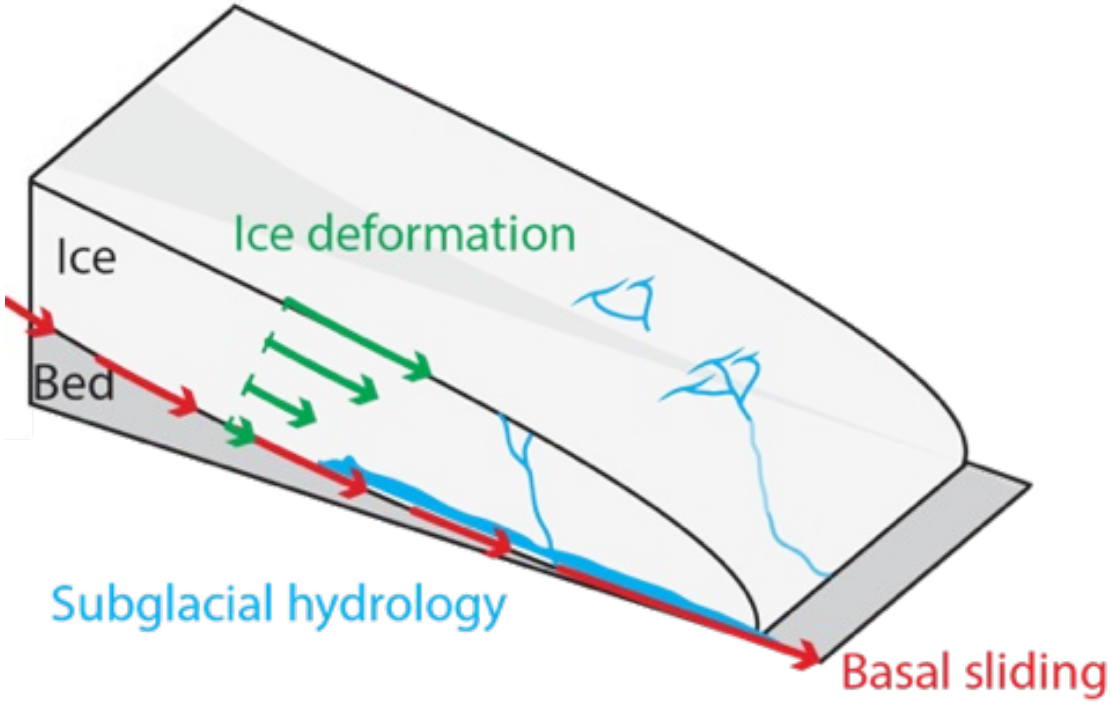
Cycle meeting – May 12, 2022

Rain-induced surface velocity variations of alpine glaciers monitored with a continuous GPS network

