend and variability of observed air surface temperature and determine its major influencing factor/s in the Philippines. A non-parametric Mann-Kendall trend test was applied to monthly mean temperature of 17 synoptic stations covering 56 years from 1960 to 2015 and a mean change of 0.58 °C or a positive trend of 0.0105 °C/year ($p < 0.05$) was found. In addition, wavelet decomposition was used to determine the frequency of temperature variability show a 12-month, 30-80-month and more than 120-month cycles. This indicates strong annual variations, interannual variations that coincide with ENSO events, and interdecadal variations that are attributed to PDO and CO2 concentrations. Air surface temperature was also correlated with smoothed sunspot number and galactic cosmic rays, the results show a low to no effect. The influence of ENSO teleconnection on temperature, wind pattern, cloud cover, and outgoing longwave radiation on different ENSO phases had significant effects on regional temperature variability. Particularly, an anomalous anticyclonic (cyclonic) flow east of the Philippines during the peak and decay phase of El Niño (La Niña) events leads to the advection of warm southeasterly (cold northeasterly) air mass over the country. Furthermore, an apparent increasing cloud cover trend is observed over the West Philippine Sea including portions of the Philippines, and this is believed to lessen the effect of the increasing air surface temperature. However, relative humidity was also found to be increasing especially on the central part of the country, which results in a high positive trend of heat index, exacerbating the effects on human discomfort. Finally, an assessment of gridded temperature datasets was done to look at the viability of using three high-resolution datasets in future climate analysis and model calibration and verification. Several error statistics (i.e. Pearson correlation, Bias, MAE, and RMSE) were used for this validation. Results show that gridded temperature datasets generally follows the observed surface temperature change and anomalies. In addition, it is more representative of regional temperature rather than a substitute to station-observed air temperature.

Keywords : air surface temperature, carbon dioxide, ENSO, galactic cosmic rays, smoothed sunspot number
Conference Title : ICECAS 2017 : International Conference on Environment, Climate and Atmospheric Sciences
Conference Location : Osaka, Japan
Conference Dates : October 09-10, 2017