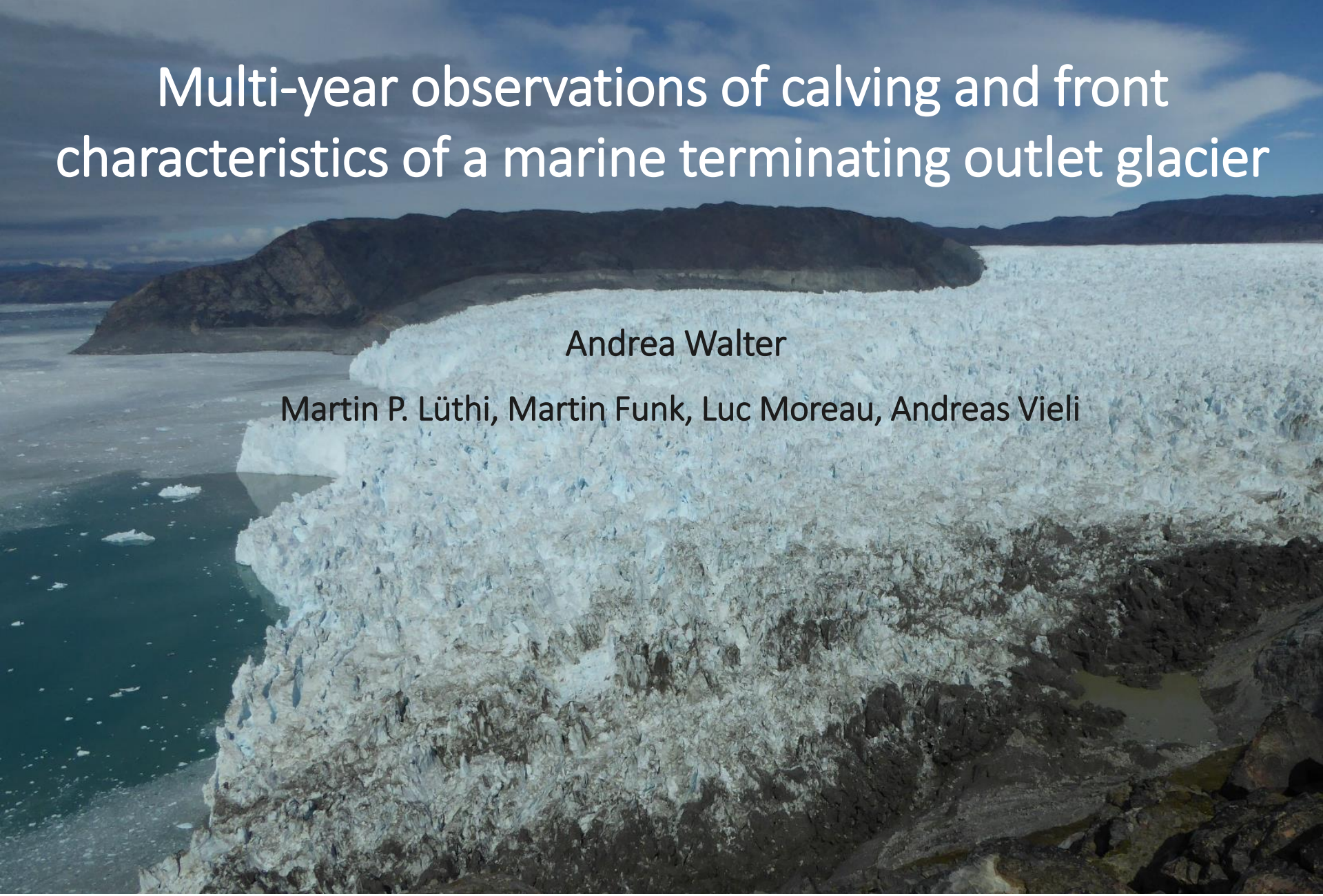
Multi-year observations of calving and front characteristics of a marine terminating outlet glacier



