

# A ~4000 year record of hydrologic variability from the Olympic Mountains, Washington

*Pacific Ocean*

Lake Quinault

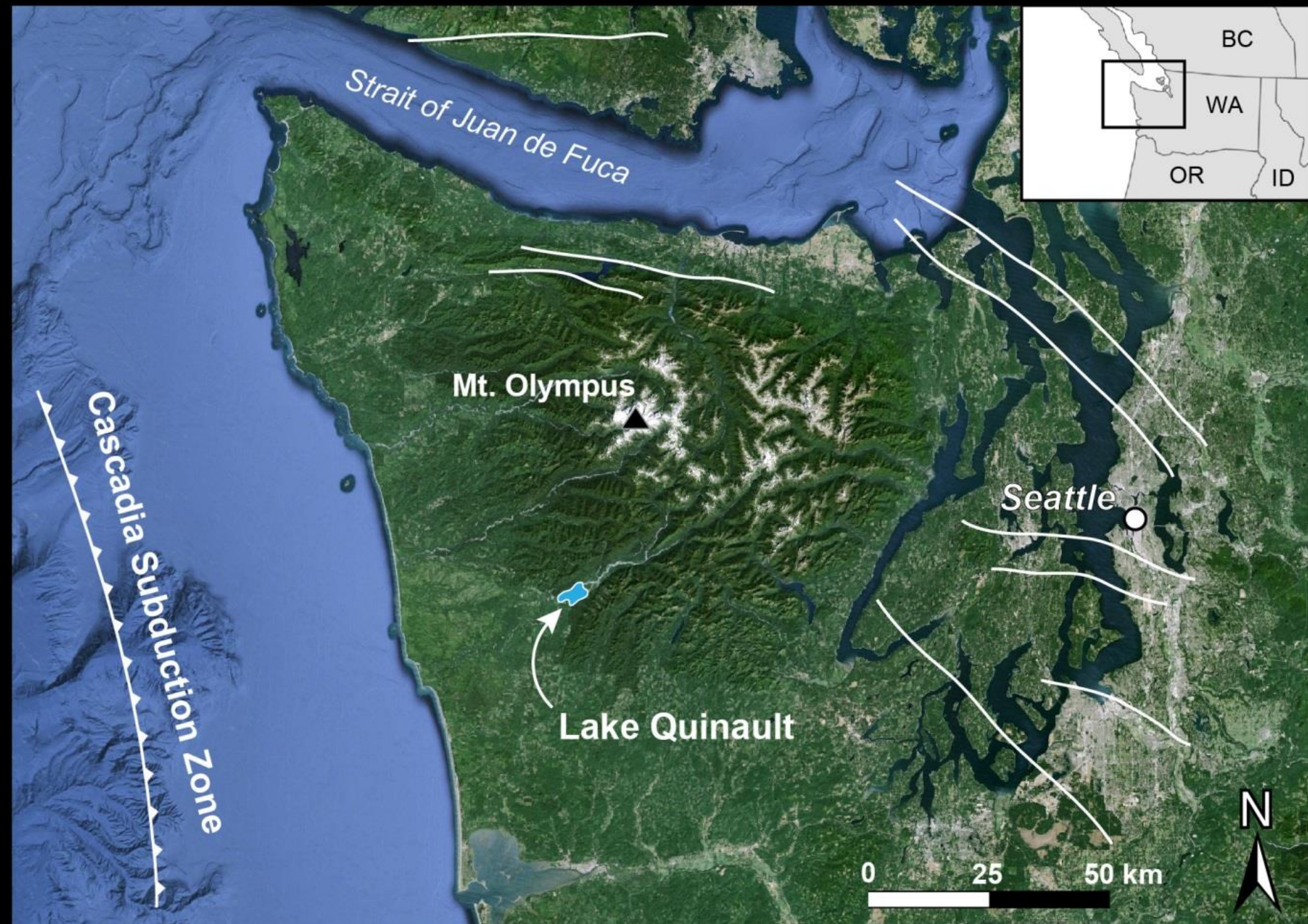
↑  
**SW**



Stephen G. Smith  
GSA Denver  
28 Sept. 2016

*Photo: Sam Beebe, Ecotrust*

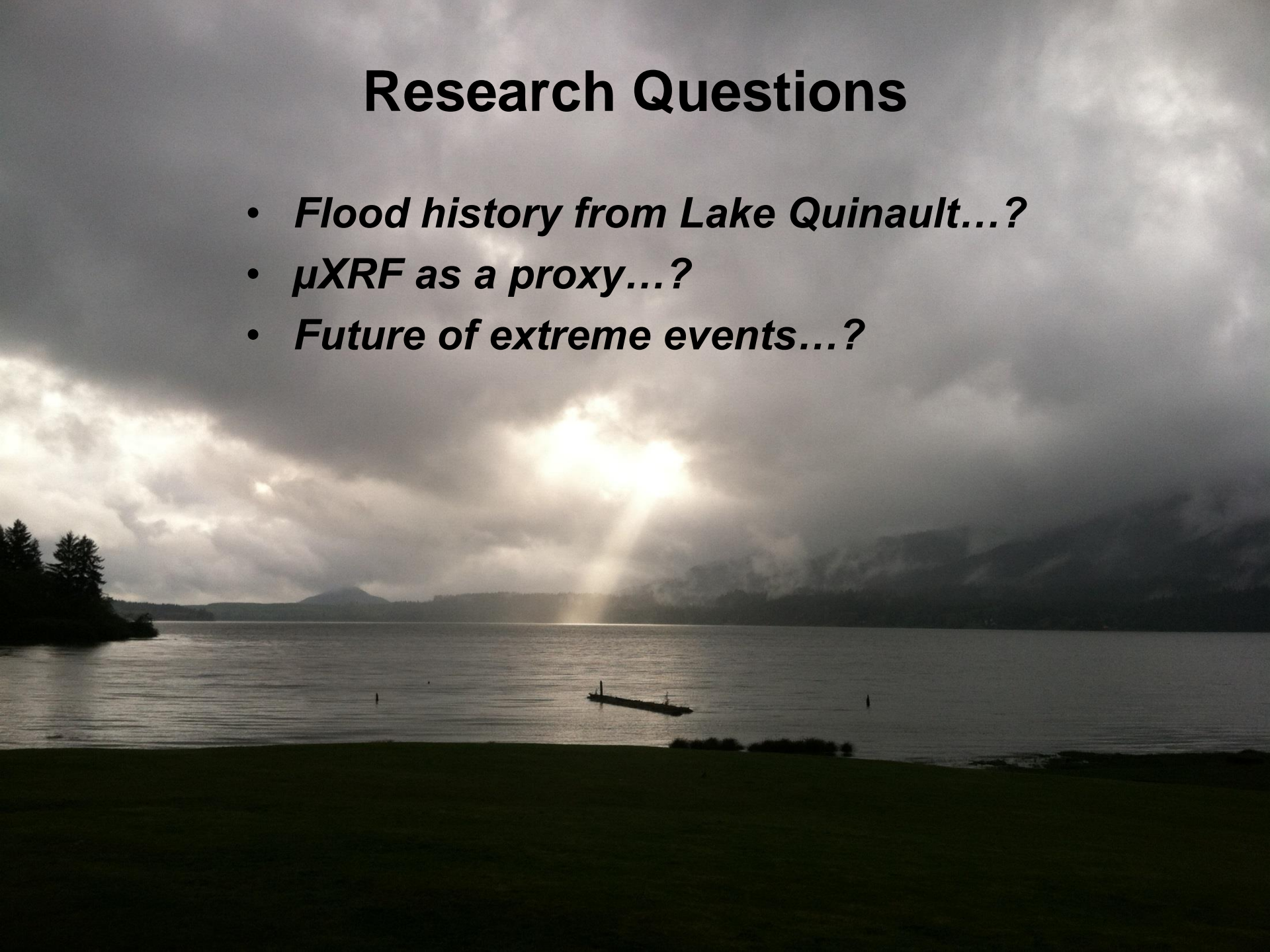




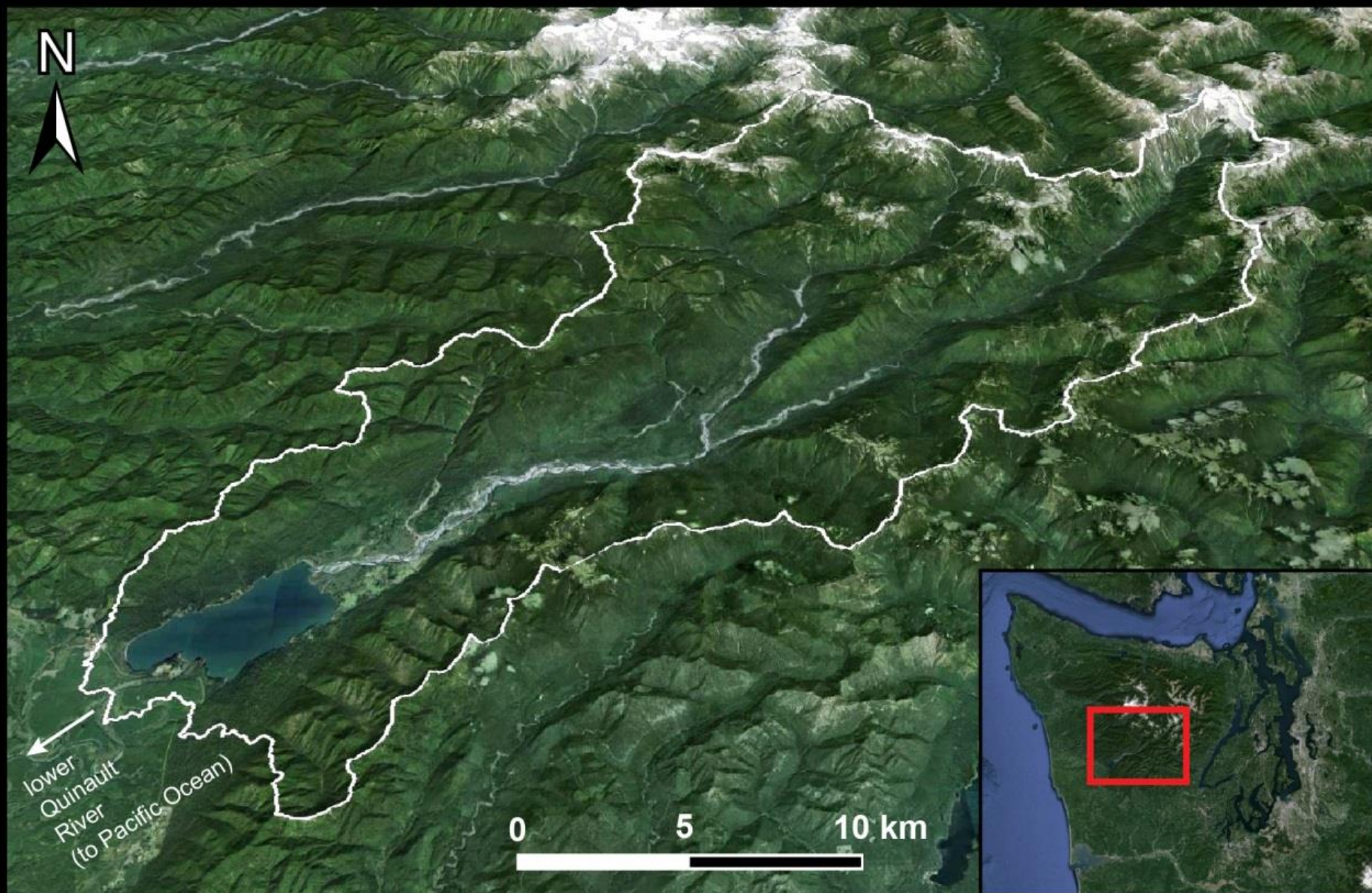


# Research Questions

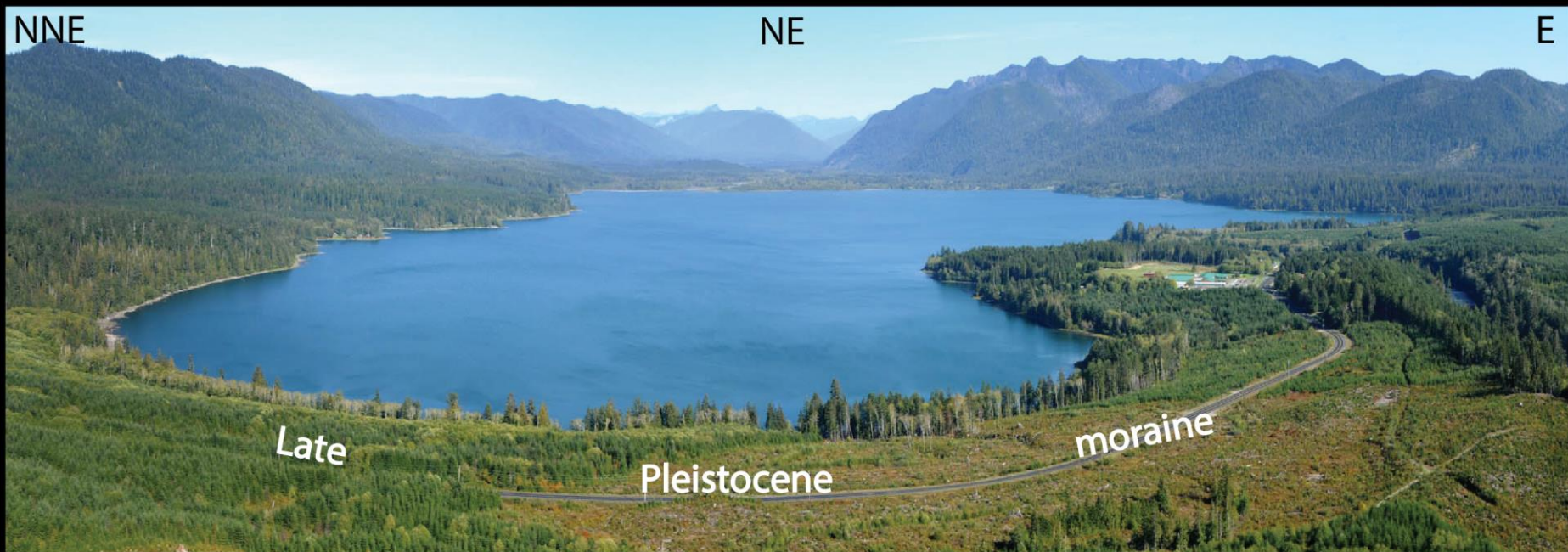
