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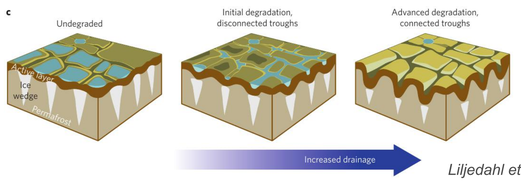
Confining the evolution of ice wedges in a warming climate

Check out our new article in *The Cryosphere* !

Introduction

- **Ice-wedge degradation** is increasingly reported throughout the **Arctic permafrost region** and affects **water, energy,** and **carbon** fluxes

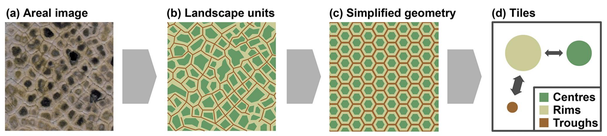


Liljedahl et al. (2016)

- We **projected** the future evolution of ice wedges.

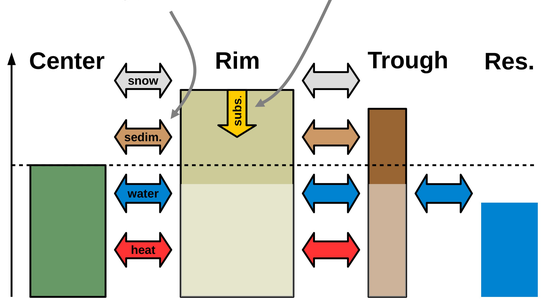
Methods

***Laterally coupled tiles**, representing landscape units of polygonal tundra*



***lateral sediment transport** as stabilizing process*

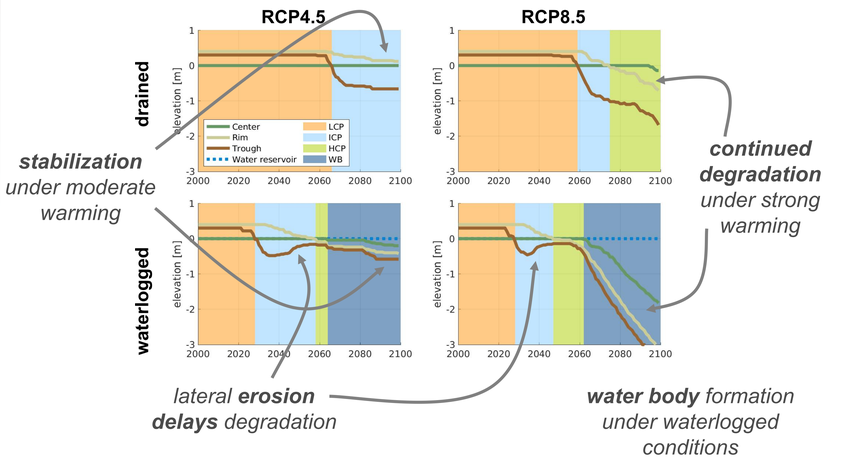
ground subsidence** due to **excess ice melt



- Simulations for **different hydrologic conditions** and **warming scenarios**

Results

Evolution of surface topography



***stabilization** under moderate warming*

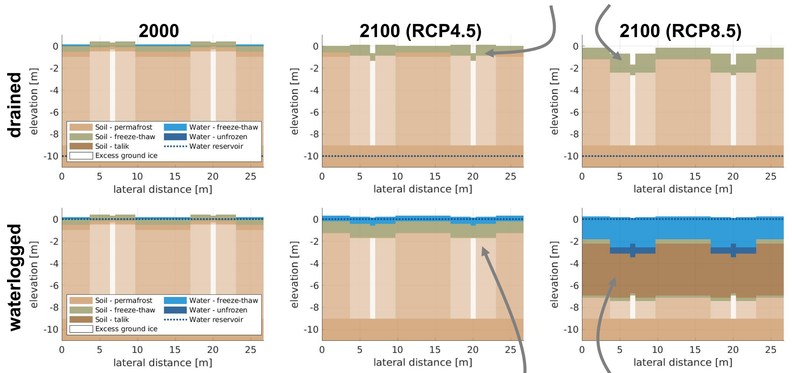
***continued degradation** under strong warming*

*lateral **erosion** **delays** degradation*

***water body** formation under waterlogged conditions*

Subsurface states

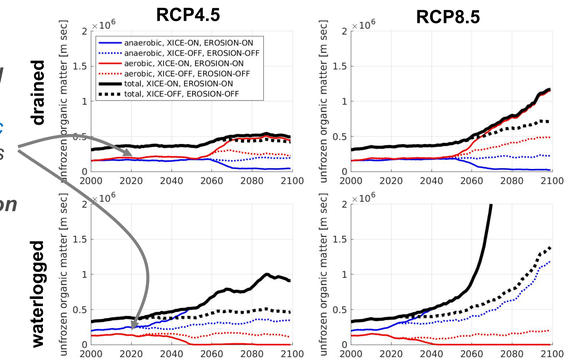
***high-centered polygons** with dry centers*



***burial of wedge ice** under flat topography*

***talik formation** underneath water body*

Thawing of organic matter



balanced** aerobic / anaerobic conditions **prior to degradation

hydrology controls** aerobic / anaerobic conditions **after degradation

***warming climate increases** total thawed organic matter by end of century (·····)*

***abrupt thawing increases** total thawed organic matter compared to gradual only (——)*

Conclusions

- **Ice wedges melt** due to Arctic warming, but **stabilize** under **moderate warming**.
- **Abrupt thaw** processes significantly **increase** the yearly amount of **thawed organic matter**.
- Small-scale processes in ice-rich permafrost require improved representation in large-scale models.

References

Liljedahl, A. K. et al. (2016). Pan-Arctic ice-wedge degradation in warming permafrost and its influence on tundra hydrology. *Nature Geoscience*, 9(4), 312–318.

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