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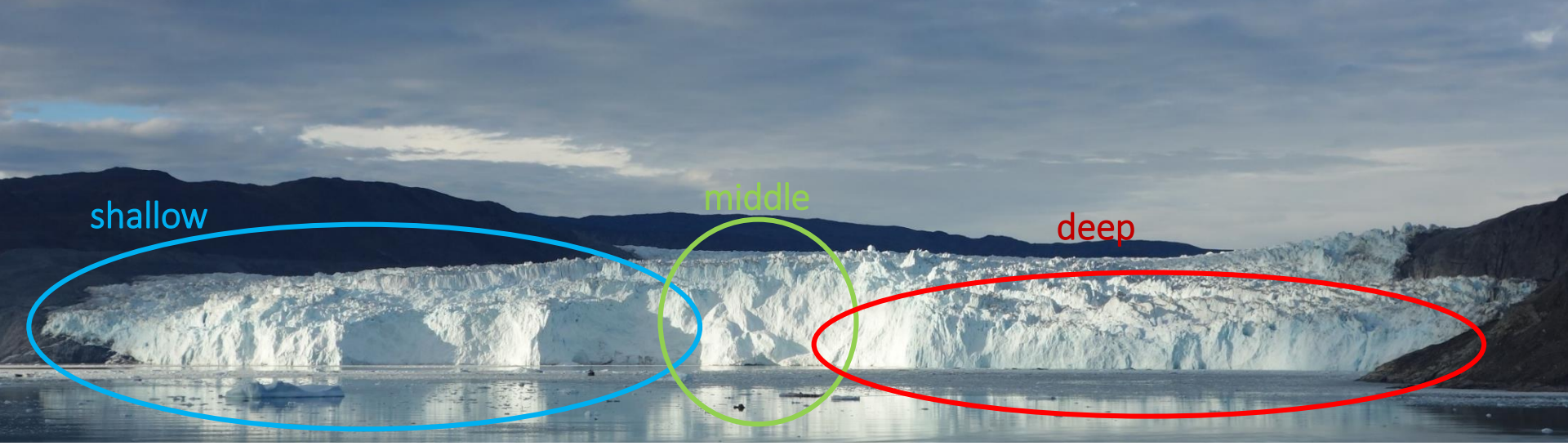
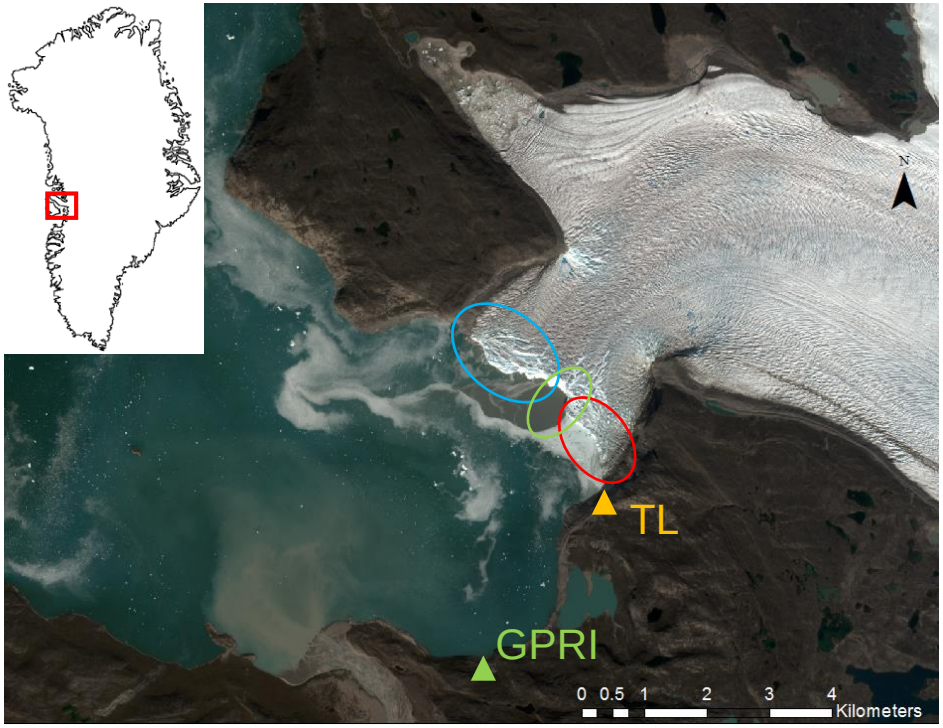