- *Flood history from Lake Quinault...?*
- *$\mu$ XRF as a proxy...?*
- *Future of extreme events...?*











*Photo: Larry Workman, Quinault Indian Nation*



NE

Quinault River delta



*High lake turbidity following a large storm*



*Photo: Larry Workman, Quinault Indian Nation*

*January, 2009*

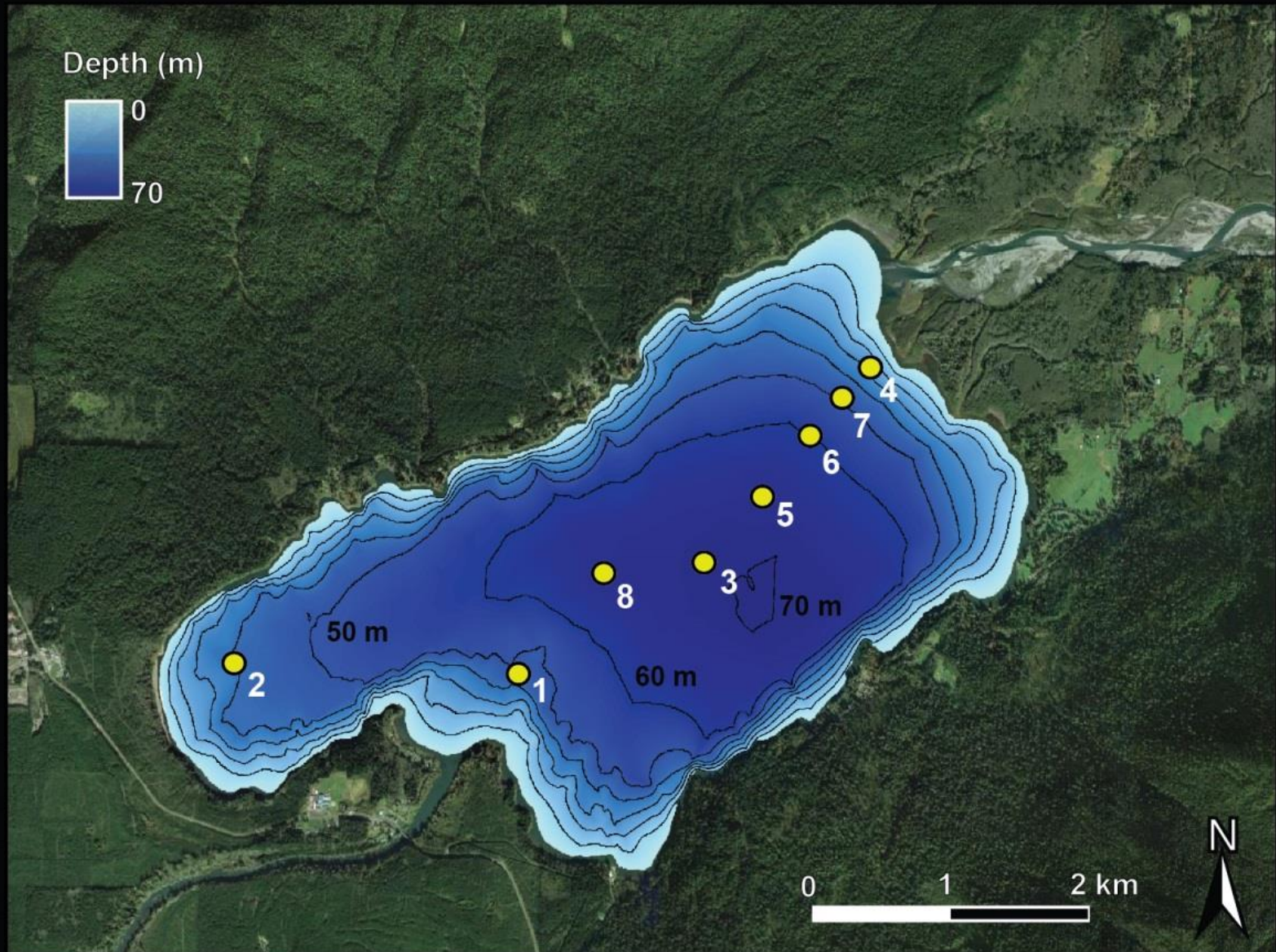
***Big floods = Big impacts. How common are these events?***

