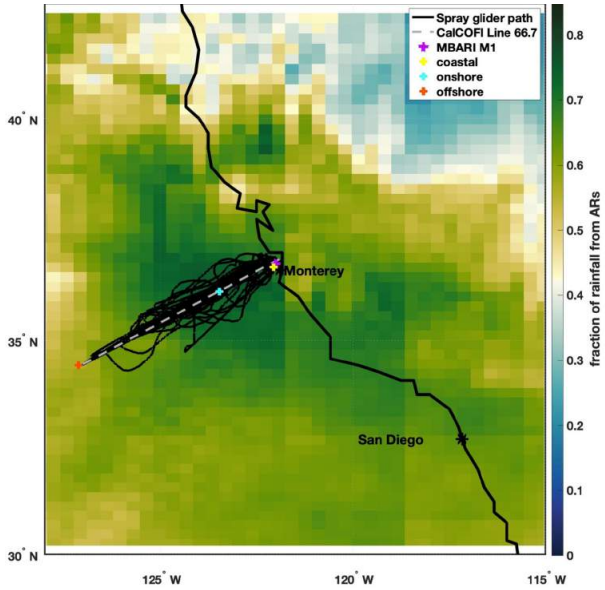
Ocean surface salinity response to atmospheric river (AR) events in the California Current System



Lauren Hoffman[1], Matt Mazloff[1], Sarah Gille[1], Donata Giglio[3], Aniruddh Varadarajan[2]

[1]Scripps Institution of Oceanography, University of California, San Diego, California, USA
[2]Department of Mechanical and Aerospace Engineering, University of California, San Diego, California, USA
[3]University of Colorado, Boulder, Colorado, USA