Eqip Sermia (69°47'N, 50°15'W)

- Front width: 3.2 km
- Water depth: 0 - 100 m (Lüthi et al., 2016, Rignot et al., 2015)
- Front thickness: 50 – 170 m
- Shallow (water depth 0-20 m), middle and deep (water depth 70-100 m) sector of the front



Gamma Portable Radar Interferometer (GPRI)

- Real-aperture (Ku-band) (Werner et al., 2008)
- 1 transmitting & 2 receiving antennas
- Measurement interval 1 min
- Field campaigns 2014 – 2019: up to 12 days

➢ **With the radar images velocity and height maps can be calculated**

Stacked (10 min) elevation models (DEM)

↓

Difference between DEMs

↓

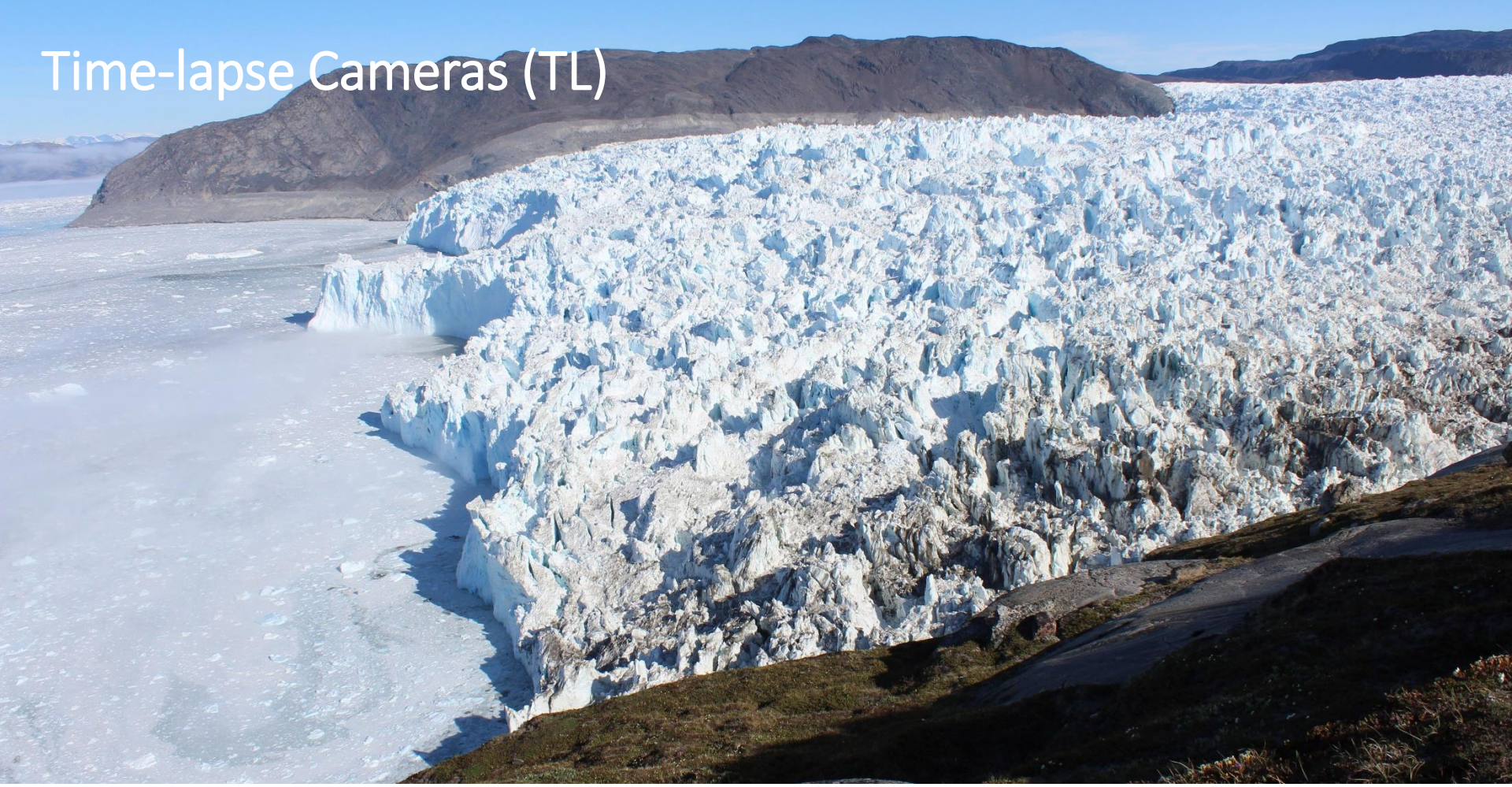
Localize negative elevation changes

↓

Extract calving events with data segmentation

Detailed description of method can be found in Walter et al. (2020)

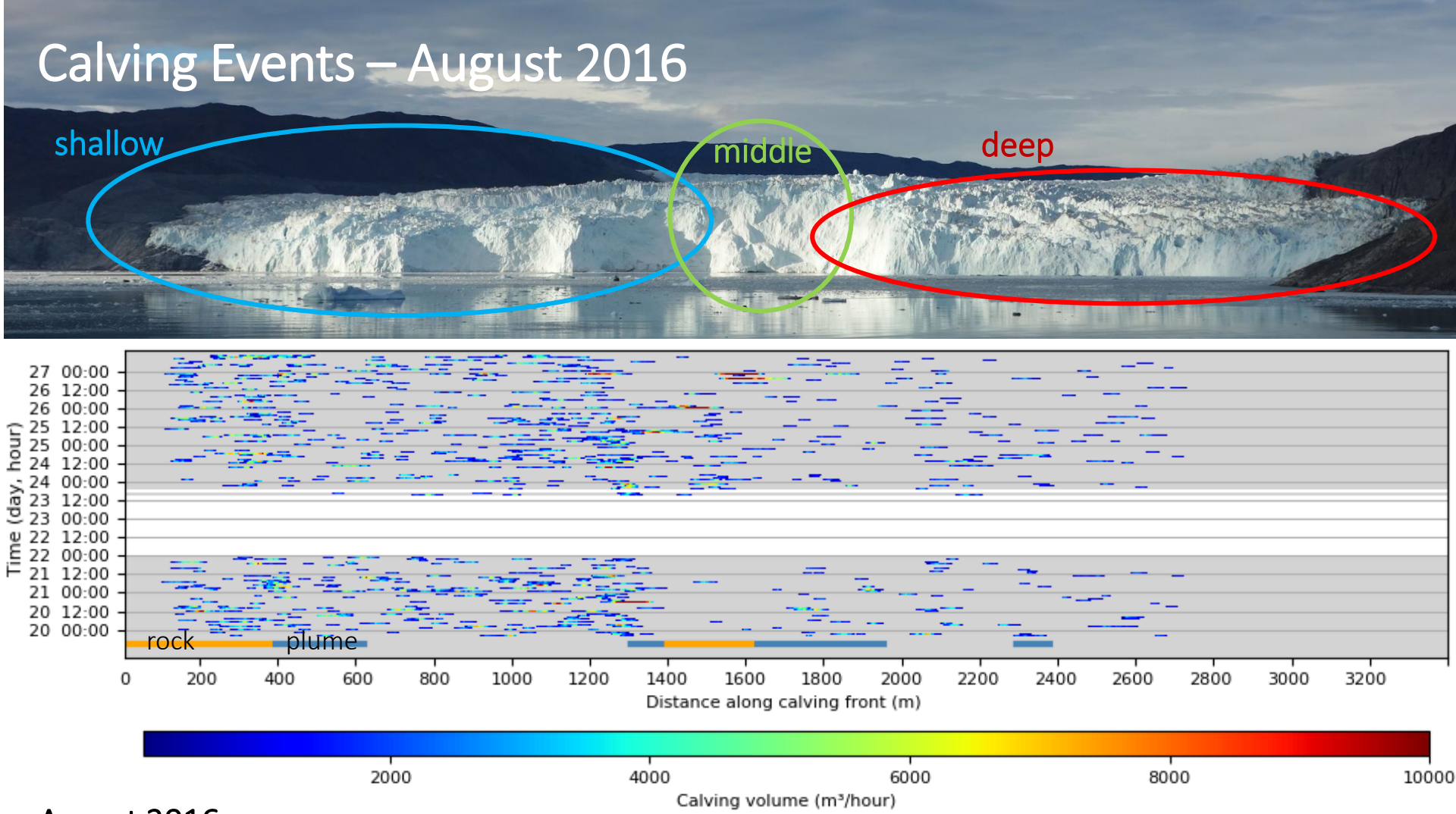
Time-lapse Cameras (TL)