Anuar Togaibekov, Andrea Walpersdorf, Florent Gimbert

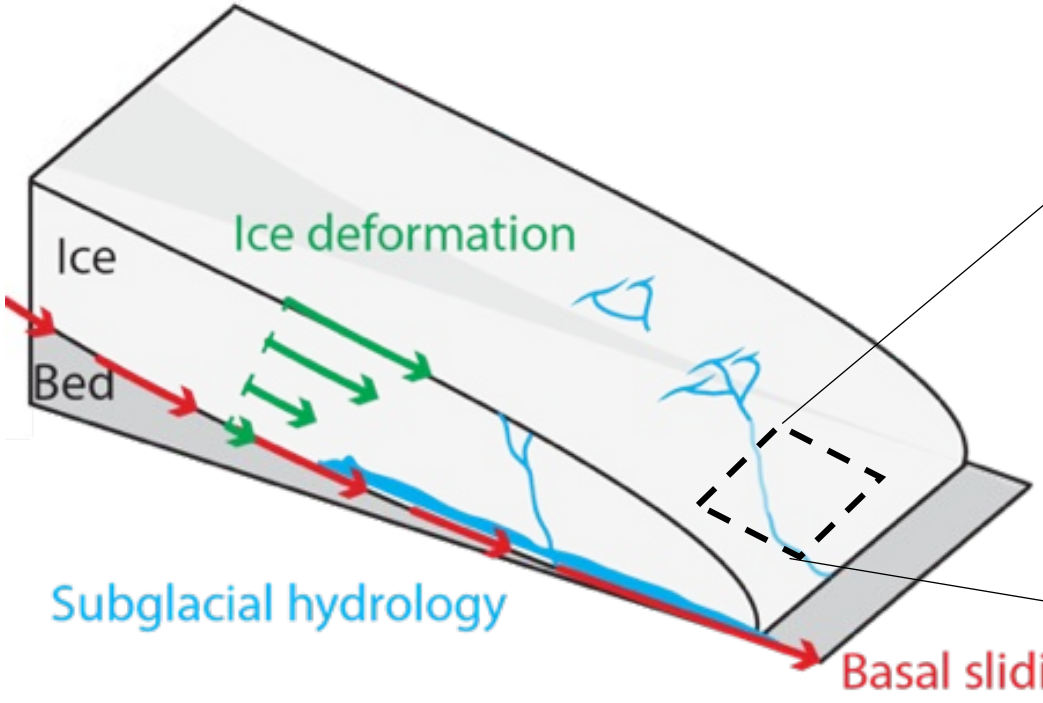
Grenoble, FRANCE

Glacier flow



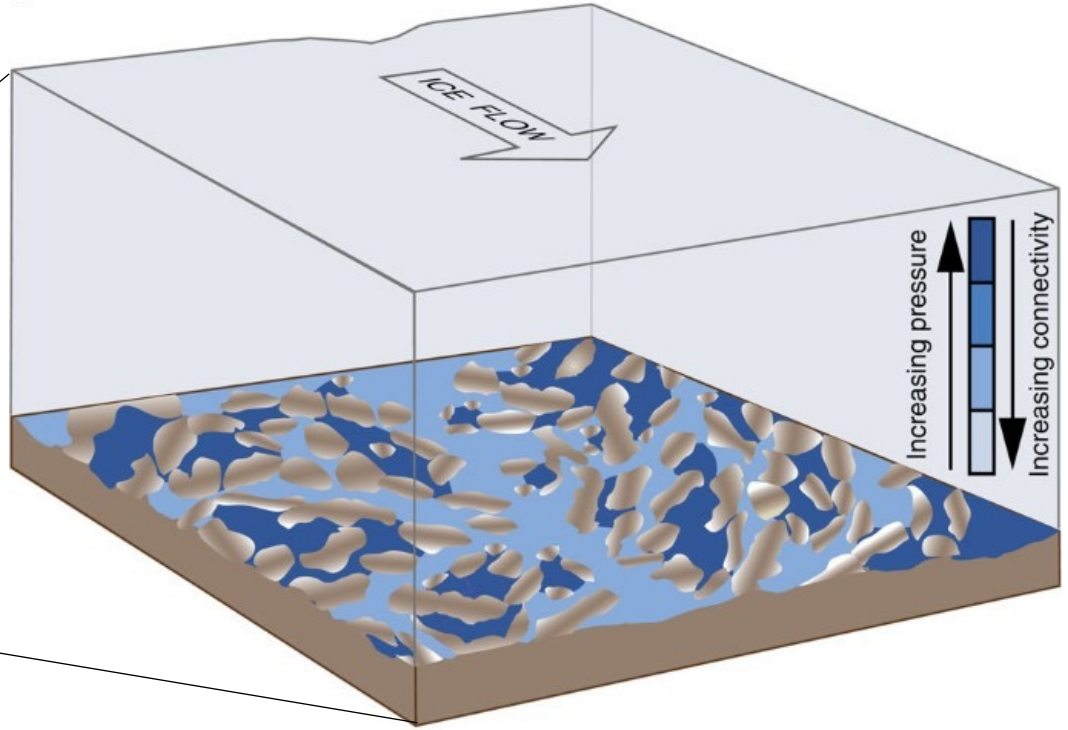
Nanni et al., 2020

Glacier flow



Nanni et al., 2020

Conceptual model of subglacial hydrologic system

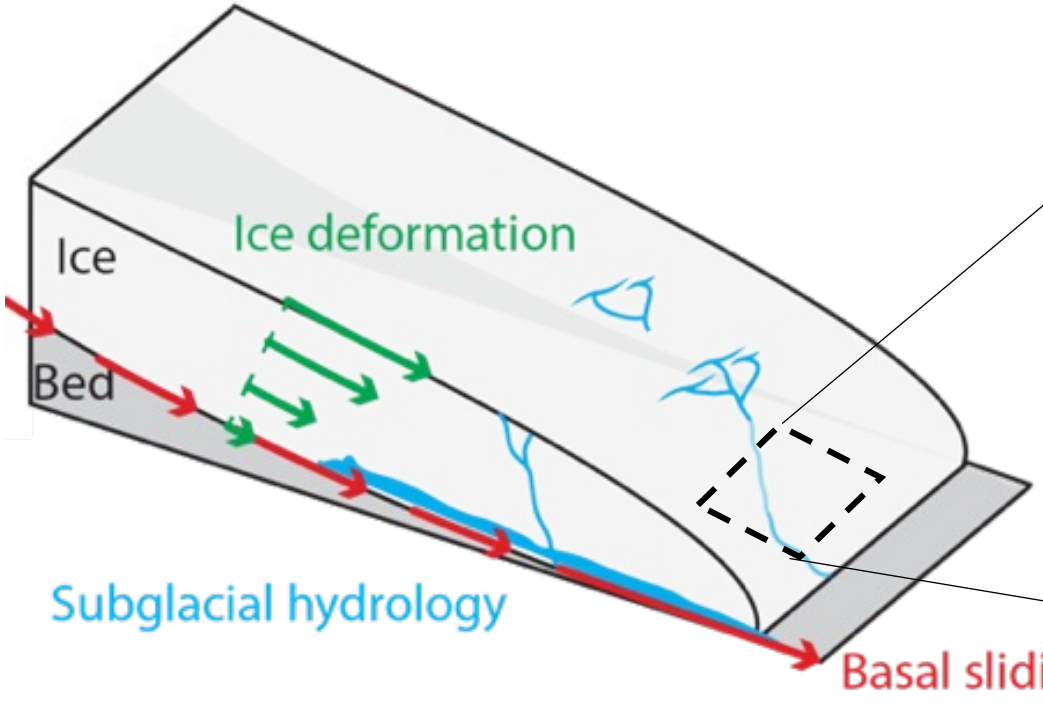


Hoffman et al., 2017

Transient rain water input effect

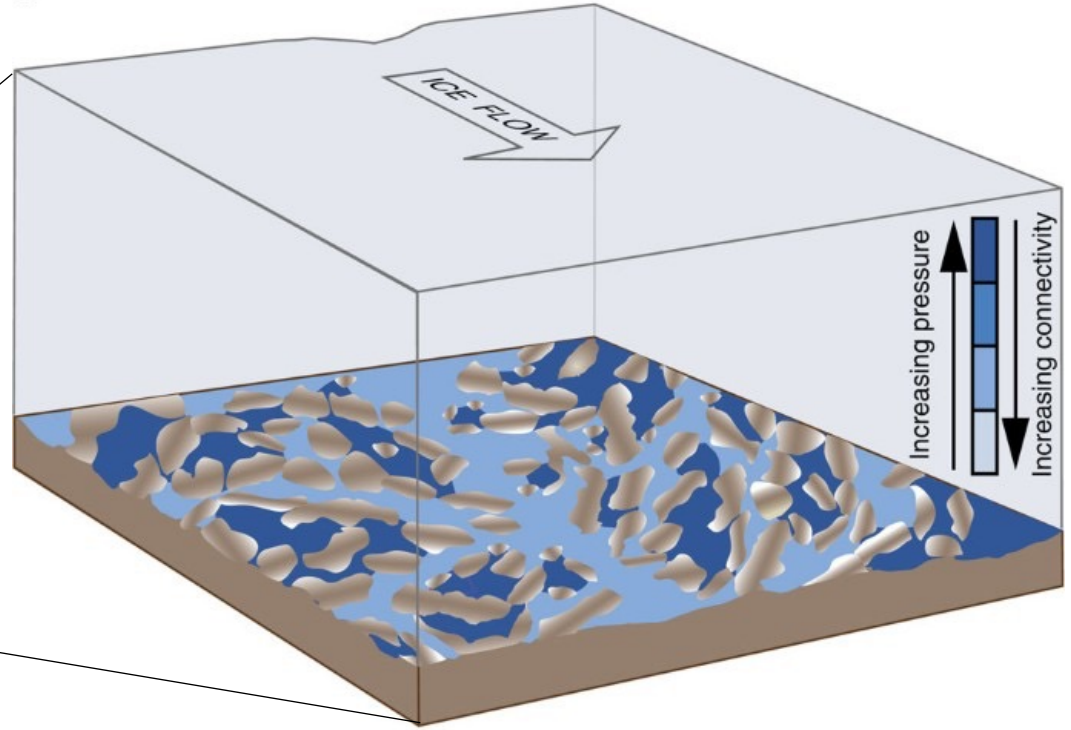
- How does water behave in the subglacial drainage system?
- Effect on changes in horizontal velocity?
- Effect on changes in vertical displacement?