# Methods



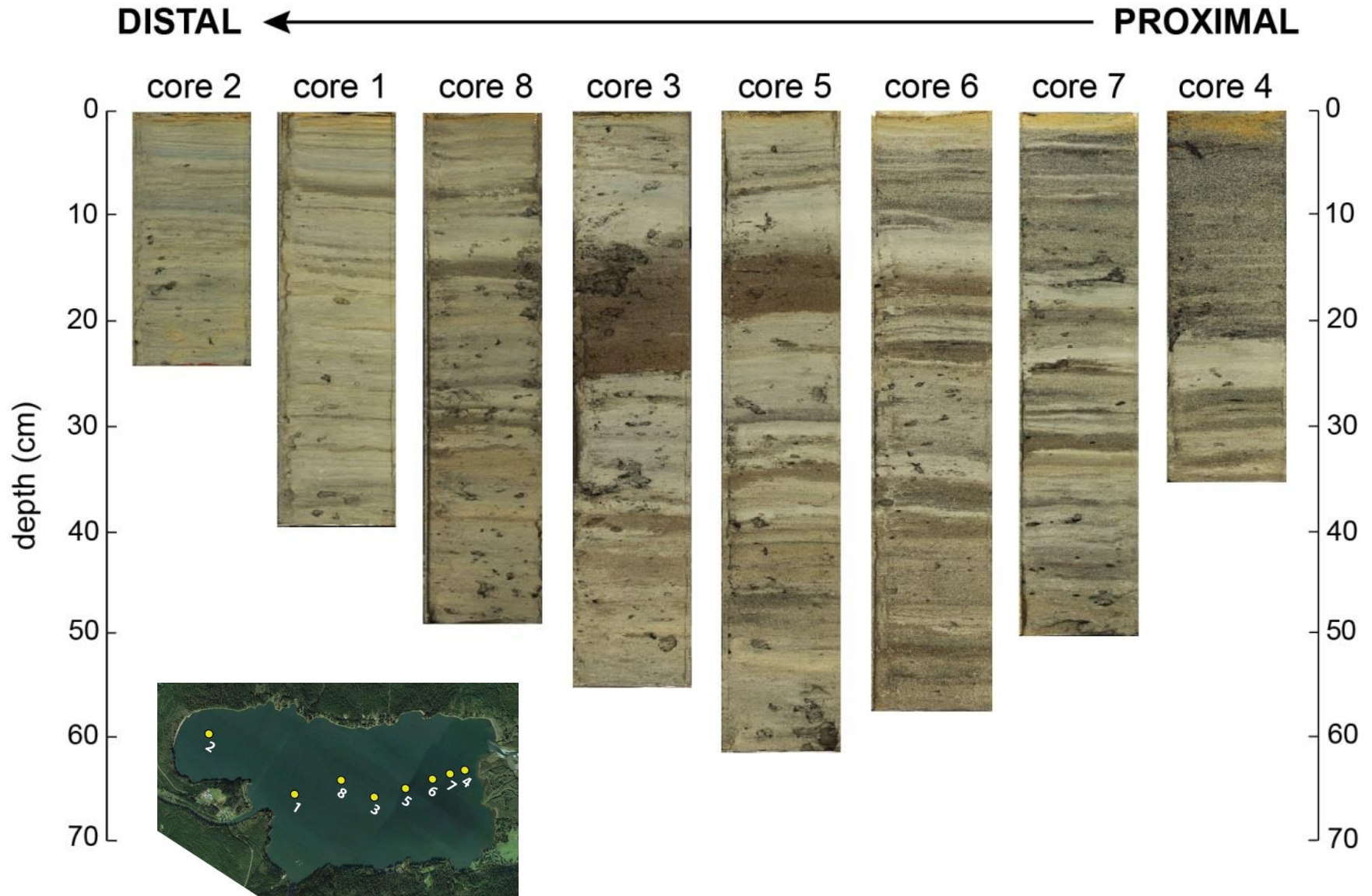


# Core locations



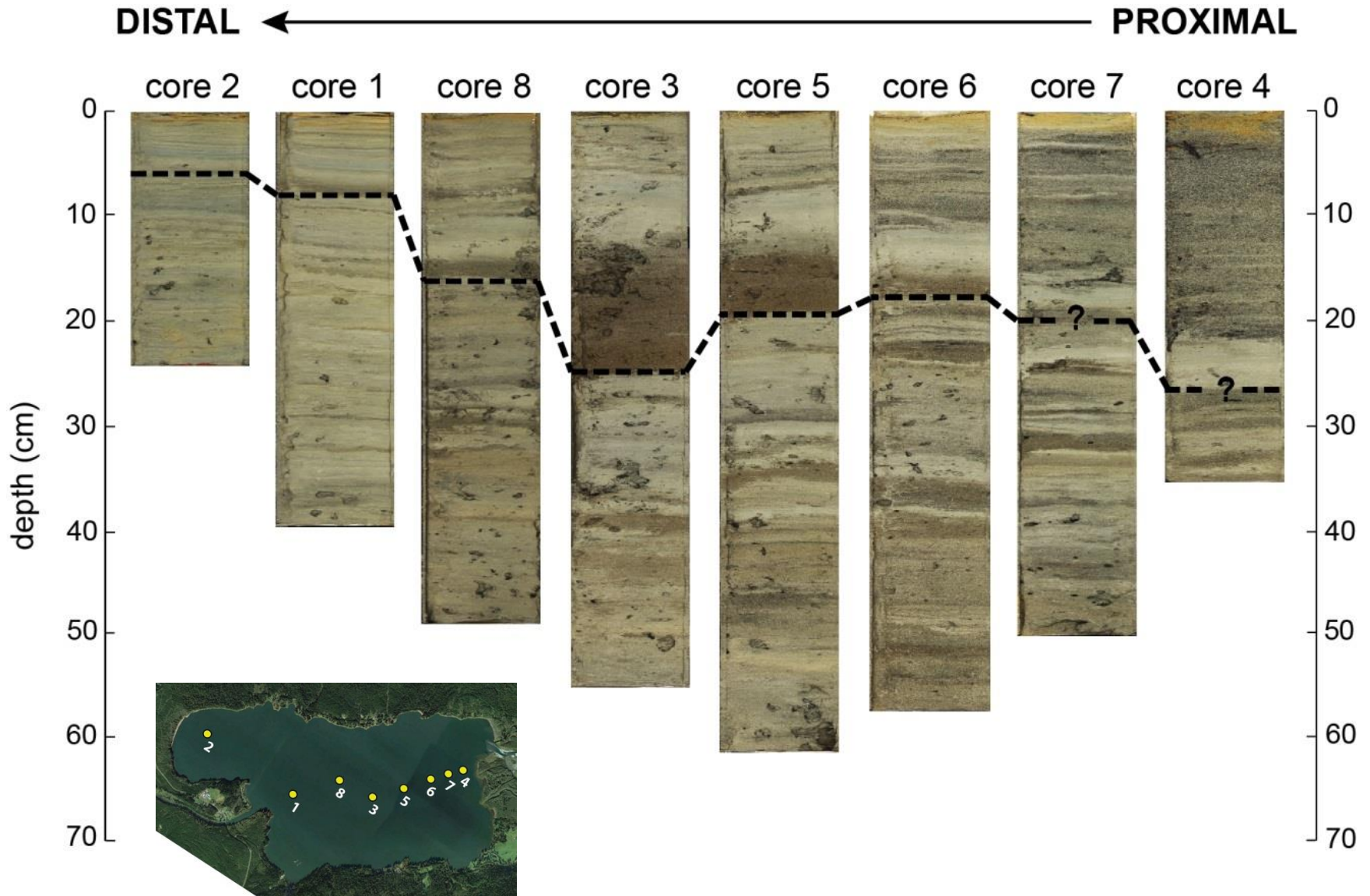


# Gravity cores



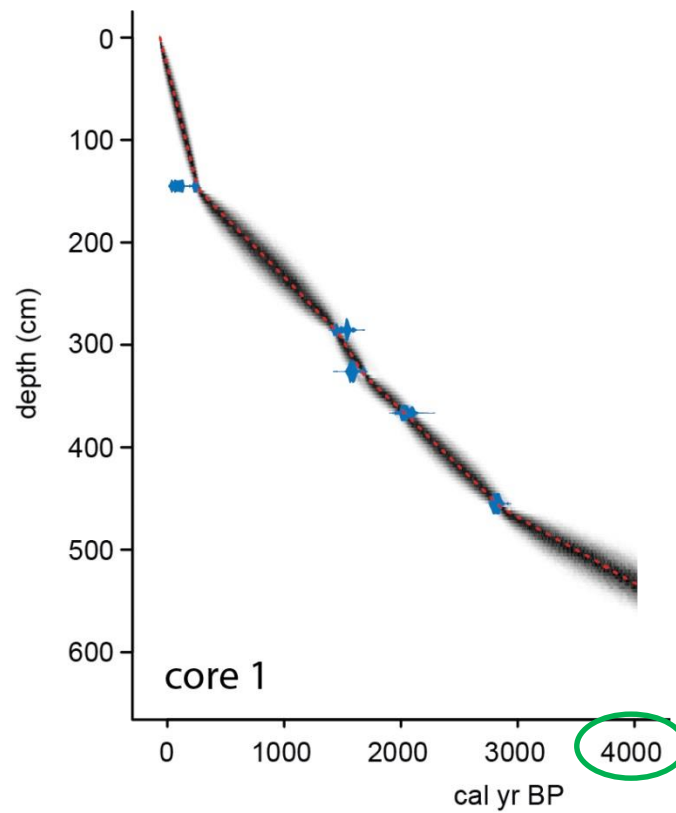
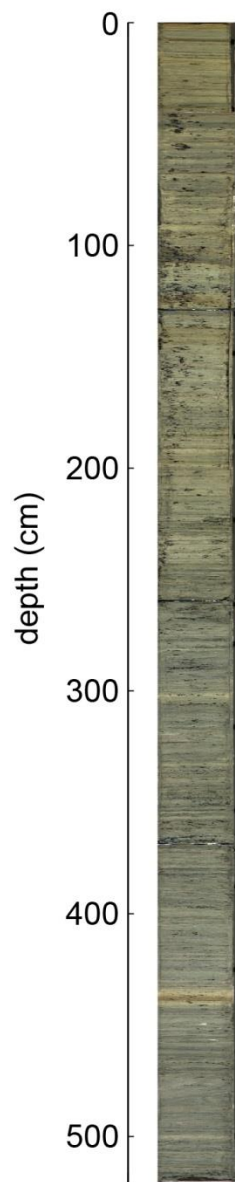
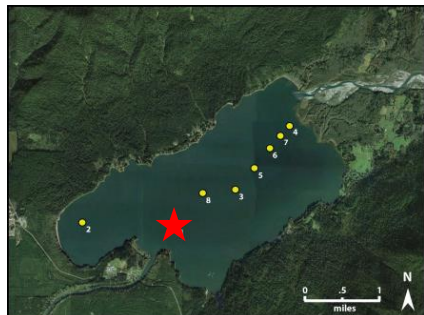