- Measurement interval 2014 - 2017: daily (Luc Moreau)
- Measurement interval 2017 – 2019: hourly

➢ Manual inspection to analyse evolution of calving front during the years

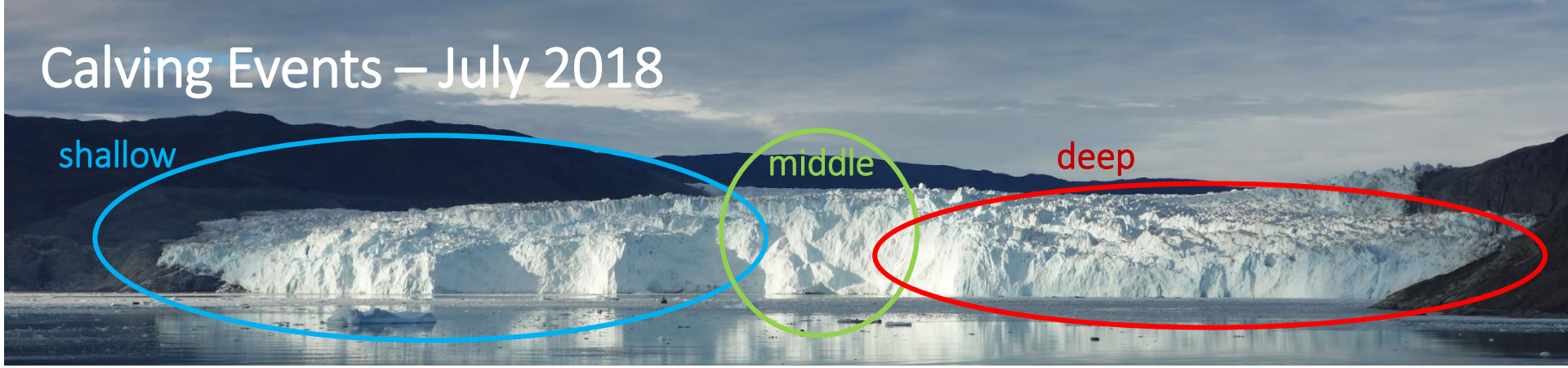
Calving Events – August 2016

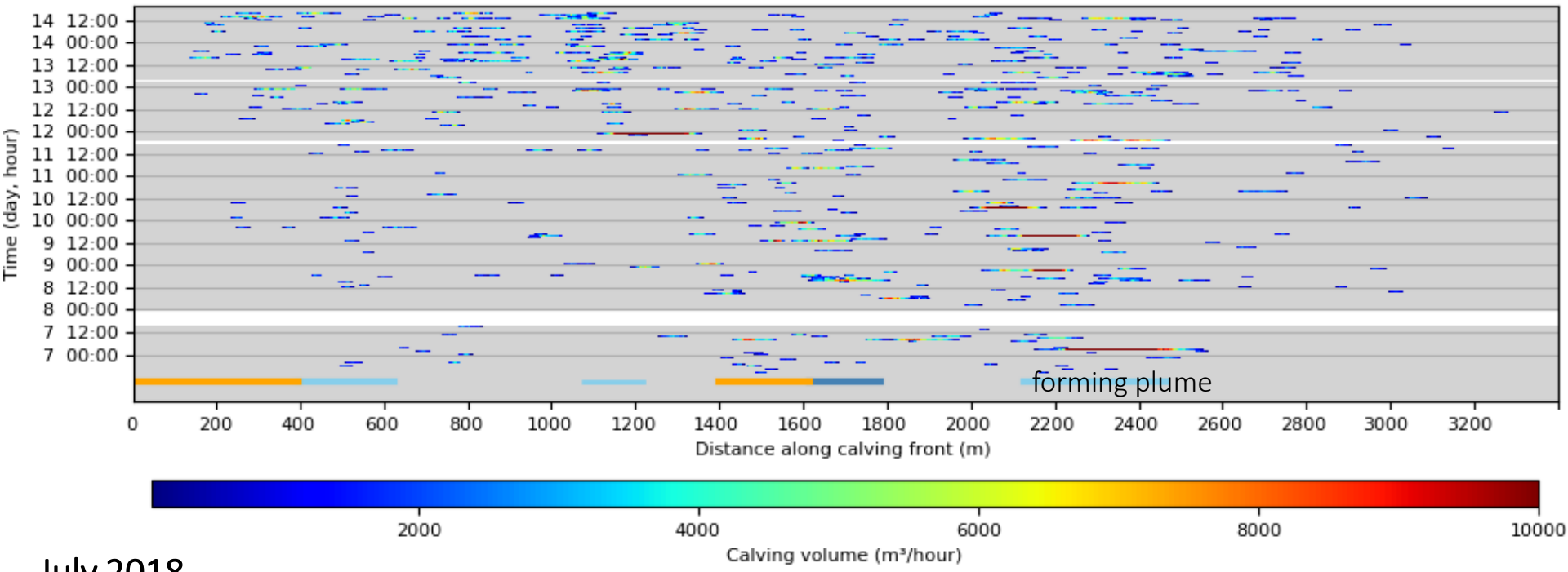


August 2016

- Many calving events during the whole observation period
- Calving rates and volumes differ substantially for the shallow, the middle and the deep sector
- Middle shows less but larger calving events

Calving Events – July 2018





July 2018

- Reduced calving activity in the beginning, increasing with time
- Large events in the deep sector

Calving Events – 2014 - 2019

27 June – 2 July 2014
