Understanding Carbon Sink Trends in India: A Climate Models Perspective

Smrati Gupta

Indian Institute of Tropical Meteorology, Pune, India. Institute of Environment and Sustainable Development, Banaras Hindu University, Varanasi, India

Author list (excluding presenting author)

Yogesh K. Tiwari

Abstract

Amidst escalating global warming and rising greenhouse gas emissions concerns, this research investigates the evolving dynamics of carbon dioxide (CO_2) sequestration by the terrestrial biosphere in the form of Gross Primary Productivity (GPP), analyzing models and observations from past to future timescales. Approximately 30% of anthropogenic CO_2 emissions are absorbed by terrestrial ecosystems through primary productivity. The study explores the interplay between land use changes, climate change, and physiological responses to evolving meteorological conditions, all of which collectively impact the carbon sink capacity of the terrestrial biosphere. Focusing on India, a region highly vulnerable to climate change effects, the research examines Climate Models Inter-comparison Project (CMIP) simulations. The study discusses an increase in GPP in India in recent years. Analyzing historical and future scenarios using CMIP models, the trend in annual GPP during the historical period stood at 2.37 gC $m^{-2}y^{-2}$. Under the highest emission scenarios, future projections indicate the trend of ~6 gC $m^{-2}y^{-2}$, based on socio-economic pathway-5 of CMIP6. The study noted a spatially varied GPP trend across India. Regions like the North East, Indo-Gangetic Plains, and Western Ghats exhibit notable GPP increases, whereas some southern regions show limited or no growth in the future scenario. The study investigates recent land use changes and discusses the GPP variations in response to forest and crop cover alterations. Additionally, the research explores the potential impact of increased rainfall in models, as indicated by CMIP6 models, on GPP trends. This study contributes valuable insights into the changing GPP trends in India, shedding light on the complex interactions between climate change, land use, and carbon cycling. This study is important for refining further generations of climate models. It emphasizes investing in and incorporating real-world observations for more accurate predictions of terrestrial ecosystem responses to ongoing environmental changes.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

AMIGO: Analysis of eMIssions usinG Observations

IGAC Regional Working Groups

MANGO: Monsoon Asia and Oceania Networking Group