# Gravity cores



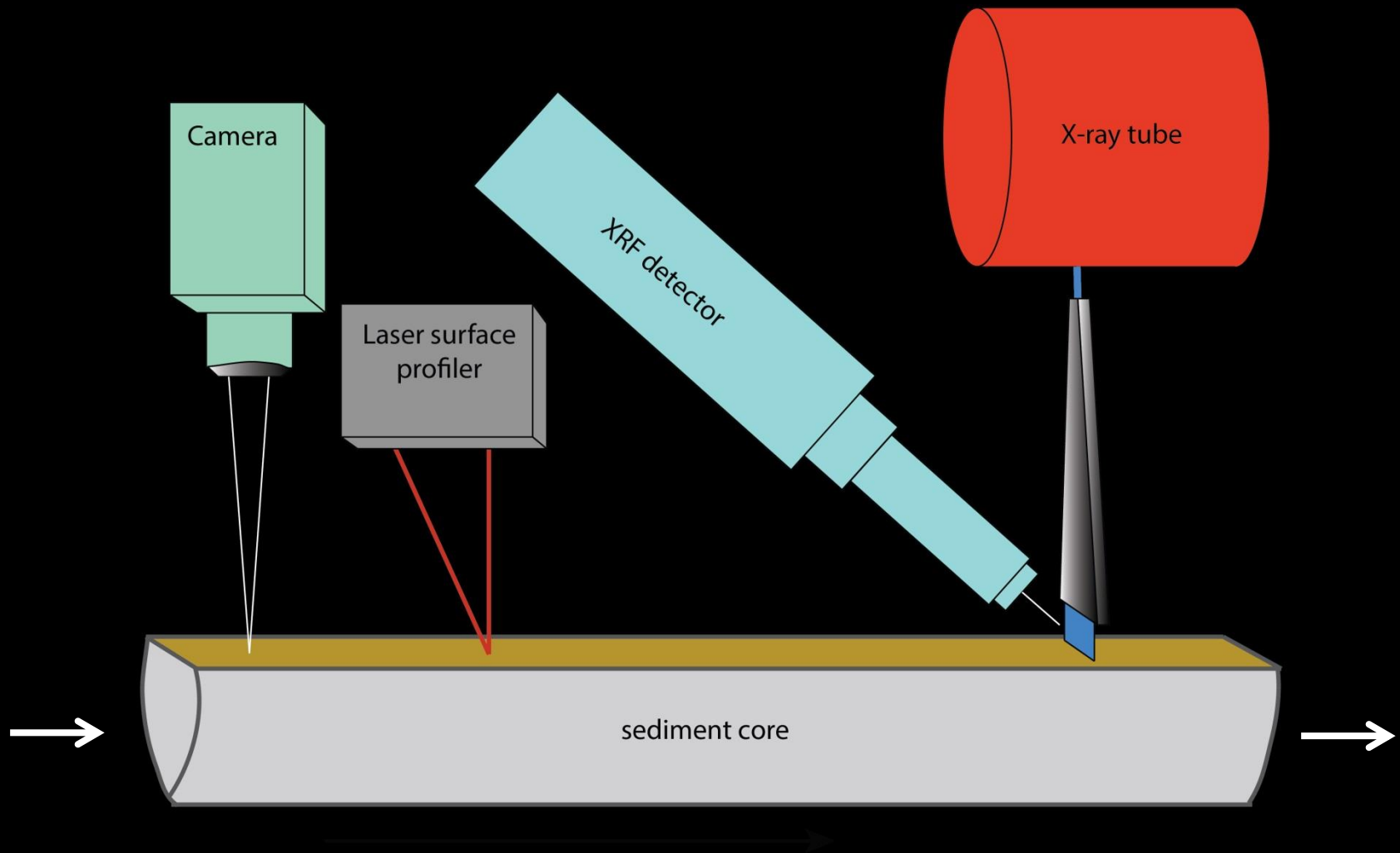


# Core 1



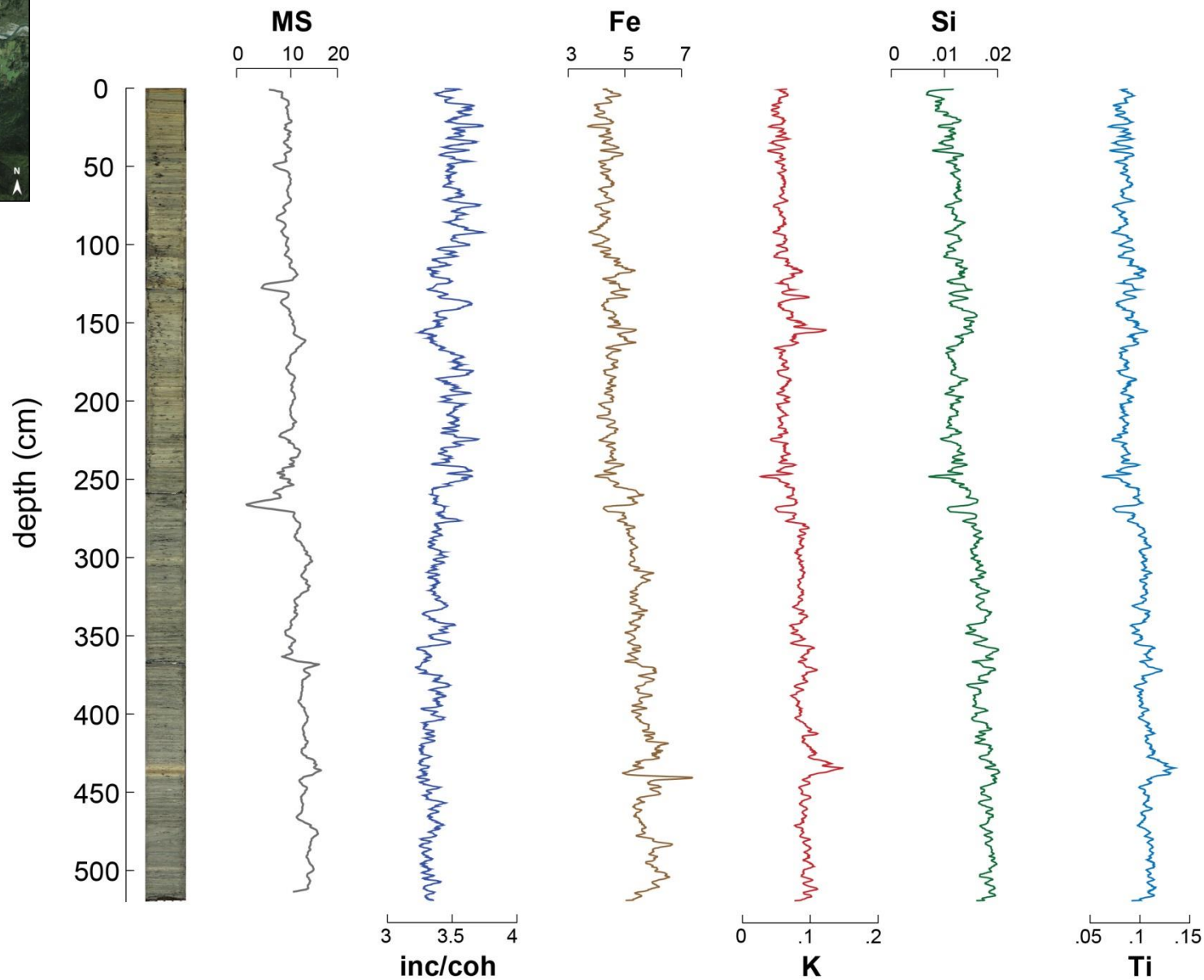


# Core-scanning $\mu$ XRF



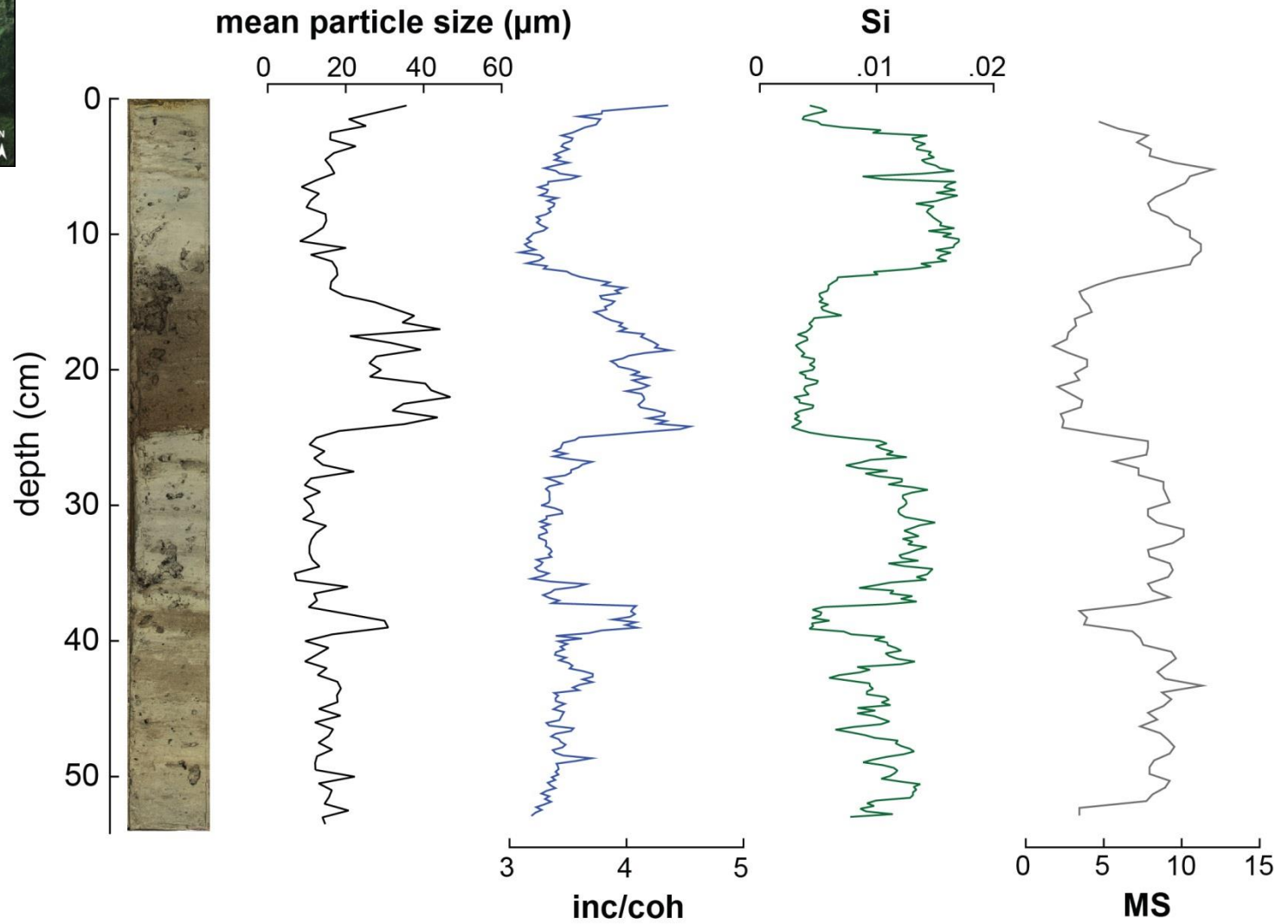
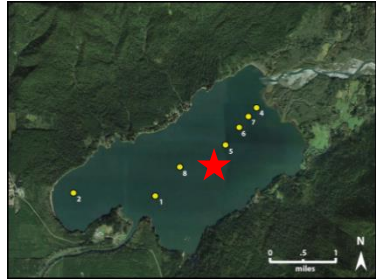


