TRAINING ON
GLACIER STUDIES, CLIMATE CHANGE AND REMOTE SENSING

Sponsored by
Department of Science and Technology, Government of India
New Delhi

Bengaluru
March 4 - 15, 2013

Divecha Centre for Climate Change
Indian Institute of Science
Bengaluru 560 012

INTRODUCTION

In the Indian Himalayas, large quantity of water is stored in the form of seasonal snow, ice and glaciers. Melt water from these glaciers and snowfields form an important source into run-off of the North Indian Rivers during critical summer months. This makes these rivers perennial and has helped to sustain and flourish the Indian civilization along the banks of the rivers Ganga and Indus. However runoff from the Himalayan glaciers are not assured because geological history of the Earth indicates that glacial dimensions are constantly changing, as glaciers are highly sensitive to minor variations in climate. Therefore, monitoring of Himalayan glaciers are important to assess future changes in the runoff of the North Indian Rivers. However, Himalaya have very rugged terrain and conventional field based methods are difficult to use. Therefore, remote sensing has emerged as an alternative method for collecting information on glaciers. In India due to lack of trained manpower, it is difficult to generate reliable information. Therefore, proper training for scientists working in the field of glaciology is needed to utilize full potential of this technology.

The training will be organized by faculty of Divecha Centre for Climate Change, Centre for Atmospheric and Oceanic Sciences at Indian Institute of Science and University of Iceland, Reykjavik, Iceland. In addition, well know scientists working in the field of cryosphere and remote sensing will be invited as a guest faculty.

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SYLLABUS

1. **Distribution of Glaciers and snow cover**

   Importance of glaciers, general principle of the meteorology of precipitation, formation of snow, physical characteristics of snow crystals, areal distribution of glaciers/snow cover and factors controlling the distribution of snow cover.

2. **Climate**

   General circulation of atmosphere and oceans, climate variability, spatial and time scales, errors and accuracy assessment, feedback mechanism and carbon cycle.

3. **Morphology of glaciers**

   Classification of glaciers, Crevasses and icefall, moraines, dead ice, depositional and erosional landforms of glacier.

4. **Transformation of snow to ice**

   Different types of metamorphism, transformation of snow into ice, Zones in a glacier, effect of metamorphism on albedo of snow and ice, grain growth.

5. **Paleoglaciation**

   Milankovitch cycles and Greenhouse effect, Little ice age (LIA), Glacial and interglacial cycles.

6. **Distribution of temperature in glaciers**

   Thermal parameters of snow/ice, types of glacier based on temperature distribution, temperature profiles, seasonal variation of temperature as function of depth.

7. Flow and sliding of glaciers

Driving and resisting stresses, Vertical profile of flow, simple models of glacier flow, deformation, steady and non steady flow of glacier.

8. Glacier Mass Balance

Summer and winter mass balance, Stake method, Geodetic method, ELA, AAR methods, hydrological method.

9. Ice and Snow ablation

Physics of snow melt, heat budget and radiation. Snow melt runoff model.

10. Glacial lake outburst flood/ Jökulhlaup

Types of Jökulhlaups, jökulhlaup process, hydograph of jökulhlaup.

11. Fundamentals of remote sensing

Interaction of electromagnetic radiation with common objects on the Earth. Laws governing this interaction. Spectral reflectance characteristics of the common objects as snow, ice and glaciers.

12. Optical properties of snow and ice

Reflectance characteristics of snow in optical regions, effect of mineral dust and black carbon on reflectance of snow and ice.

13. Response of glaciers to climate change

Reaction to change in mass balance and reaction to additional forcing.

PRACTICAL: Glacier mapping using remote sensing techniques, estimation of accuracies, Mass balance estimation using different techniques, glacier and snow melt runoff estimation.

FACULTY

1. **Dr. Anil Kulkarni**
   Distinguished visiting Scientist, Divecha Centre of Climate change, Indian Institute of Science, Bengaluru.

2. **Dr. Helgi Björnsson**
   Professor, University of Iceland, Reykjavik, Iceland.

3. **Dr. J. Srinivasan**
   Professor and Chairman, Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru.

4. **Dr. S. K. Satheesh**
   Professor, Centre for Atmospheric and Oceanic sciences, Indian Institute of Science, Bengaluru.

5. **Dr. Govindswamy Bala**
   Associate Professor, Centre for Atmospheric and Oceanic sciences, Indian Institute of Science, Bengaluru.

GUEST LECTURES

Guest Lectures by well known Scientists.

VENUE & DATE

Divecha Centre for Climate Change
Indian Institute of Science, Bengaluru, India

Training Date : March 4 - 15, 2013.

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REGISTRATION FEES

No registration fees for the trainees.

DEADLINES

Last date for submission of application form:
January 15, 2013

Intimation to selected candidates:
January 20, 2013

ACCOMMODATION

Accommodation and TA/DA will be provided by Divecha Centre for Climate Change according to the Government of India rules.

ELIGIBILITY

Research Fellows and students from recognised institutes/Universities/organisations.

COURSE DIRECTOR

DR. ANIL KULKARNI
Distinguished Visiting Scientist
Divecha Centre for Climate Change,
Indian Institute of Science,
Bengaluru - 560 012, India
Email: anilkulkarni@caos.iisc.ernet.in

ABOUT Bengaluru

The capital of Karnataka State, Bengaluru, is renowned as the 'Garden City' by virtue of its many parks, gardens, tree-lined avenues and abundant greenery. The city also has a rich heritage with its historical association with the Wodeyars, Tipu Sultan and the British. Places of tourist interest such as the Lalbagh Botanical Gardens, Cubbon Park, Tipu's Palace, Bull Temple and a range of Museums compete with modern malls and entertainment zones for every visitor's time. The capital of the erstwhile Wodeyar dynasty, Mysore, is no more than 145 kms. away and makes for an interesting day-trip.

HOW TO REACH

The IISc campus is conveniently located for those arriving by air as well as those choosing to travel by train. The new Bengaluru International Airport is 35 kms. from the campus. The campus is equidistant from the City Railway Station and the Cantonment Railway Station which are both about 7 kms away. The Yeshwanthpura Railway Station is no more than 2 kms.

CONTACT PERSON

Please send the application forms along with a recent passport size photograph to the following address :

Ms. Smriti Basnett
Divecha Centre For Climate Change,
Indian Institute of Science, Bengaluru – 560012, India
Mobile : (+91) 9945668990
Email : glacier.training@caos.iisc.ernet.in

Training on Glacier Studies, Climate Change and Remote Sensing Bengaluru March 4 - 15, 2013.

Application Form

Name _____

Profession _____

Organization_____

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Telephone _____

Email _____

Academic qualification _____

Area of research/ study_____

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Relevance of training in research / study:

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Name and Signature of
P.I. / Guide /H.O.D

Seal of Organization