lahoffma@eng.ucsd.edu

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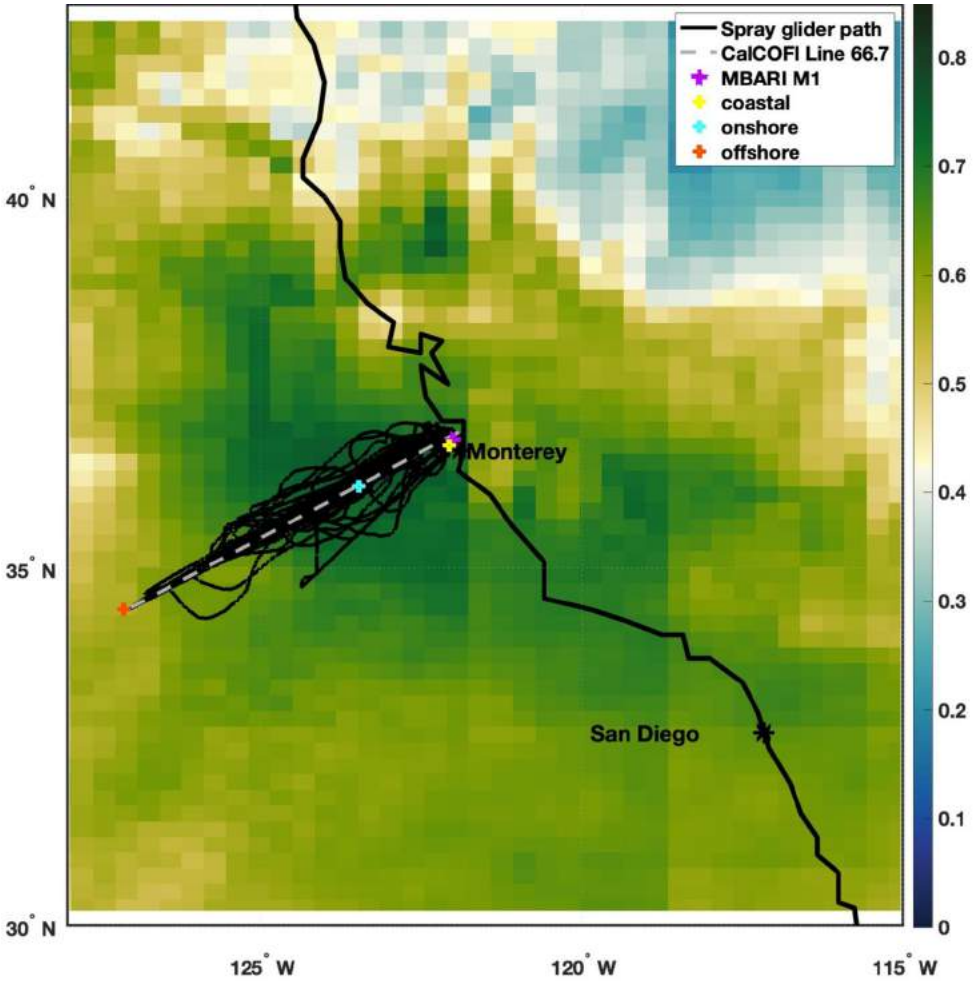
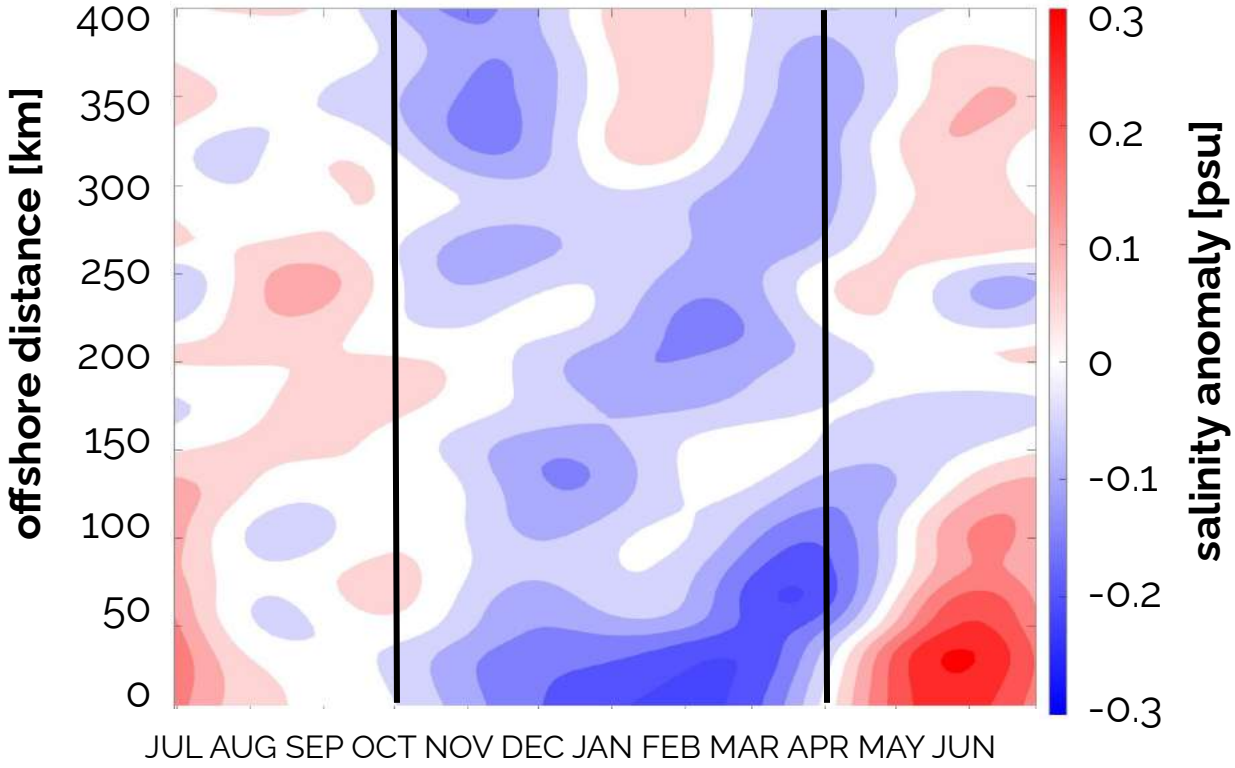
Atmospheric rivers account for a large fraction of the rainfall in the California Current System.



Hoffman et al. *JPO.* in press (2022)

Previously, salinity changes in the California Current System have largely been attributed to advection of freshwater from the northeast Pacific.