# Core 1



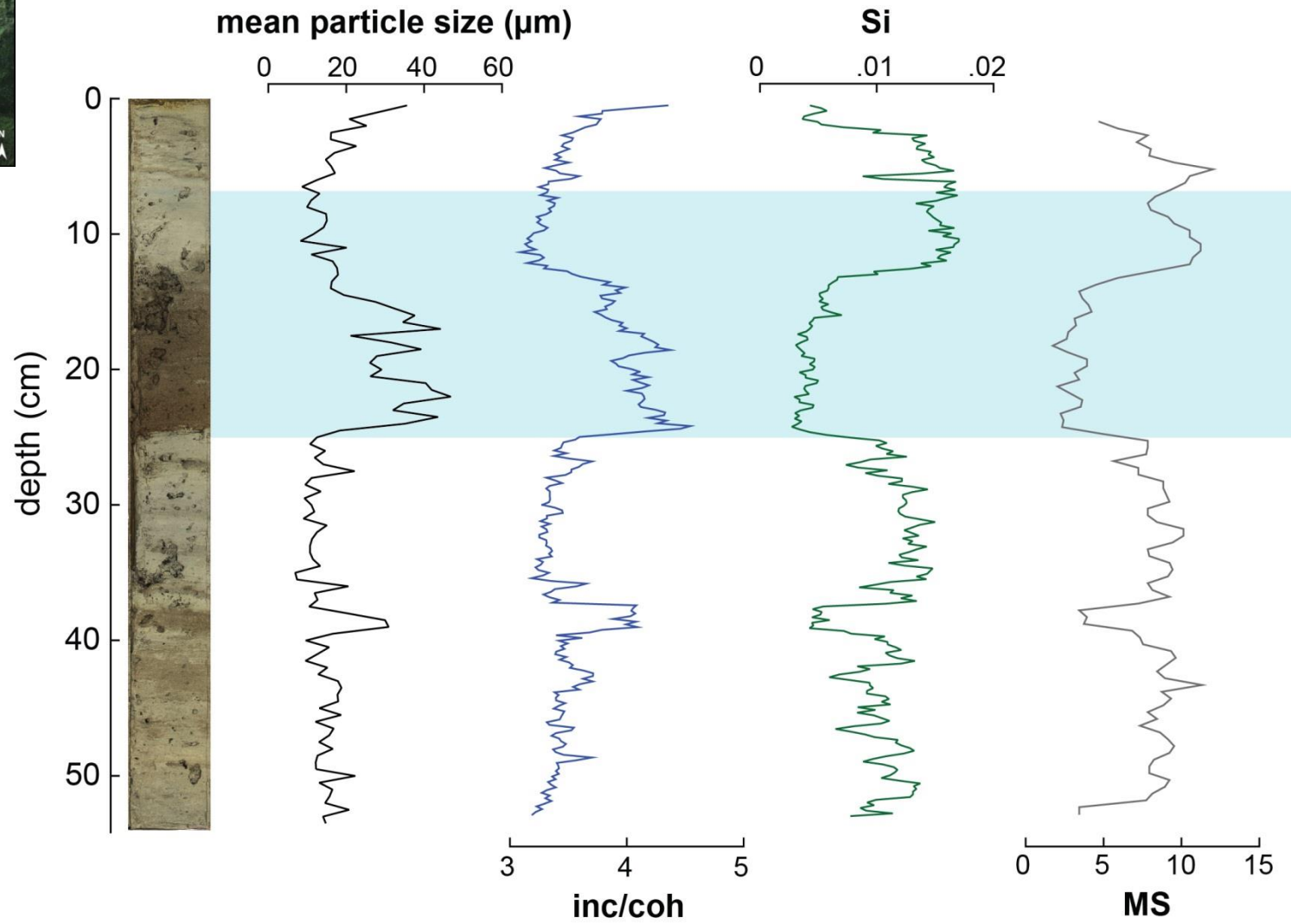
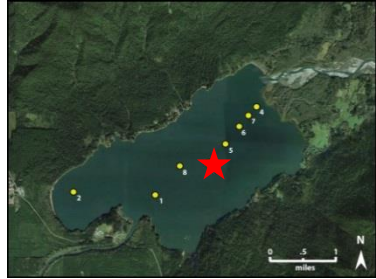


# Core 3



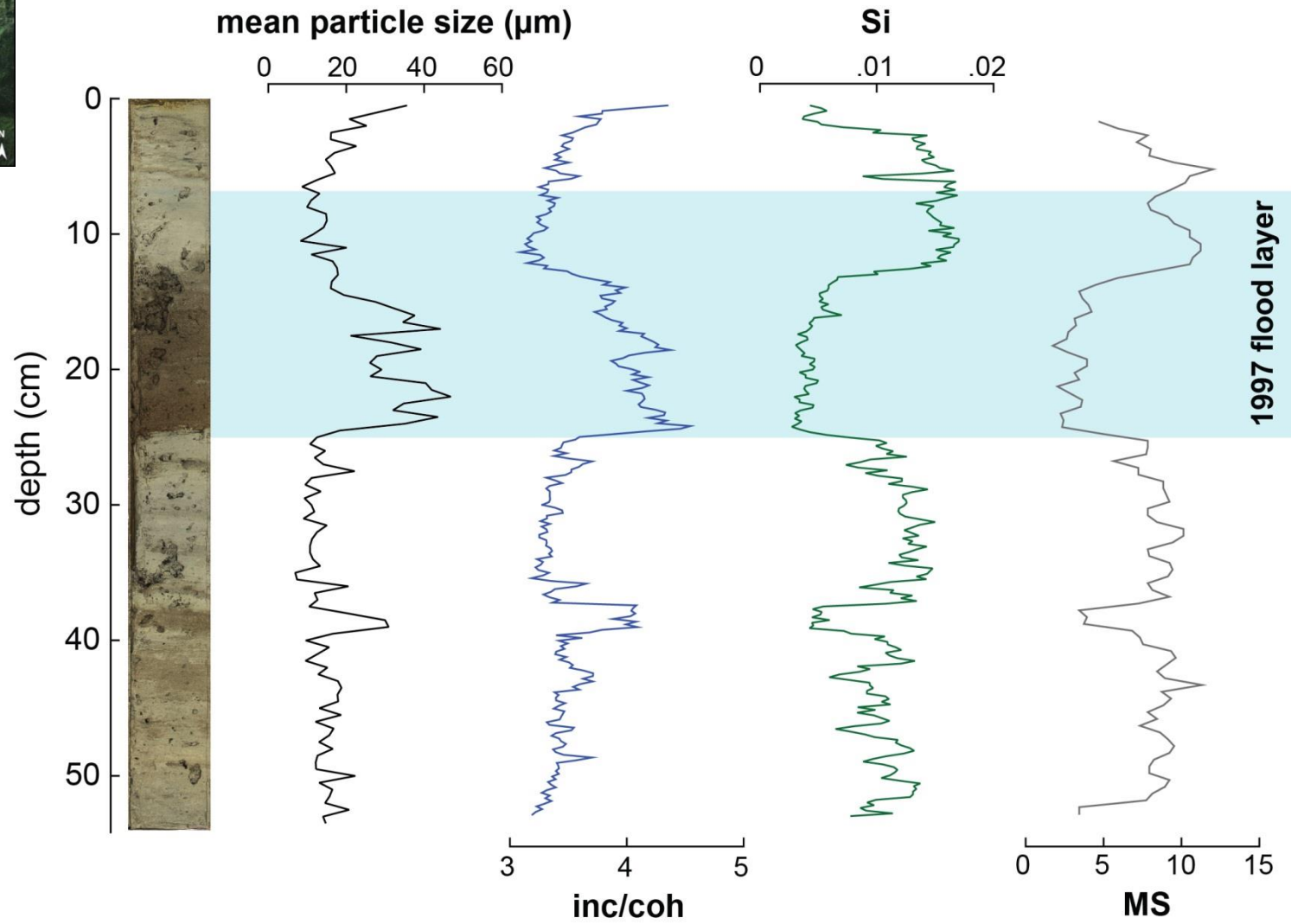
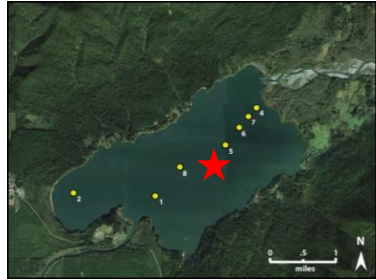


