Divecha Centre for Climate Change
Indian Institute of Science
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SEMINAR NOTICE

Title: **"Forward and Inverse Modeling of Glacier and Ice-shelf Fracture"**

Speakers: **Dr. Ravindra Duddu**
Associate Professor of Civil and Environmental Engineering
Vanderbilt University, Nashville, TN

Date: 23rd January 2023(Monday)

Time: 3.30PM – 4.30 PM

Venue: DCCC Auditorium, 2nd Floor, D314.

Coffee/Tea : 3.00 - 3.30PM

Speaker Bio:-

Ravindra Duddu got his B. Tech in Civil Engineering from the Indian Institute of Technology Madras. He obtained his M.S. and Ph.D. in Civil and Environmental Engineering from Northwestern University. He worked as postdoctoral researcher at the University of Texas at Austin Institute for Geophysics and Columbia University in the City of New York. Currently, he is an Associate Professor of Civil and Environmental Engineering at Vanderbilt University, with secondary appointments in Mechanical Engineering and Earth and Environmental Sciences. His research interests are in the area of computational solid mechanics with a focus on multi-physics modeling of material damage evolution. Specific applications include fracture of Antarctic glaciers and ice shelves, and delamination/fracture of fiber reinforced composites. Ravindra Duddu is a recipient of the US NSF early CAREER award, Fulbright Kalam-Climate Fellowship, UK The Royal Society International Exchanges travel award, and ONR Summer Faculty Fellowship.

Abstract:-

The dynamic mass loss due to ice flow from the Antarctic and Greenland ice sheets directly into oceans is the greatest source of uncertainty in predicting sea level rise. The fracture and detachment of icebergs from the edge of a glacier or an ice shelf, known as calving, significantly controls the mass loss from ice sheets. Calving is intricately linked to climate dynamics through ice-ocean-atmospheric interactions, and it has been hypothesized that hydrofracturing of ice shelves/tongues followed by ice cliff failure could contribute to rapid sea level rise over the coming centuries. However, existing calving schemes in numerical ice sheet models are too simplistic, which can

exacerbate biases and uncertainties in predicting the calving fronts of glaciers and ice shelves, and ultimately sea level rise. Therefore, it is important that we improve our understanding of the fracture mechanics of ice shelves and glaciers, and better represent calving in numerical ice sheet models. In this presentation, I will present advanced modeling approaches for simulating and understanding the iceberg calving process. First, I will present continuum poro-damage mechanics models for simulating the hydrofracture process. I will discuss the model results for idealized marine-terminating grounded glaciers and the implications of ice rheology and damage model assumptions for calving from ice shelves and glaciers. Second, I will present a continuum damage material point method for simulating flow and fracture of shallow ice shelves. I will discuss simulation results for idealized marine ice sheet, and model calibration for Larsen C ice shelf calving. I will end with some remarks on the data needs and limitations of these models, and future extensions to improve the representation of calving in ice sheet models.

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All are welcome!