ISRO-Geosphere Biosphere Programme (GBP) Contribution to Climate Change Studies - Perspectives

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The Earth's climate is regulated by Land-Air-Ocean interactions intricately linked to Geosphere-Biosphere-Atmospheric processes. These interactive forces modulates equilibrium in the weather and climate. The indiscriminate land use practices, fossil fuel burning, increased vehicular traffic, loss of vegetation cover, etc. are exerting changes in the radiative forcing reaching the earth's surface. The elevated levels of trace gases, and altered absorption efficiency of the land cover are interactively summarizes the forcing to pronounce changes in climate on a short, medium and long term scales which operate at micro, meso and synoptic spatial scales. The temporal and spatial scales of changing Earth's climate result in aberrations on natural cycles of monsoon, vagaries in the natural disasters, increased temperatures both on surface and oceans, loss of soil moisture, decrease in the extent of snow/glaciers, changes in plant productivity etc cumulatively inflict irrecoverable changes to our climate.

Realizing the importance of temporal and spatial scales in Geosphere and Biospheric exchange processes ISRO focused its objectives mainly on large-scale issues contribute to the understanding of parameters responsible for climate change. Towards this Specific Atmospheric Assessment Projects (SAAP) viz. 1) Aerosol Radiative Forcing over India – on a periodic basis is contemplated through the establishment of MWR network in the country for possible uses in the assimilation to our numerical weather forecasting. 2) Atmospheric Trace Gases composition and Transport over India envisages to apportion the sources and sinks of the trace gases and their residence time of transporting to other regions and to identify ecological hotpots. 3) Atmospheric Dust Composition and Transport - through establishment of aerosols dust composition observatory network and the transport of atmospheric dust from the continental and extra continental regions to understand on the intra-annual variability of our atmospheric composition and the possible role of dust in regulating radiative forcing. 4) Atmospheric Boundary Layer Characterization - through establishment of boundary layer Lidars is envisaged. 5) Energy and Mass Exchanges in Vegetative Systems – a project planned to understand the exchanges of energy and water use during the growing season of our major agricultural systems to possibly assimilate into the crop production and protection models.

The **Integrated Land Ecosystem and Atmospheric Projects (ILEAP)** viz. 1) Land Use Land Cover Dynamics and Impact of Human Dimensions in the Indian River Basis over the last 30 years is proposed to analyze the issues causing concerns on our dwindling hydrological regime. 2) The Multi-proxy Quantitative Paleo monsoon reconstruction for past 21,000 years BP and Regional Climate Modeling efforts are integral part of the past and future predictions of our changing Indian climate on a scientific basis.

As far as atmospheric CO_2 and its flux is concerned there are no primary databases or reliable observations available for use in the carbon dynamics studies. Towards this GBP is planning for **Intense Observational Projects (IOP)** related to 1) Vegetation Carbon Pool Assessment and 2) Soil Carbon Pool Assessment.

ISRO-GBP's climate change research programme envisages the development of small satellites capable of measuring and monitoring of trace and greenhouse gases and atmospheric aerosol characterization etc. The satellite based observations eventually be integrated with ground observational network of ISRO-GBP and attempt to make it operational to implement the climate scenario of Indian continent in the near future.

The ISRO-GBP projects would thus provide enhanced understanding of India's regional climate and its atmospheric composition.