# Core 3

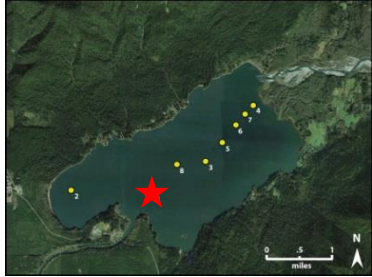




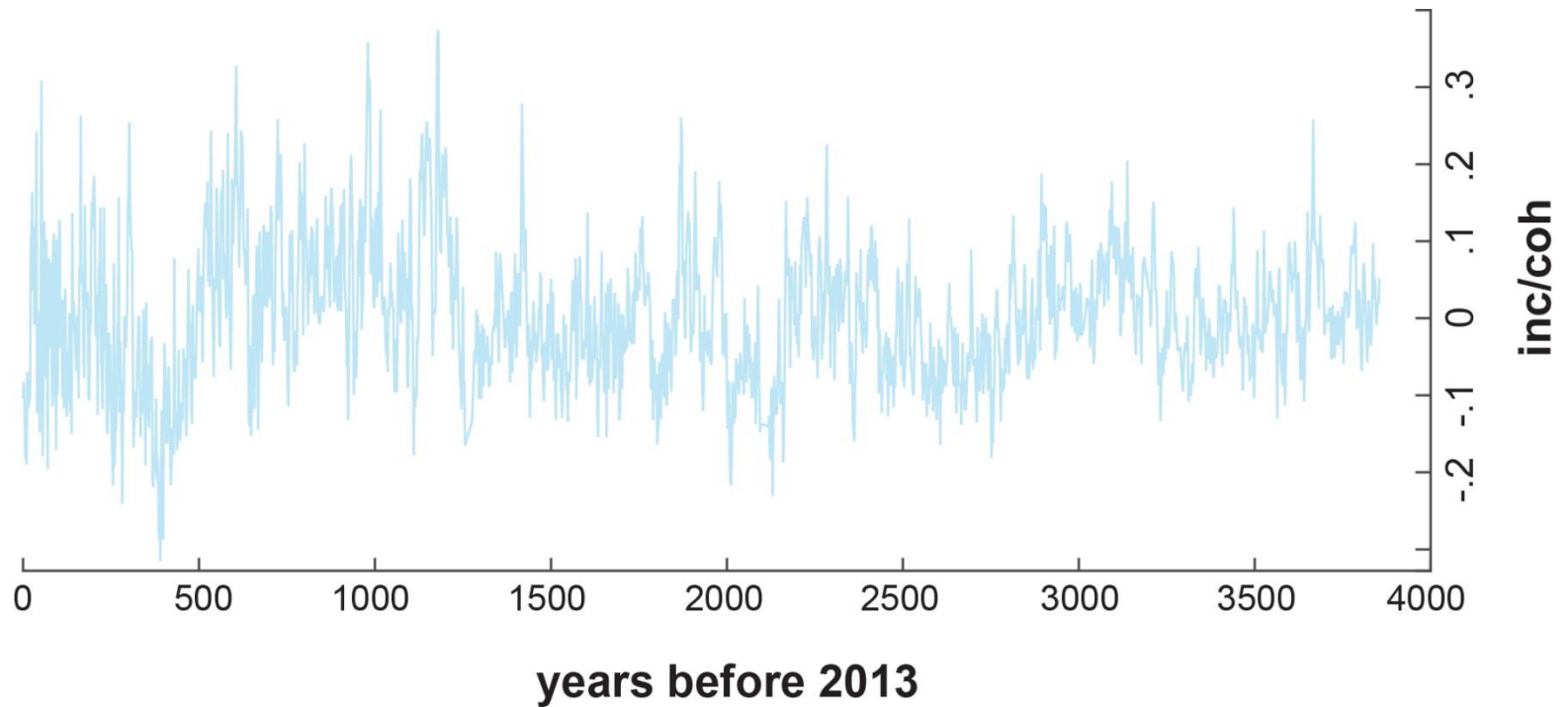
# Core 3



# Core 1

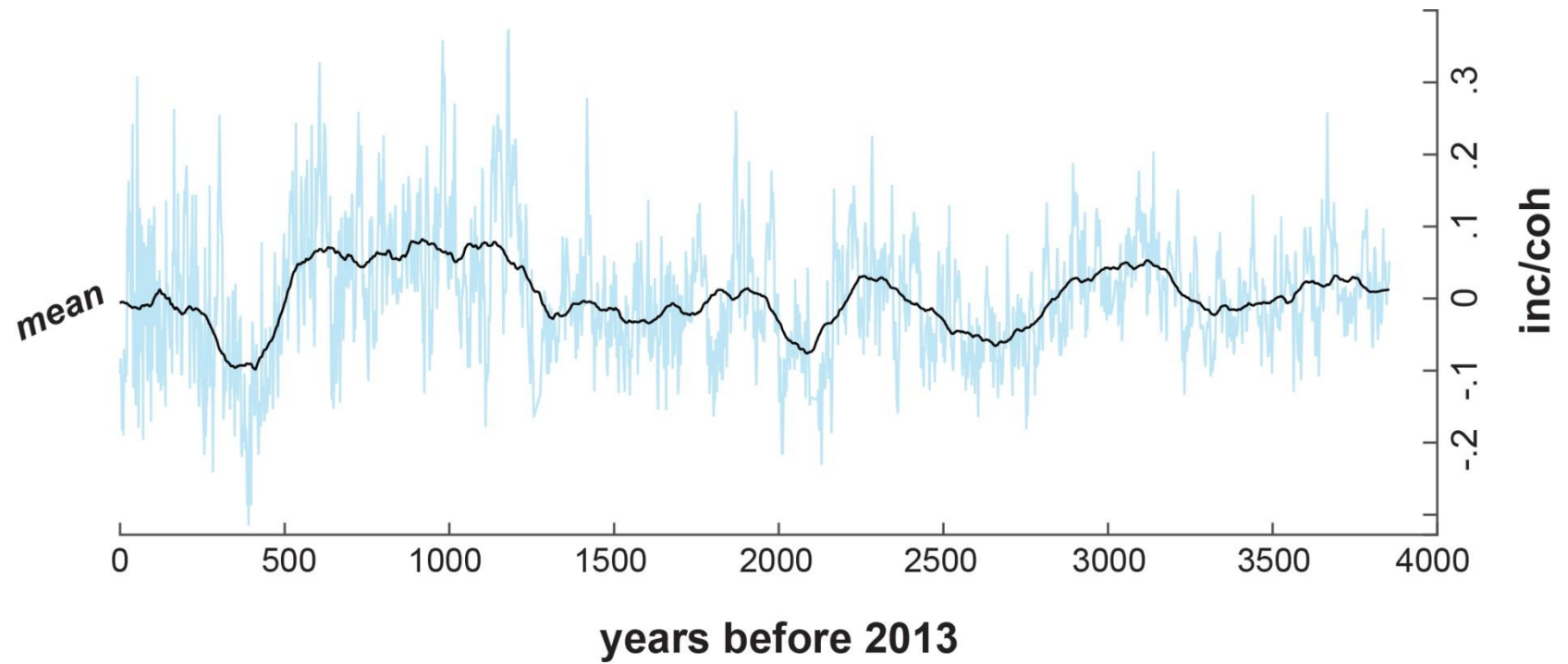
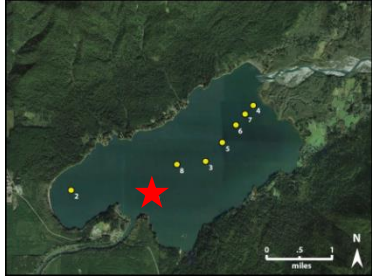


**Identifying extreme flood events...**

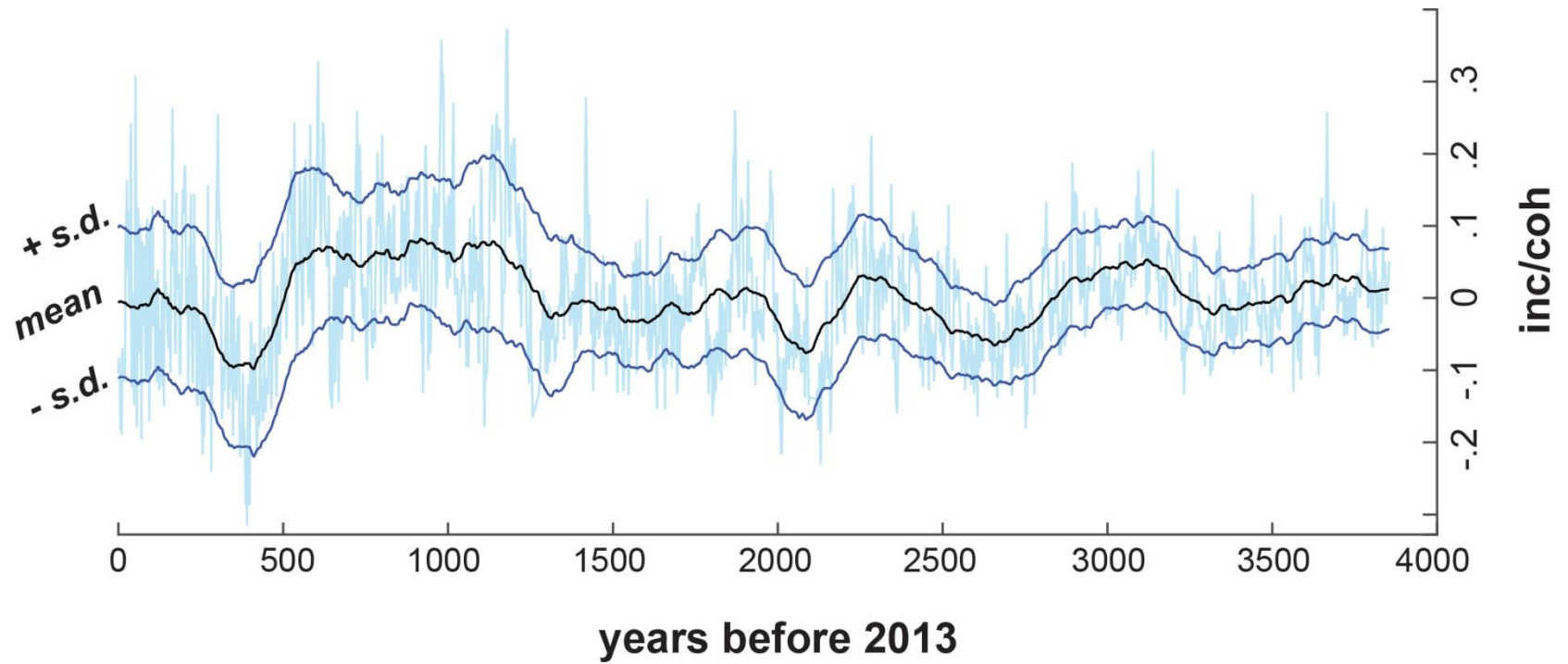
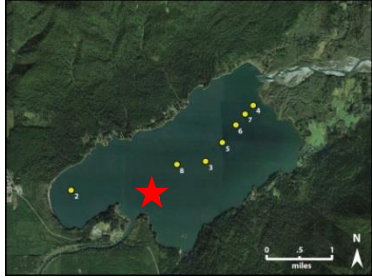




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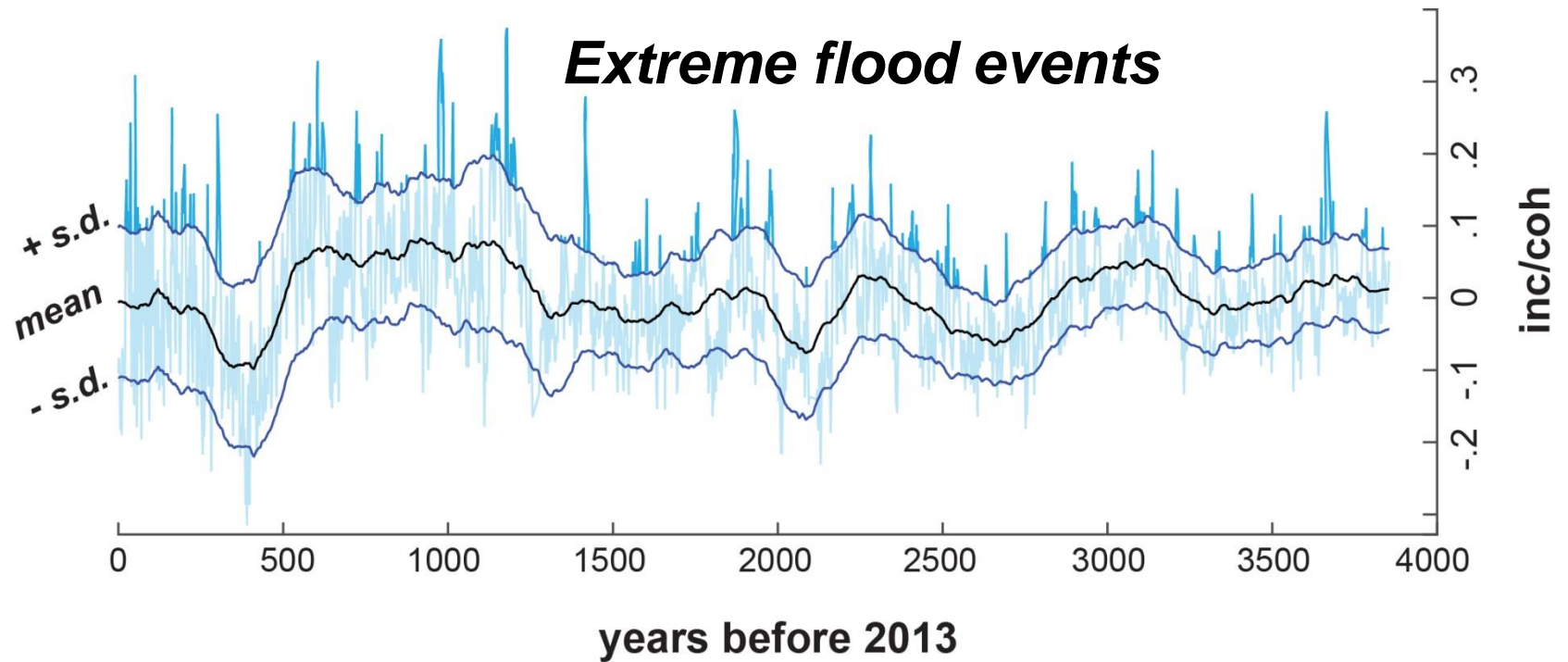
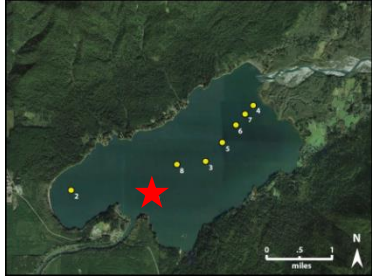


