**Abstract**

I have tried to present a theoretical and experimental study of viscous gravity currents lubricated by another viscous fluid from below. We use lubrication theory to model both layers as Newtonian fluids spreading under their own weight in two-dimensional settings. We have two conditions regarding the delivery of the lower viscous layer, either axisymmetric, or channel wise. Also the surface topology is changed from a smooth to a uniform porous medium, and is both sloped and horizontal at times. The main focus is over the instabilities in viscous fluid on the top of the lubricant, down a slope.

I have achieved some very interesting result, including a very new form of instability in lubricated viscous gravity currents whose waveform is a very strong function of viscosity ratio. This was obtained by diminishing the effect of the vertical pressure gradient and thus helping build an approximately constant height profile. I am still trying to analyse the actual data, and thus focus to derive a function between the waveform of the instability and the viscosity ratio.

This study will help us understand more about the motion of the ice sheets in Greenland and Antarctica. The ice sheets are generally kilometres high, and due to this, there is extremely high pressure at the bottom. Owing to the anomalous nature of water-ice, a thin layer of water is formed at the bottom, which lubricates the ice sheets. Also, thicker the ice sheet, the thermal resistance of the ice sheet increases, reducing the heat dissipated outside. So higher the ice sheet, higher the lubrication. This has the effect in general that once it starts moving, it keeps on accelerating.

The motion of the ice glaciers hasn’t been studied much, also, it has several instability phenomena, which I was more interested to study about. Also, I needed to replicate the porous nature of the basal bed, and try to observe, the effects of the porous medium too. The whole idea and the net contribution of lubrication to the motion of ice sheets haven’t been studied much, and thus was very interesting to propose a model for it.

**Work Culture/Resources**

I was working at the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, under Prof. Grae Worster and Prof. Sam Pegler, and was really a very nice experience. I conducted all the experiments at GK Batchelor Lab, having the distinction of the first fluid mechanical lab in the Mathematics Department, and it’s really amusing to work at such a facility. The laboratory is very well equipped, and quite resourceful. Also, a lot of independence is given to the researchers, in terms of the experiments, and it’s really very nice.  I had very productive discussions with my supervisors, and they guided and helped me time to time.

Also, Cambridge is a very fun and social place. I met various people, working on very different topics in the same labs. People in the mathematics department have been solving problems ranging from Biological system to the financial models, from space-time warp to the geological phenomena. There is a lot of diversity, both in terms of people and the works going on. I also interacted with people outside the department too, historians, evolutionary scientists and environmentalists too. And I am deeply thankful to the IIT Kgp US Foundation for all the help to make this possible for me.