- Many calving events during the whole observation period
- Calving rates and volumes differ substantially for the shallow, the middle and the deep sector
- Middle shows less but larger calving events

19 June – 5 July 2015
- Reduced calving activity in the beginning, increasing with time
- Large events in deep sector and shallow sector

19 August – 27 August 2016
- See 2014

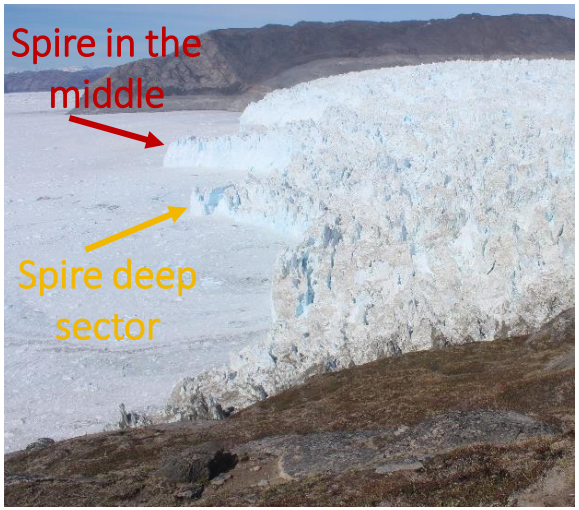
16 June – 25 June 2017
- Medium calving activity
- Middle shows a lot and large calving events
- In the deep sector many events at one location

6 July – 14 July 2018
- Reduced calving activity in the beginning, increasing with time
- Large events in the deep sector