# Core 1

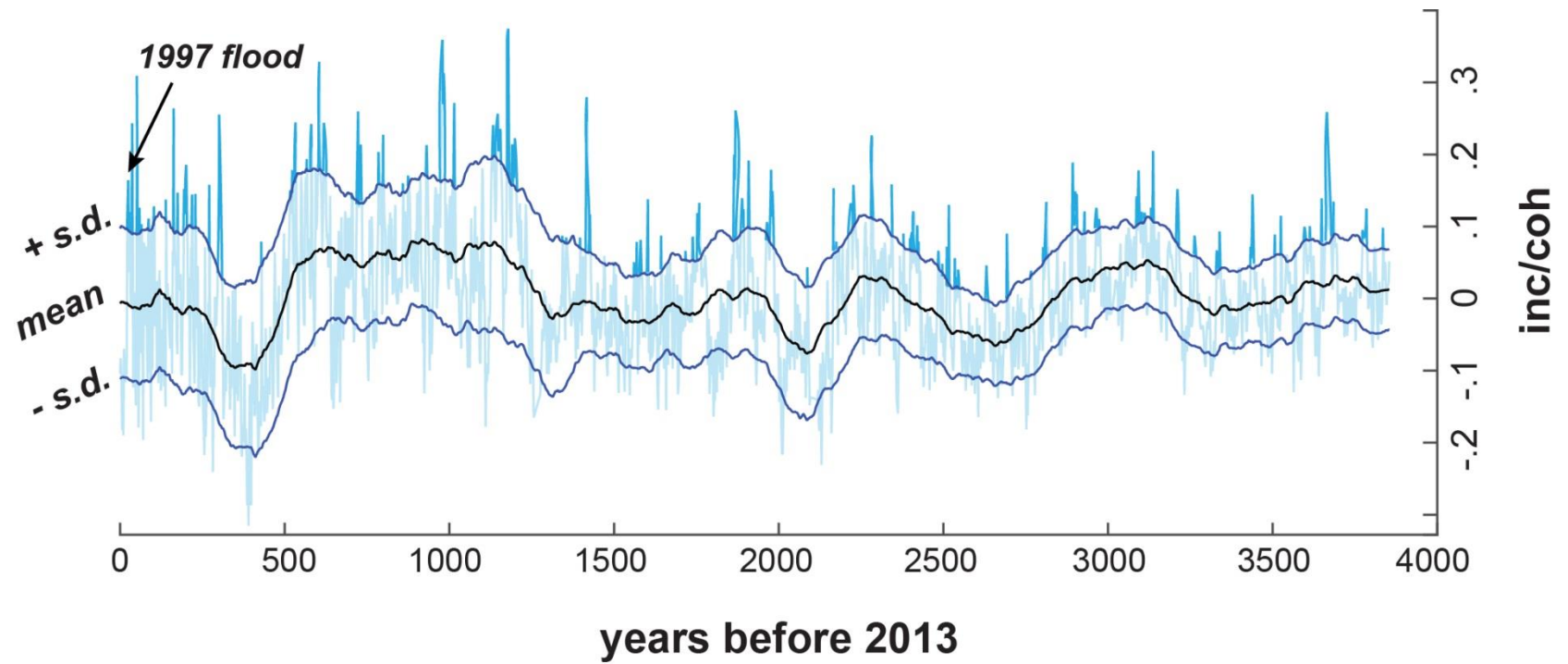
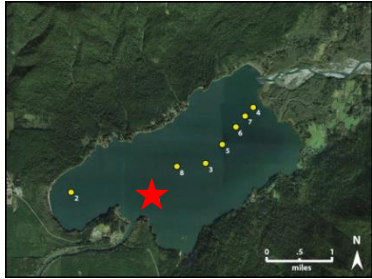




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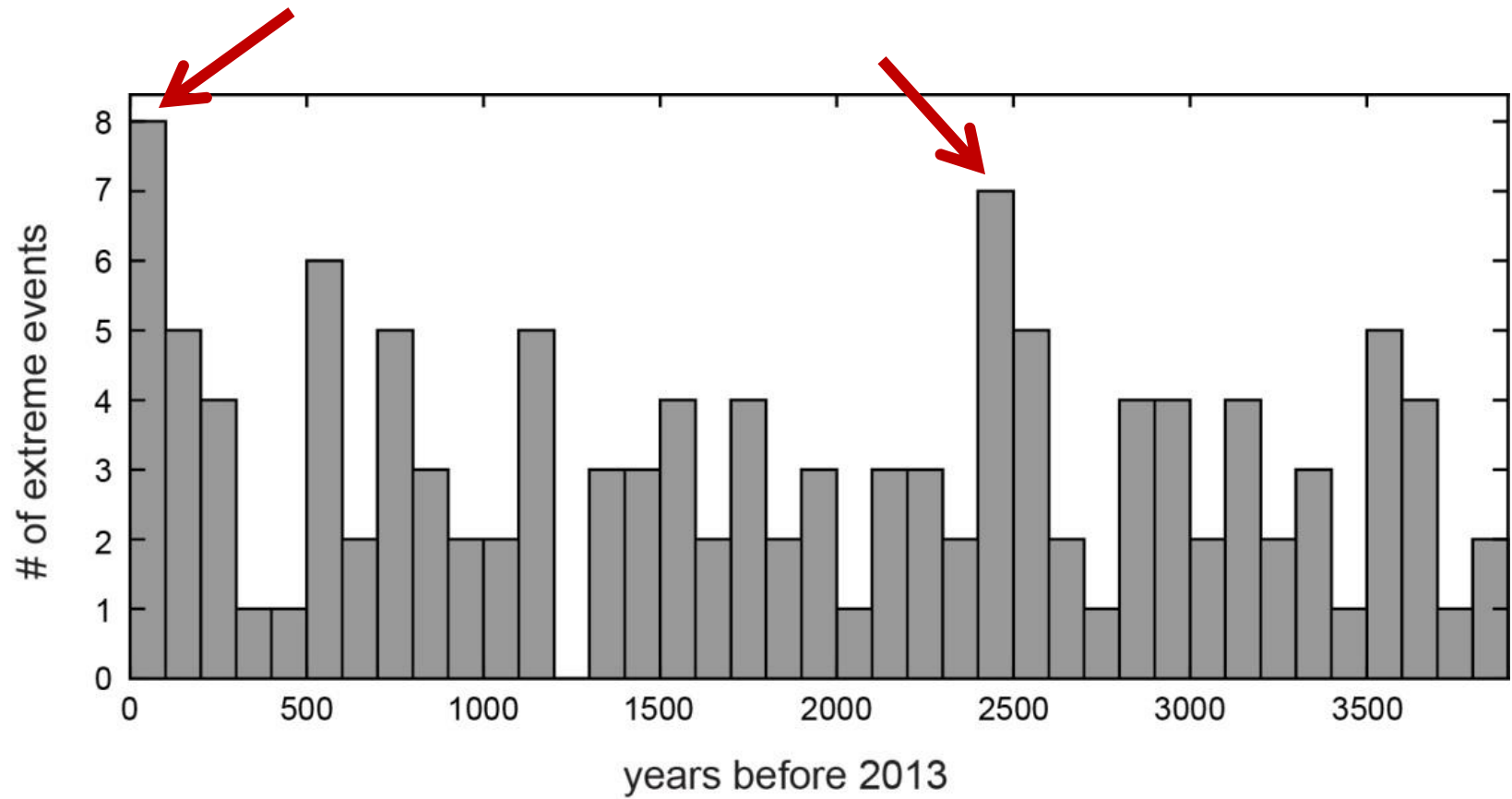