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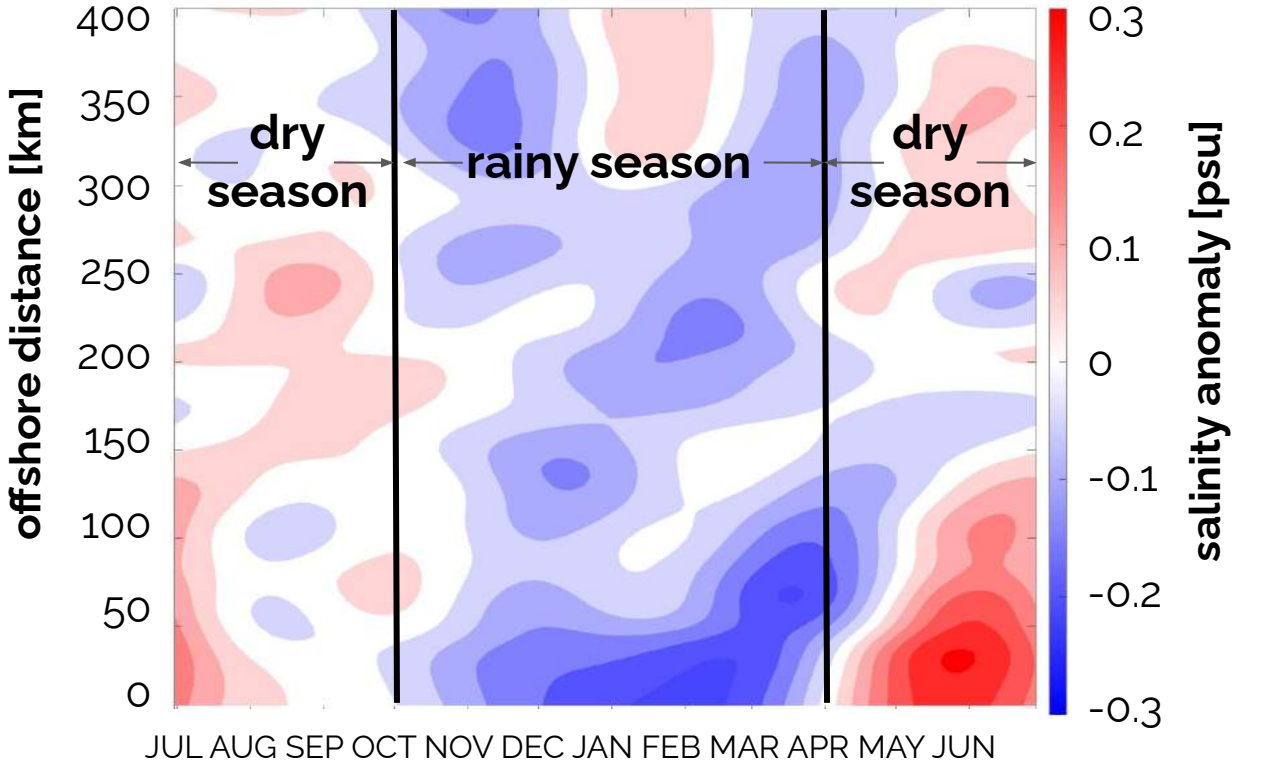
Previously, salinity changes in the California Current System have largely been attributed to advection of freshwater from the northeast Pacific.

We hypothesize that rain could also play a role in salinity changes on seasonal and event timescales.



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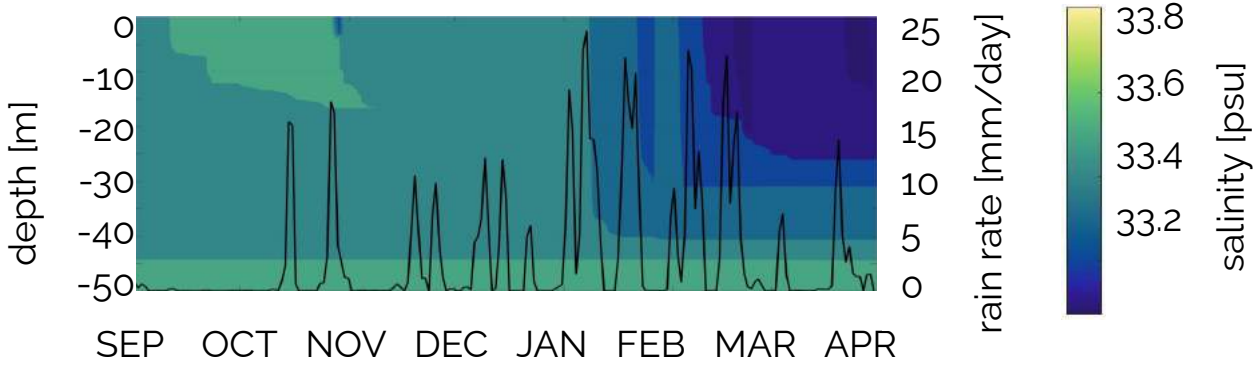
This study aims to characterize the ocean surface salinity response to rainfall from atmospheric rivers.

