

Relationship Between Precipitation and Carbon Dioxide (CO₂) Over Indian Sub-Continent

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The association between carbon dioxide and rainfall is investigated over the Indian region. The study is performed on fine scale (2 degree, 2.5 degree) grid map for the period of 9 years from 2003 to 2011. Carbon dioxide data from Atmospheric Infrared Sounder (AIRS) and rainfall data from Tropical Rainfall Measuring Mission (TRMM) are used in this study. Data are mapped for both carbon dioxide and rainfall across all the months/ seasons of the study period. The concentration of carbon dioxide is found to be highly variable spatially as well as seasonally. It varies from $\sim 3.68 \times 10^{-4}$ (July-August, 2003) to $\sim 4 \times 10^{-4}$ (January-February, 2009) over land and which is larger than over oceans. It is observed that in the winter months (November to February) the concentration is relatively higher, while during the monsoon season the concentration is low. It seems to be the wash out effect of rainfall over carbon dioxide. Over the oceans the Carbon Dioxide concentration show the slight seasonal changes and the range is less as compared to the land. The rainfall varies from no rainfall to 102 cm/month (July, 2007), on average monthly basis.

The correlation coefficient (R_{xy}) between Carbon Dioxide and rainfall is calculated during all the months from 2003 to 2011, and the values have been mapped and shown using MATLAB. The correlation coefficient is highly variable during different months over the study region, with a wide range. The computed minimum value was in January (-0.8859) and the maximum value in the month of August (+0.8863). The computed correlation coefficients show positive values for the summer months of the sub-continent over land with rise in values of correlation from the month of April, reaching uniformly high value in August over 9 years, and then the coefficient decreases as the autumn sets in. However, over the oceans the fluctuations are not high with the change in seasons. It is discerned that the percentage increase in rainfall is not in direct proportion to the increased carbon dioxide concentration i.e. the relationship is not linear. Moreover, the increased rainfall in response to increasing carbon dioxide concentration in a region is limited which may be attributed to certain regional parameters such as topography of the area, vegetation and emissions of carbon dioxide due to various anthropogenic activities. The study would be extended in future by taking large area and other parameters into account.

Keywords: Carbon dioxide concentration, rainfall, correlation coefficient, TRMM, AIRS, India