# Core 1

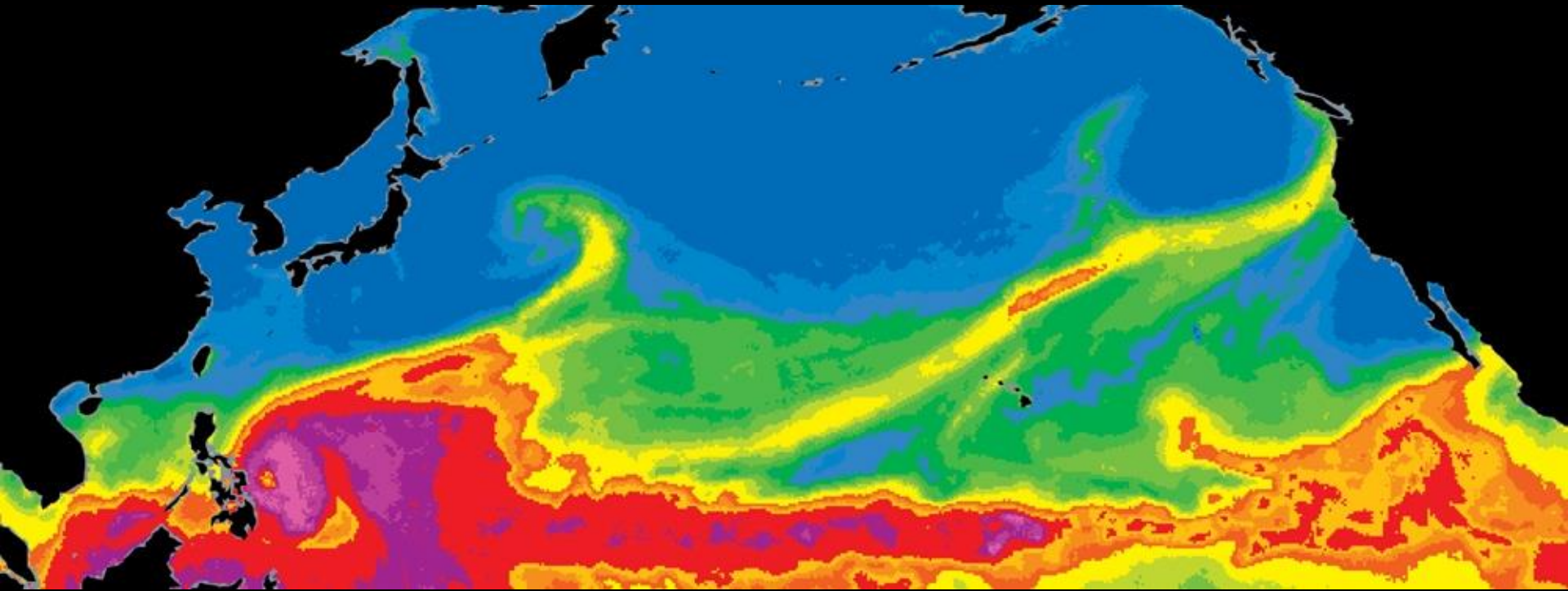




## Extreme floods through time



# Atmospheric rivers





UW WRF-GFS 36km Domain

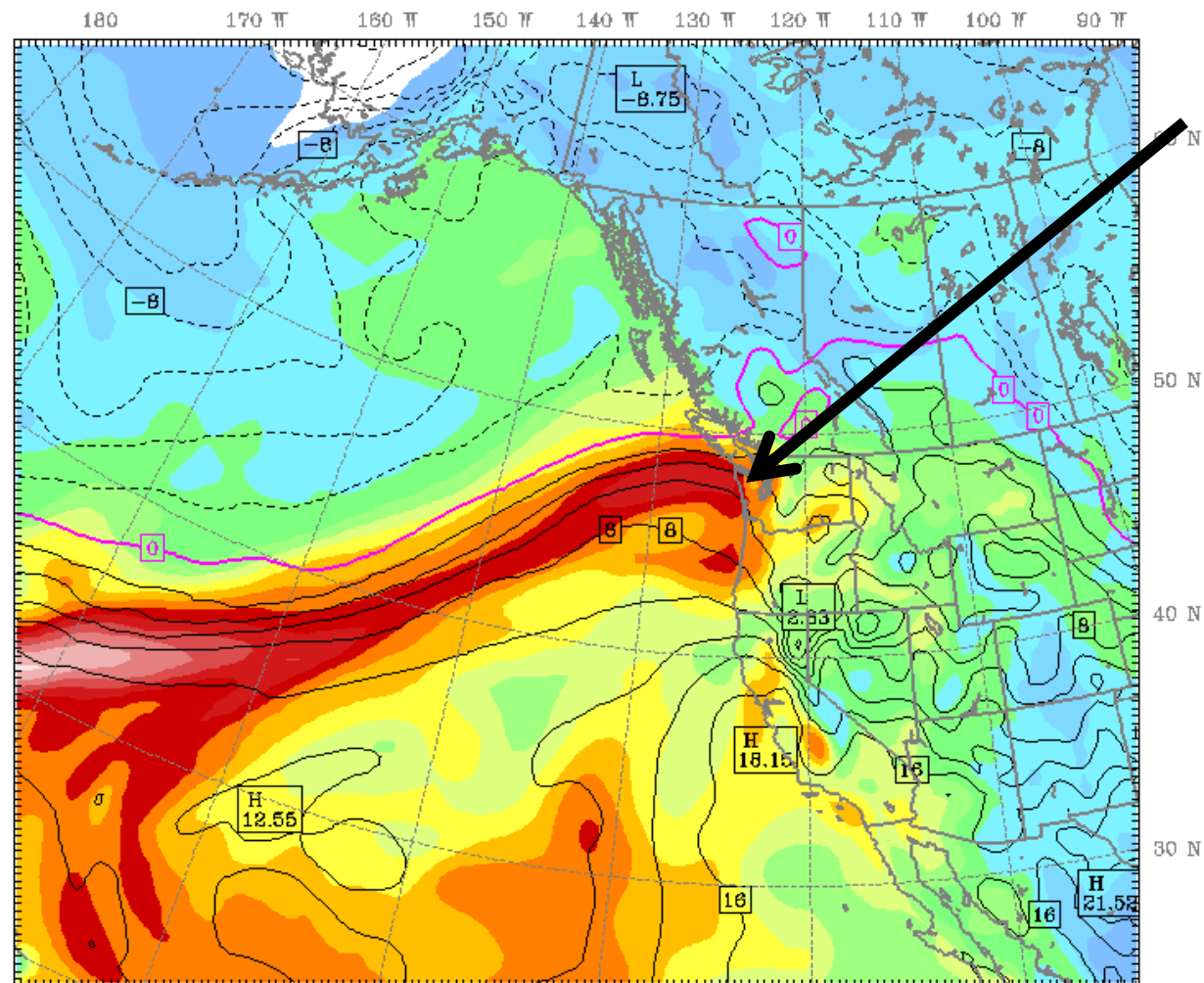
Init: 12 UTC Tue 29 Mar 11

Fcst: 39 h

Valid: 03 UTC Thu 31 Mar 11 (20 PDT Wed 30 Mar 11)

Column-integrated water vapor (mm)

850 mb Temperature (C)



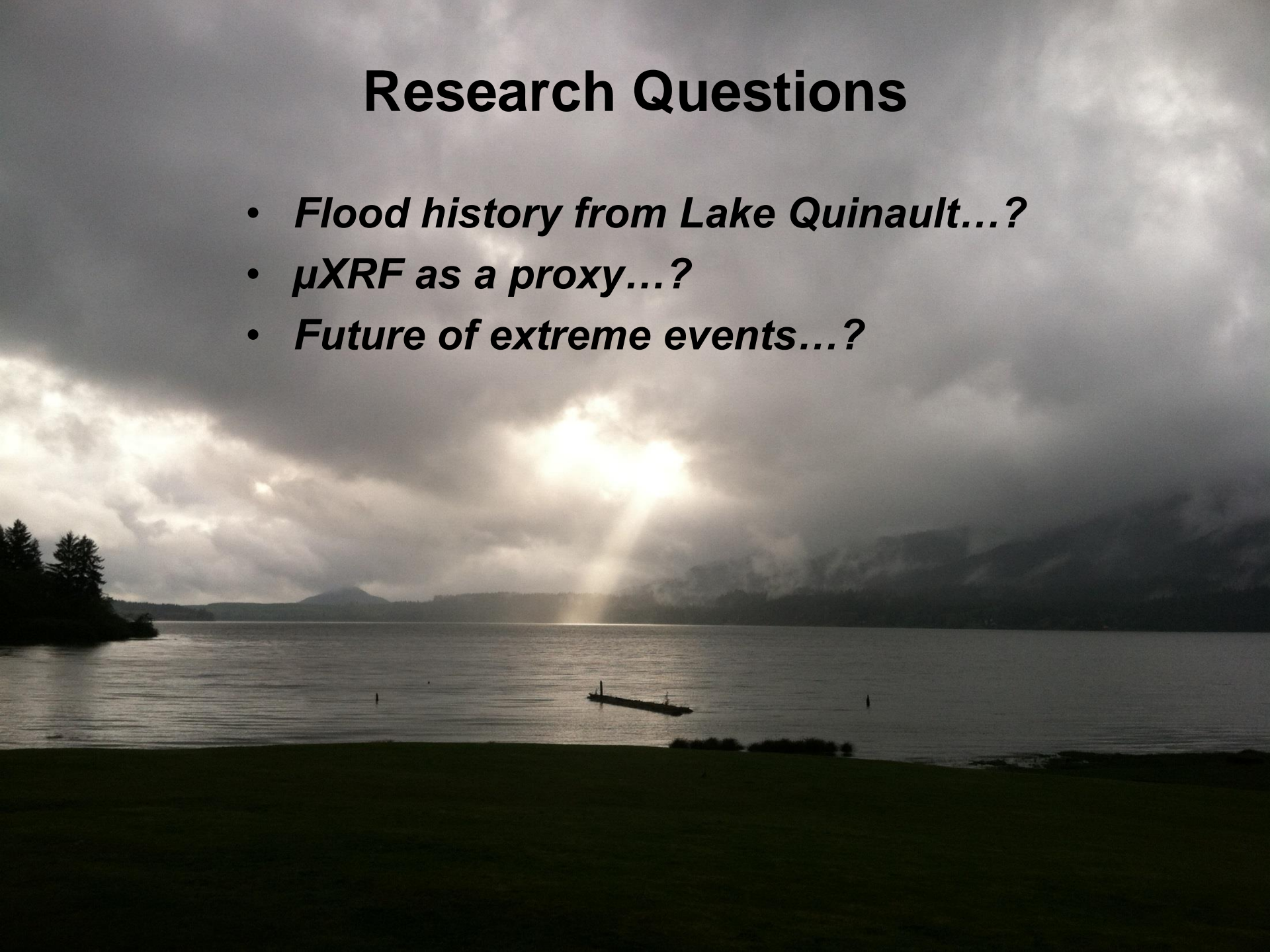
CONTOURS: UNITS=°C LOW= -16.000 HIGH= 20.000 INTERVAL= 2.0000

0	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	mm
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Model Info: V3.1.1 KF YSU PBL Thompson Ther-Diff 36 km, 37 levels, 216 sec  
LW: RRTM SW: Dudhia DIFF: simple KM: 2D Smagor

# Research Questions

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- *$\mu$ XRF as a proxy...?*
- *Future of extreme events...?*





# Acknowledgements

- **Quinault Indian Nation, National Park Service, LacCore**
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- **Bruce Riddell, Jubril Davies, Corey Moore, Deanna Metevier**

**NC STATE**  
UNIVERSITY



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