Glacier flow



Nanni et al., 2020

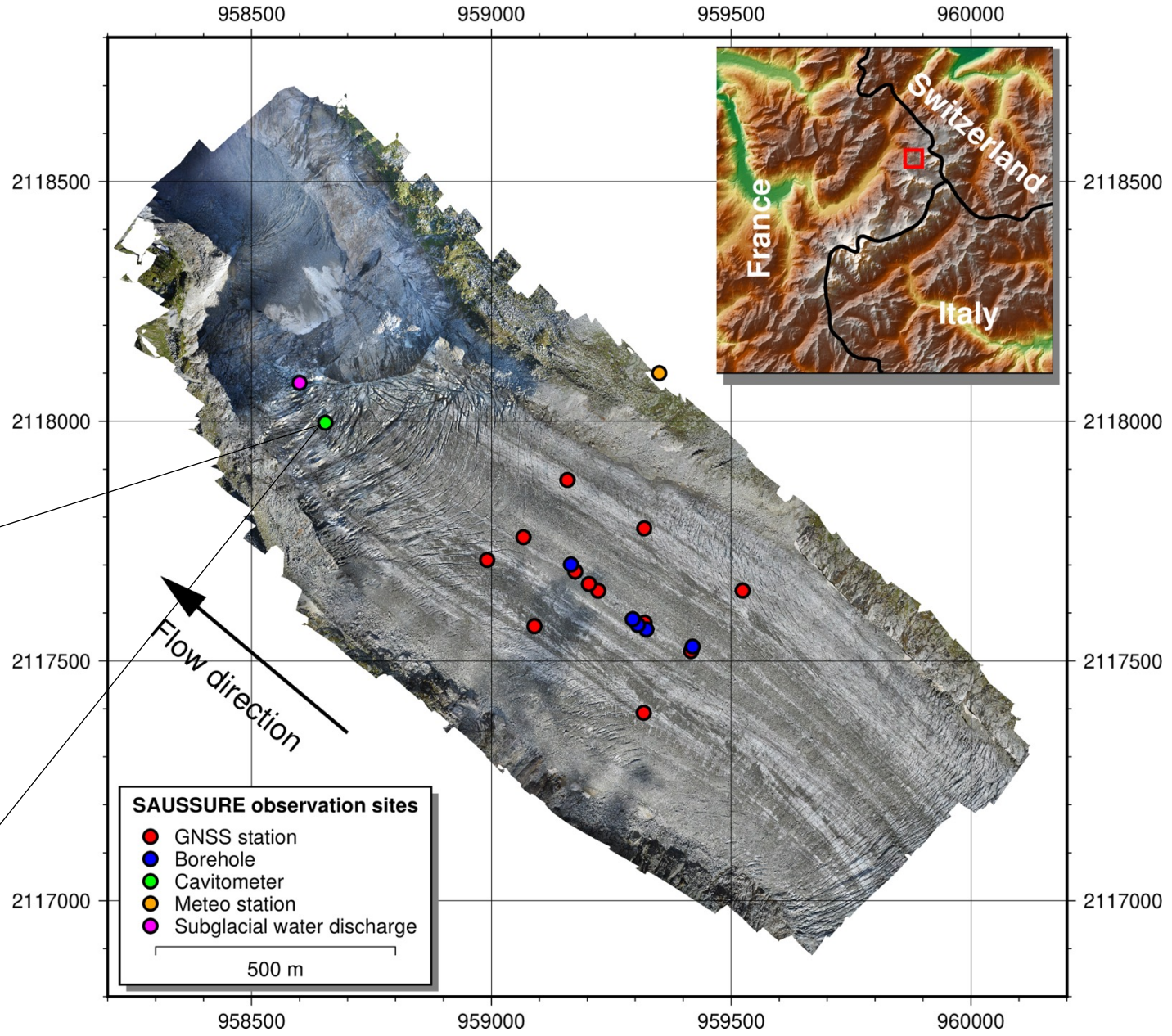
Conceptual model of subglacial hydrologic system



Hoffman et al., 2017

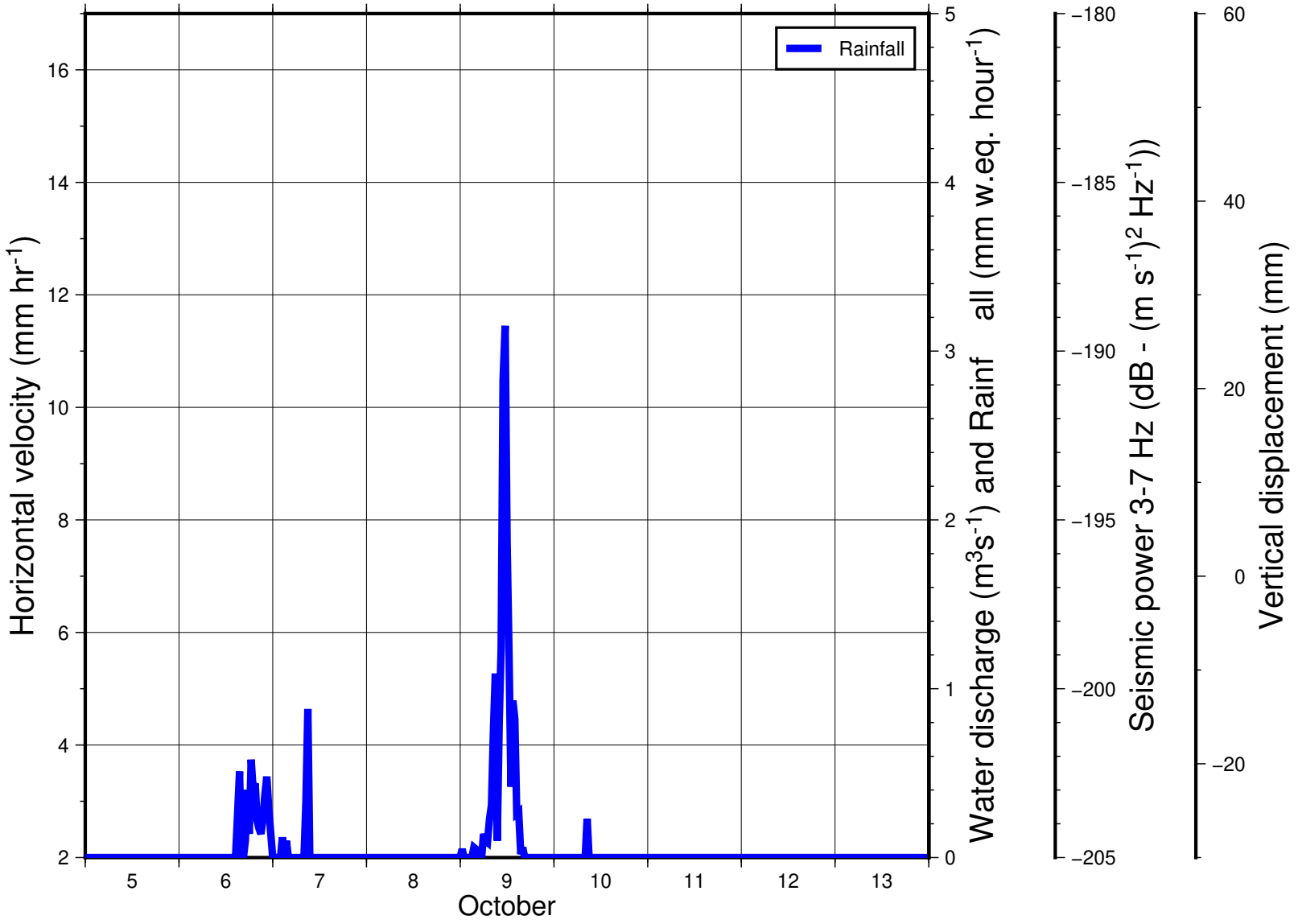
Photo credit: Andrea Walpersdorf

Photo credit: Luc Moreau



Temporal relationship between:

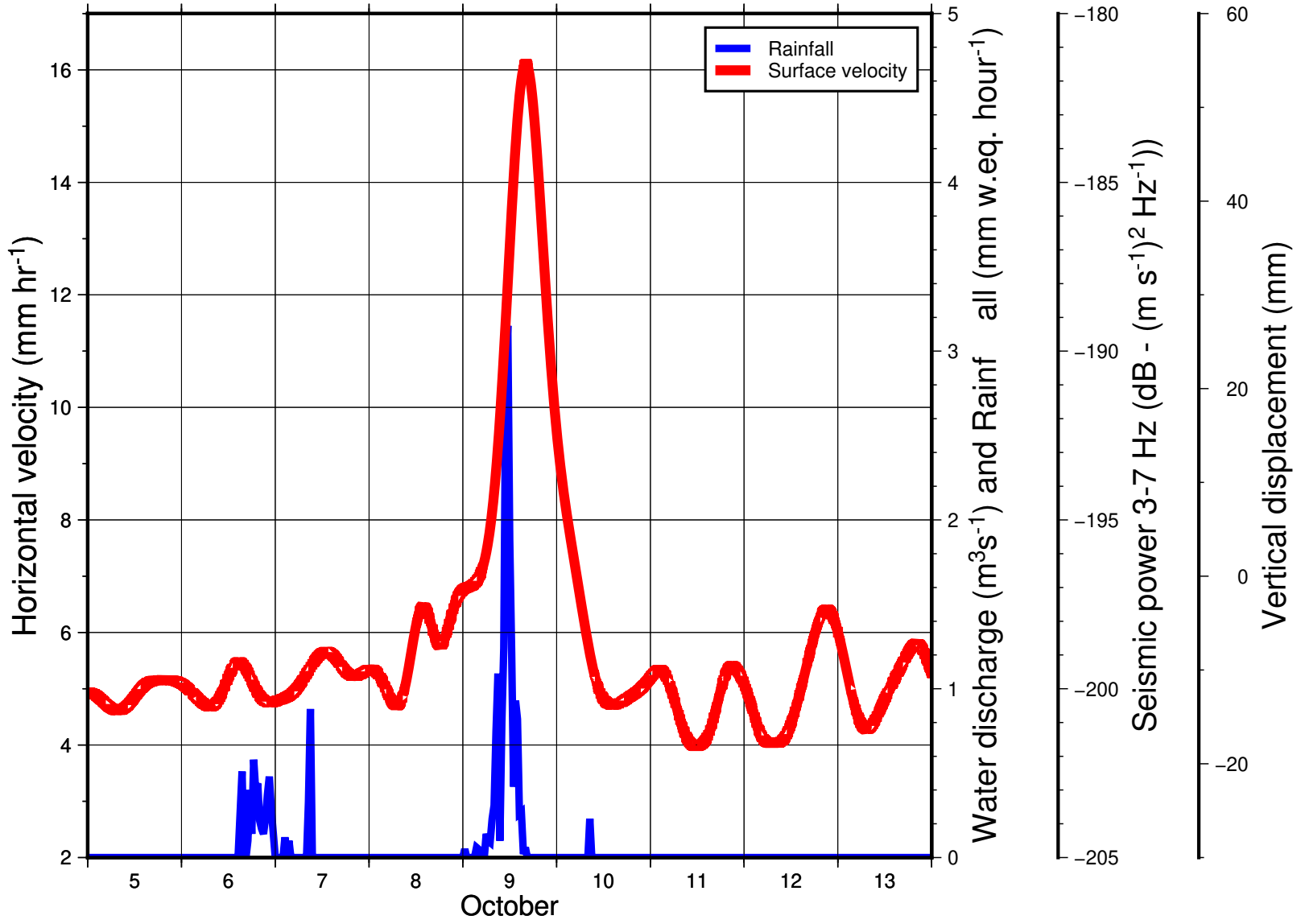
Rainfall



Temporal relationship between:

Rainfall

Surface velocity

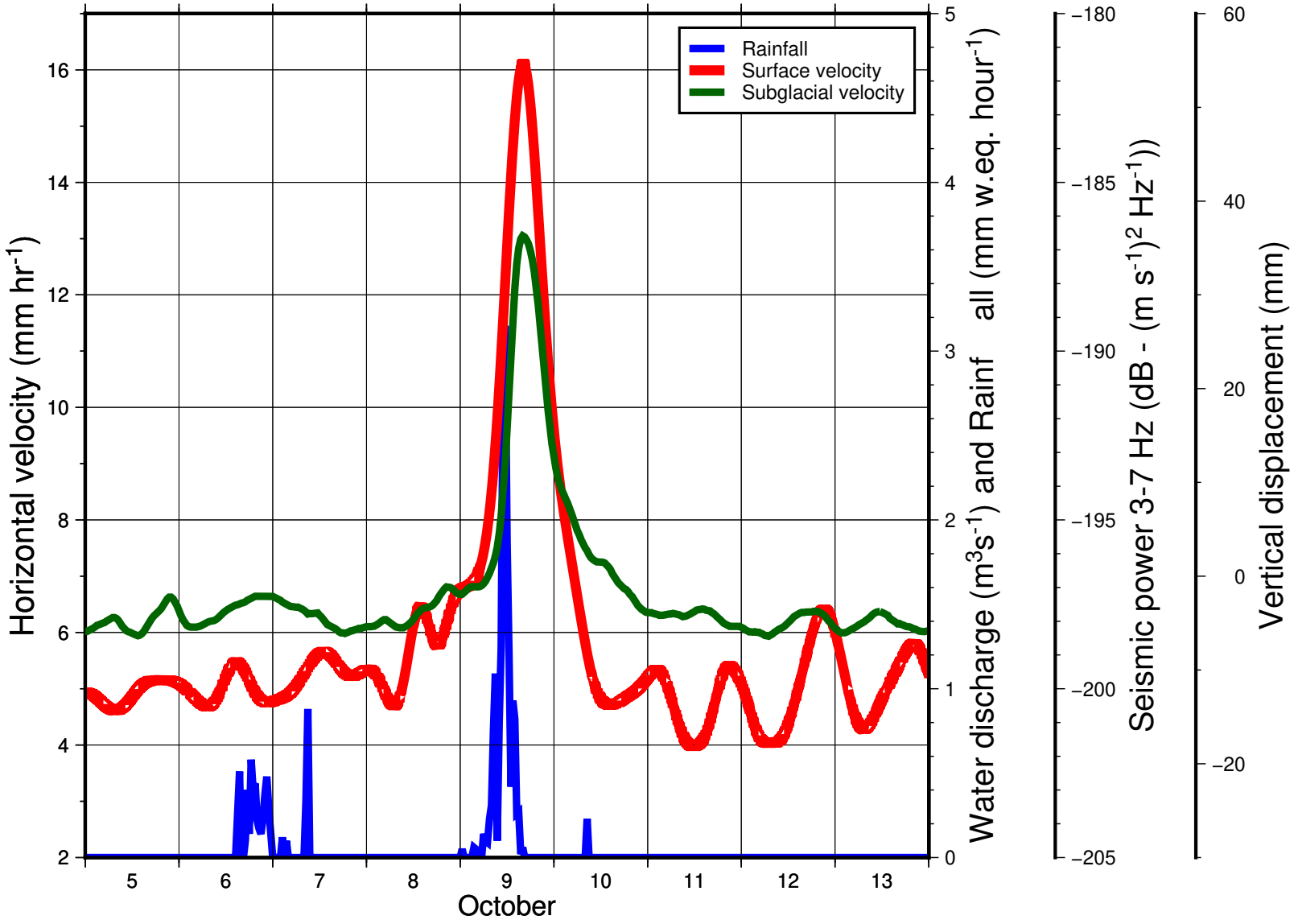


Temporal relationship between:

Rainfall

Surface velocity

Subglacial velocity



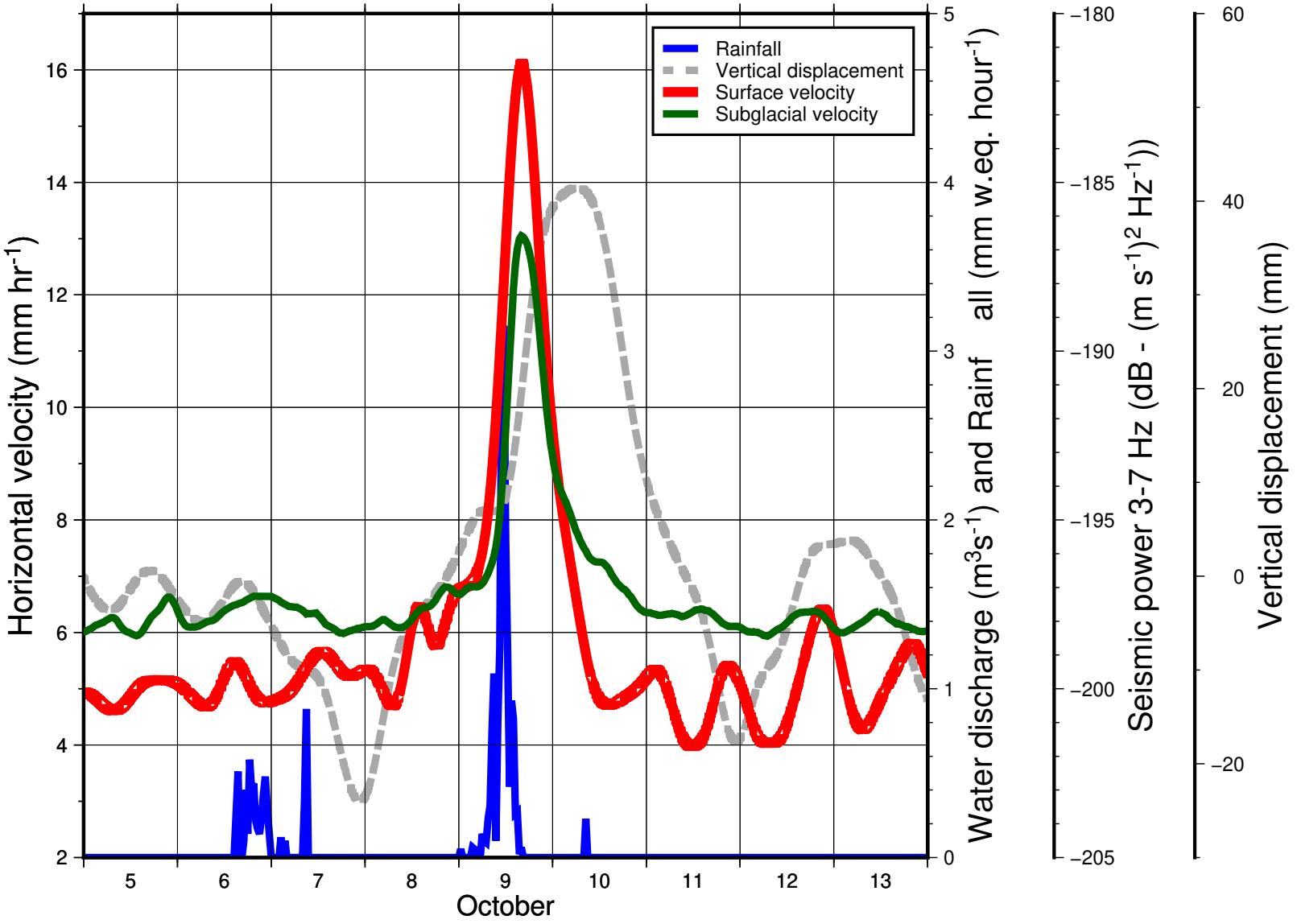
Temporal relationship between:

Rainfall

Surface velocity

Subglacial velocity

Vertical uplift



Temporal relationship between:

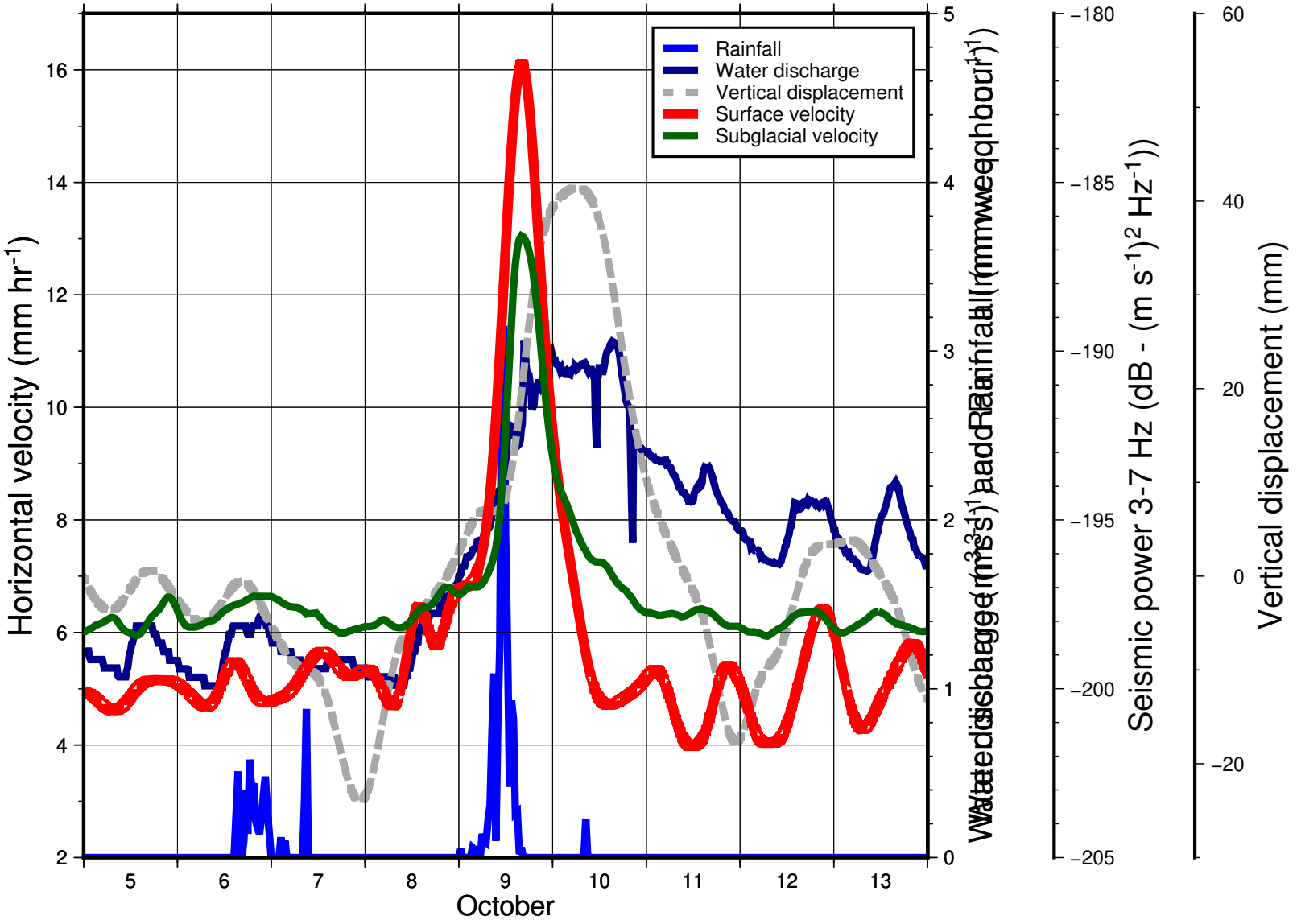
Rainfall

Surface velocity

Subglacial velocity

Vertical uplift

Water discharge



Temporal relationship between:

