Slide 2 – Background and motivation

**GrIS**

Greenland is covered by a massive ice sheet which fluctuate in volume depending on the global temperature, and impact the sea level by stocking or releasing water.

The GrIS contains the equivalent of 7.4 m of sea level rise.

The melting is accelerating due to climate change and is due to the increase of ablation of the ice compare to the accumulation of snow.

**Ice dynamics**

Glaciers are complex systems with storage and drainage systems on top and inside the glacier.

* Describe parts

The meltwater infiltrates the system through moulins and crevasses, increase the water pressure in the aquifer, and lower the effective pressure, producing basal sliding.

These phenomena were known in smaller glacier but not believed to be present far in the GrIS and the ice sheet was believed to be quite resilient to climate change.

There is conflicted ideas about how meltwater influence ice motion

Data:

1. strong correlation between meltwater and ice motion
2. acceleration during early summer and deceleration during late summer

Model:

1. increase in meltwater creates bigger channels and lower waterlevel in glacier and slow down
2. waterlevel stay the same, but the inefficient drainage area is concerned

**Lacunes/question**

Conceptual and mathematical models are made with indirect data. Very few studies focus on moulins in the GrIS.

Moulins are a direct source of information of the hydrogeology of the bed.

To understand and interpret waterlevel data collected in the field in moulins, a simple model focusing waterlevel fluctuation in moulins is used to identify timescales influencing the fluctuations.

Slide 3 – Methods

2 coupled differential equation are used to simulate the waterlevel fluctuations in moulin.

1. Reservoir constriction equation to reproduce the hydraulic head in the moulin
   1. Influenced by **recharge**, **section of the moulin**
   2. And influenced by the **discharge** which depend on the **section of the channel** and **the head**

The section of the channel is going to wary and influence the discharge. To simulate the variation of conduit we use:

1. Creep or melt of the channel
   1. Creep is Influenced by the **conduit section** and **Z (Pi)** and **h (Pw)**
   2. Melt is influenced by the **section of the conduit** and **the dischage**

Solved with odeint in python

Used a set of parameters: table describe

Fixed recharge to see what happend

Slide 4 – Results

Identify 2 main timescale independant of recharge fluctuation, just due to the time the system takes to equilibriate

Slide 5 – Results

Varying parameters changes the amplitude and period of the 2 timescales

To identify timescales, used a fourier transform to see if possible to identify timescales

We can see the oscillations and the frequency gives the period of the oscillation.

Extracted the pics

Slide 6 – Results

Here you can see a plot of the frequencies per radius used for the simulation, for a thickness 1000 m and each line represent a different recharge

When the radius is bigger, the periode of the oscillation is wider, and when the recharge decrease (from 10 to 1 m3/s)

Slide 7 – Results

Slide 4 – Conclusion