Project Proposal for Ph.D.

Project Details

Project Title
Aerosol-Cloud interactions over the south Asian region using a global climate model

Project Summary
Atmospheric Aerosols are tiny solid or liquid particles floating in the atmosphere which play a crucial role in regulating the radiation budget and the climate of the Earth Atmosphere system through a myriad of physical and chemical processes such as interaction with radiation, influencing the microphysical properties and the lifetime of clouds, acting as a substrate for various chemical reactions in the atmosphere etc. Tools that are available with the scientific community to understand and quantify the impact of changing emissions of aerosols on weather and climate are global climate models (GCM), which are computer programs or numerical models that mathematically represent various physical and chemical processes of the global climate system. Consistent evaluation of aerosols, clouds, and aerosol-cloud interactions (ACI) simulated by climate models with observations across the globe is crucial for identifying the deficiencies in the representation of some of these unresolved processes and improve our understanding of aerosol effects on cloud and climate using these models as a tool. The objectives of this PhD research project are to use a newly developed aerosol emission inventory for India as input in a global climate model CAM5.3, evaluate the simulation of aerosols, clouds, and their relationship over the south Asian region by this model using satellite observations. The project also aims to examine if there are evidence of aerosol induced cloud invigoration of middle and high-level clouds over the Indian summer monsoon region using satellite observations and CAM5 model simulations. The thesis will also examine the impact of changes in emissions of individual aerosol types on clouds suppression/invigoration over the Indian summer monsoon region using CAM5 model.

PhD Supervisors

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<tr>
<th>Role</th>
<th>Faculty</th>
<th>Academic Unit in IITD/Institute/University</th>
<th>Email ID (Official)</th>
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<tbody>
<tr>
<td>Supervisor 1</td>
<td>Prof. Dilip Ganguly</td>
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<td>Supervisor 2</td>
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Project requirements (Student qualifications, experience required, etc)

- 1st class M.Sc. degree in Physics / Chemistry / Mathematics / Atmospheric / Oceanic / Climate Sciences or 1st class M.Tech, degree in Atmospheric / Oceanic / Climate Science
- Candidate should have at least 1 year of research experience in doing numerical simulations using a global climate model in a HPC environment and experience of analyzing satellite data of aerosols meteorological variables such as rainfall, cloud cover etc.
### Source of fellowship/funding

| CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any |
| Part-time Student |

### Role of Faculty Members involved:

Prof. Dilip Ganguly has expertise in modeling the production, transport, transformation, and removal of atmospheric aerosols in Atmospheric General Circulation Models and Chemical transport models. He will be responsible for guiding the student in performing numerical simulations using a global climate model in the IITD HPC, analyzing the model simulated data, satellite data of aerosols meteorological variables such as rainfall, cloud cover etc.

Prof. Gazala Habib has vast experience in developing emission inventories of aerosols and other air pollutants. She has also experience of laboratory measurements of aerosols and investigating their physical, optical, and chemical properties. She will be responsible for guiding the student in preparing the proper aerosol emission inventory data that is will be used as an input to the climate model.

Prof. Gazala Habib and Prof. Dilip Ganguly have a joint multi-institutional sponsored research project titled “National Carbonaceous Aerosol Project (NCAP)” funded by the MoEF&CC (Ministry of Environment Forest & Climate Change) in which Prof. Habib is leading the multi-institutional effort towards development of a new emission inventory for India while Prof. Ganguly is leading the multi-institutional effort in conducting numerical simulations using global climate models to understand the impact of aerosol emissions on the regional climate of India.

The PhD student will use the newly developed aerosol emission inventory for India as input in a global climate model CAM5.3, evaluate the simulation of aerosols, clouds, and their relationship over the south Asian region by this model using satellite observations.