Rainfall

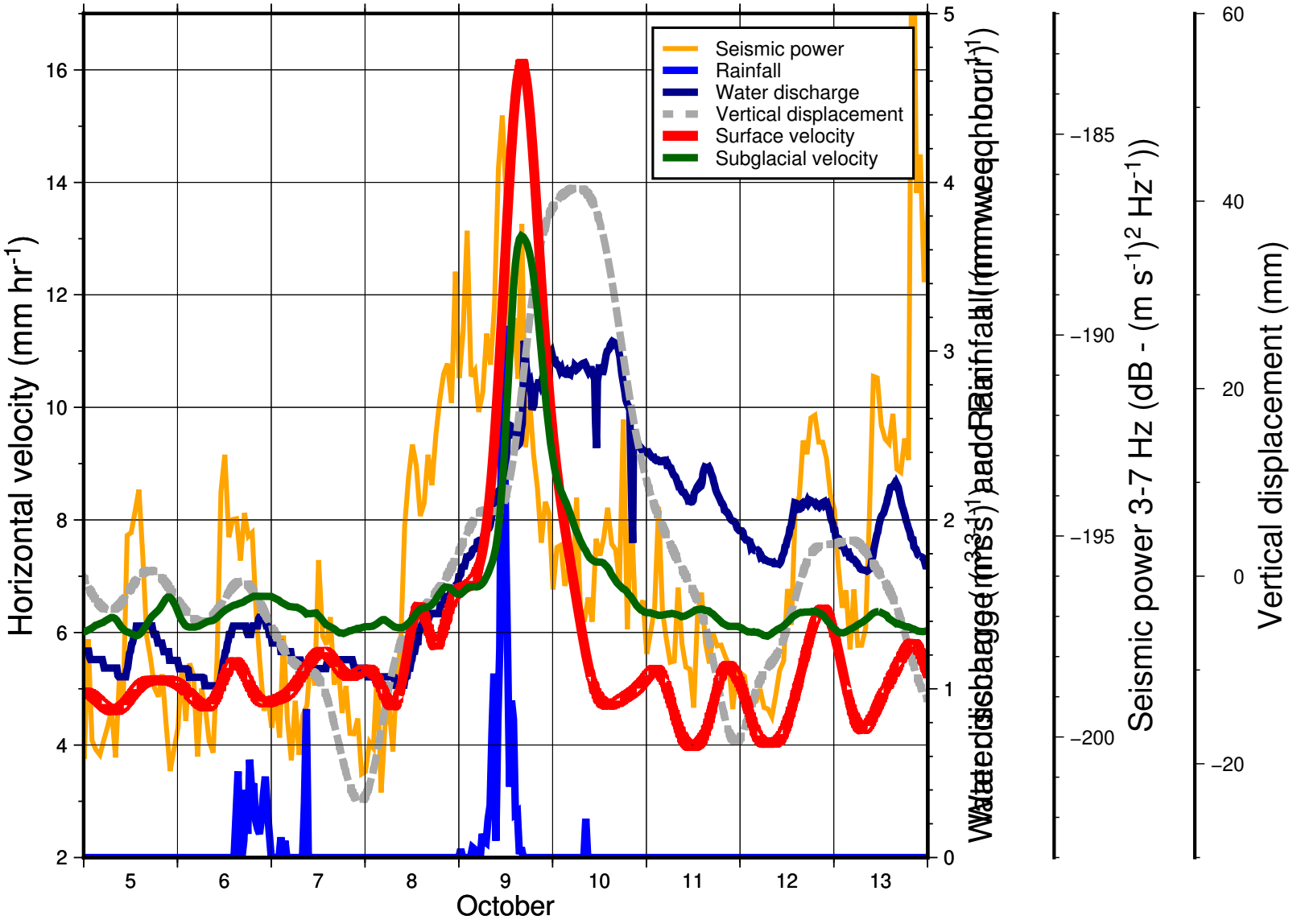
Surface velocity

Subglacial velocity

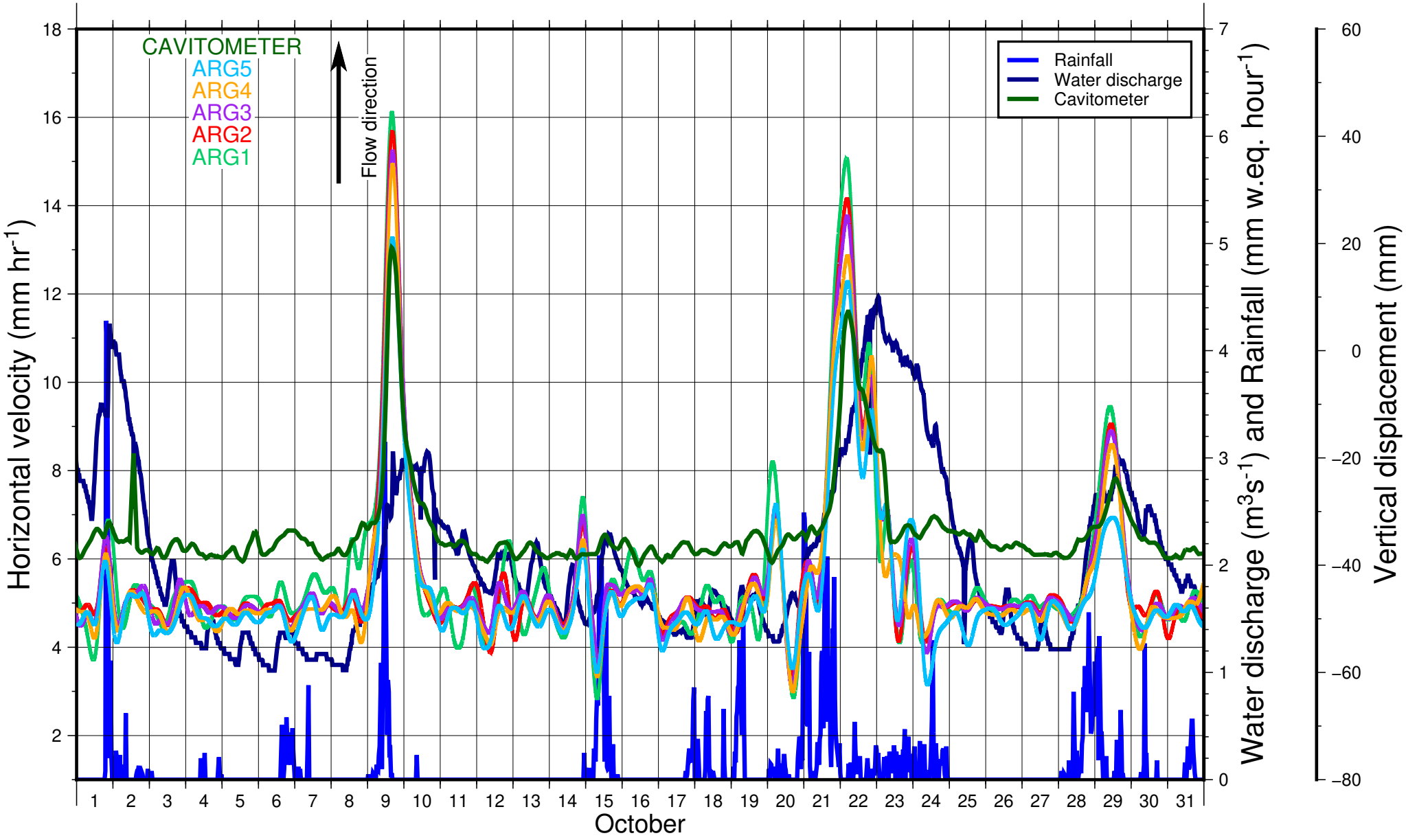
Vertical uplift

Water discharge

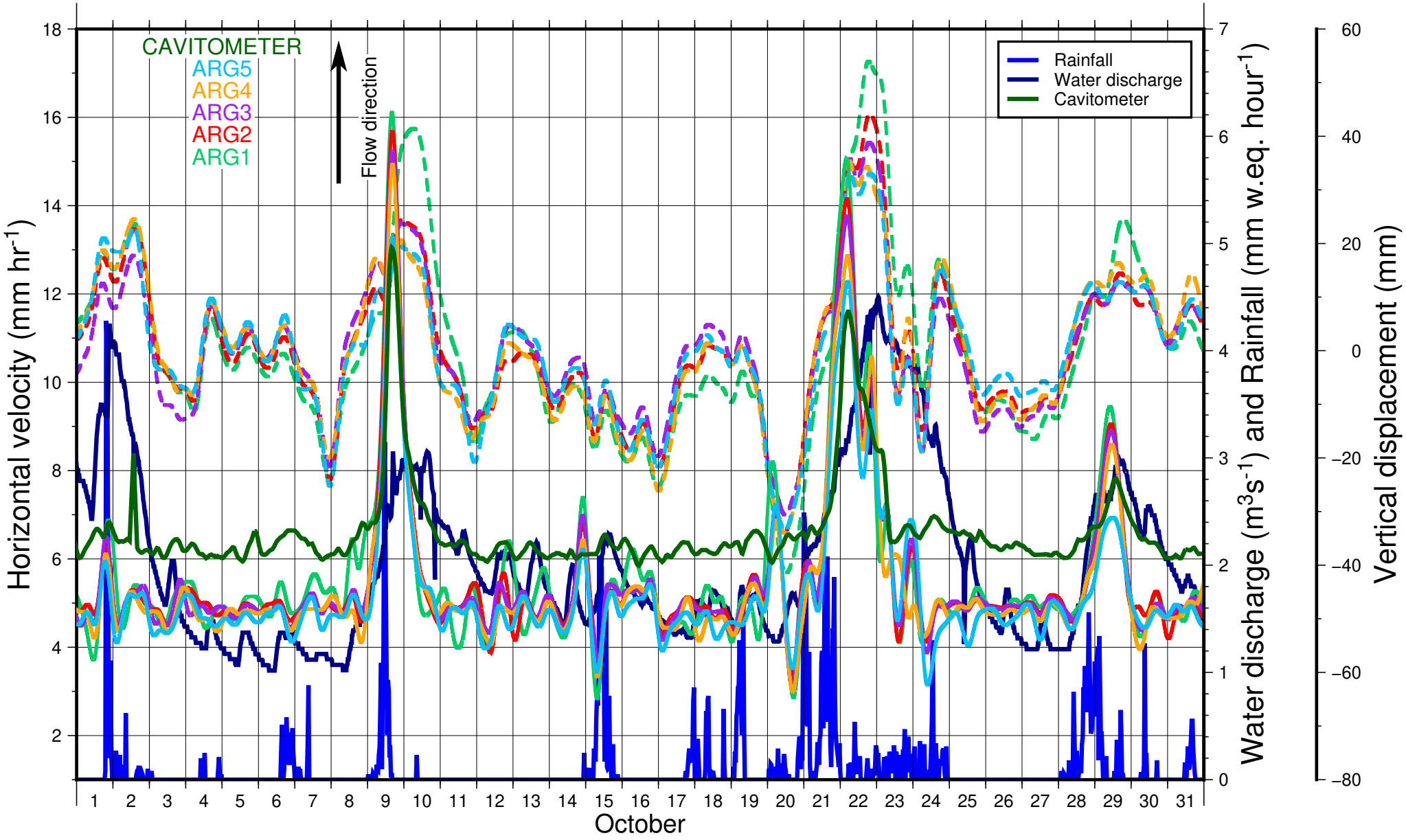
Seismic power



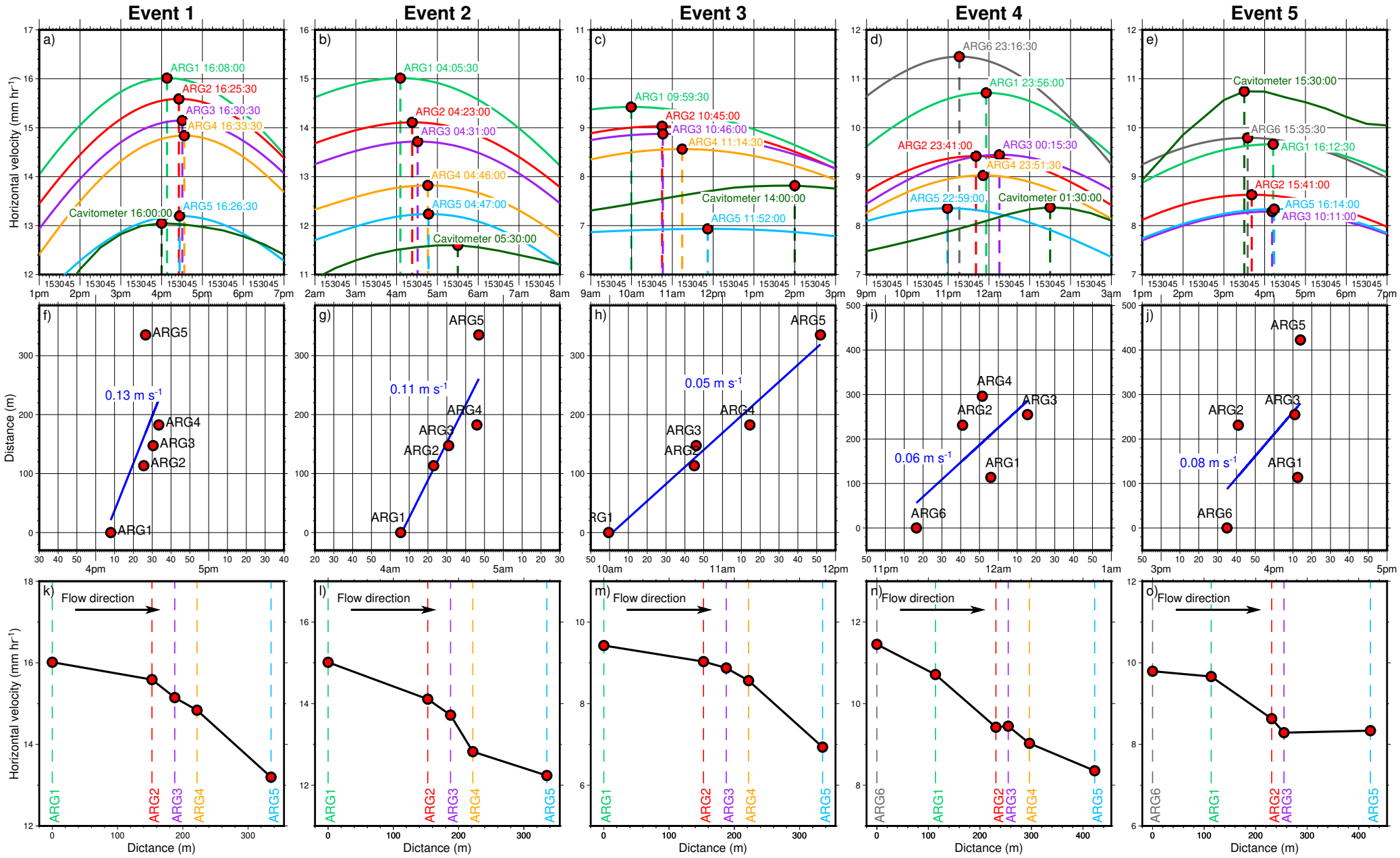
Speed-up events in October 2019



Speed-up events in October 2019

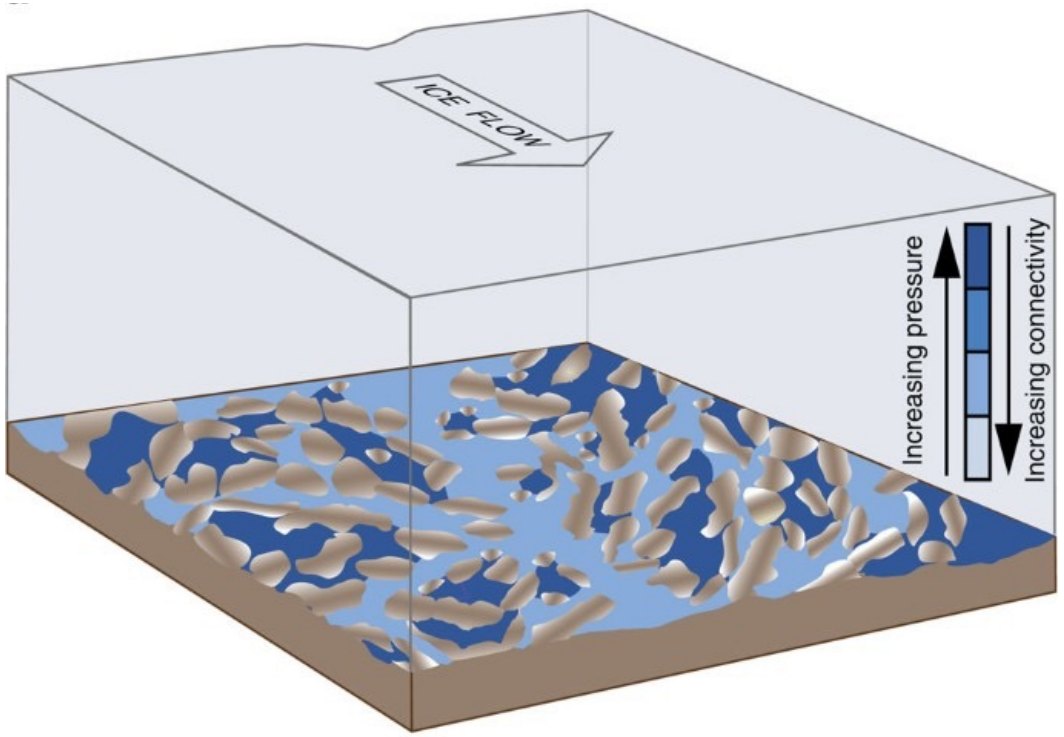


Velocity pulse propagation



SUMMARY

- The same mechanism does not entirely control horizontal acceleration and uplift
- Conditions for horizontal acceleration:
  - Rate of water flux rather than volume
  - Efficiency (connectivity) of subglacial drainage system
- Uplift is modulated by the water input in the system which is associated with cavity expansion
- Pulse propagation velocity ranges between 00.5 and 0.13 m s^{-1} suggesting that the subglacial hydrologic system is distributed and inefficient



Q&A