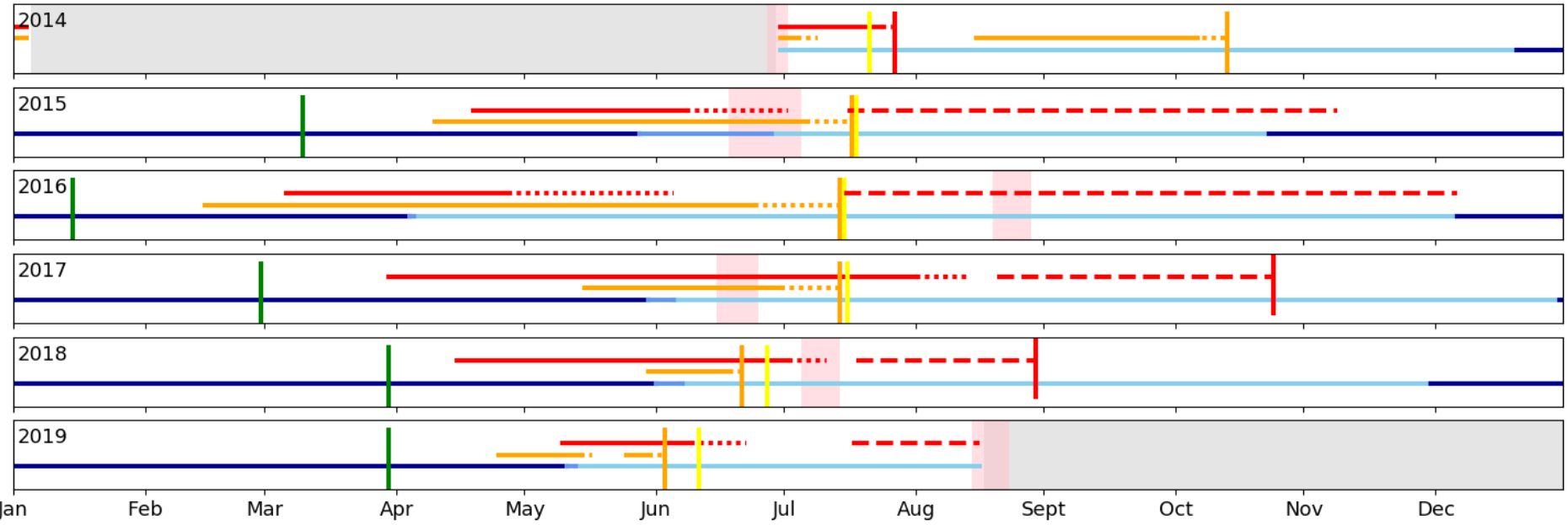
15 August – 24 August 2019
- See 2014
- Middle no large events

Years with high calving activity
Years with reduced calving activity
Years with medium calving activity
Characteristic features only appearing in this year

Evolution of calving front 2014 - 2019



Very thin or no mélange
Dense mélange
Thinning of mélange
Advanced front
Spire in the middle in evidence
Spire in the middle retreats
Spire in the middle less high
Spire in the middle disappears
Spire in deep sector in evidence
Spire in deep sector retreats
Spire in deep sector disappears
Outcrop in deep sector builts up
data gap
GPRI observation



Discussion

- **Reduced** (2015 & 2018) or **medium** (2017) calving activity are observed if **mélange** retreated shortly before or during the field campaign
- **Large events in deep sector** occur when the **spire in the middle** retreats and at the same time a **subglacial plume** forms (2015 & 2018)
- **Large events in shallow sector** occur when a **subglacial plume** forms (2015 & 2018, 2017 the plume occurs shortly after the field campaign)
- **Many events at one location in deep sector** occur when the **spire in the middle** is still high but not yet retreating (2017)
- Reduced calving activity in deep sector due to **subaquatic calving** and **ocean melt**
- **Less but big events in middle** due to positioning of the front on a **rock ridge** (2014 & 2016), in other years the front is still more advanced

- **Calving activity and pattern seem to be controlled by the front position and the formation of subglacial plumes**

References:
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Thank you for looking at our display!

Acknowledgment:
We thank Luc Moreau for providing us the time-lapse images from 2014 – 2017. Also we thank Diego Wasser for setting up the time-lapse camera from 2017 onwards.

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