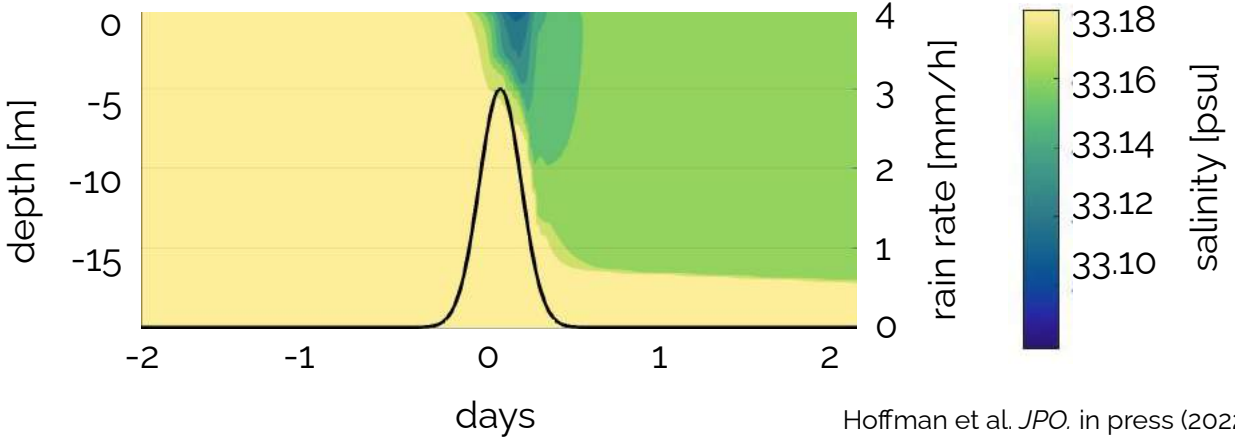
seasonal

1. Do ARs impact freshening over the rainy season?



event

2. Are salinity changes from individual AR events detectable by ocean instruments?



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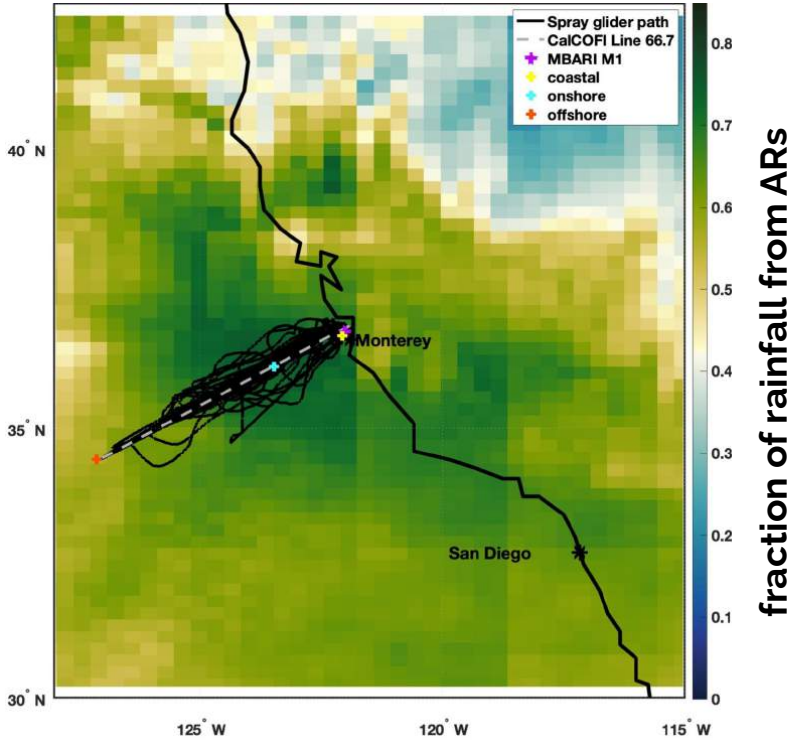
A combination of observations and a 1-D model are used to understand the salinity response to rain events on different timescales.

Dataset	Variable
ERA5	rain, wind, atmospheric data
SIO-R1 AR Catalog	AR presence
Underwater Spray glider	salinity, temperature
MBARI M1 Mooring	salinity
MITgcm 1-D model	salinity



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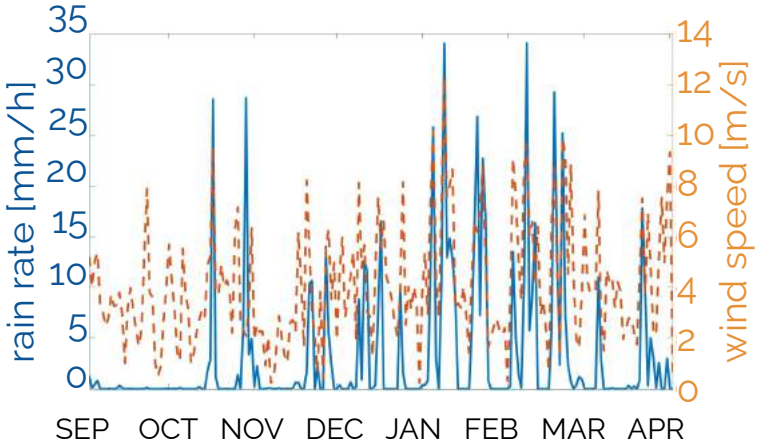
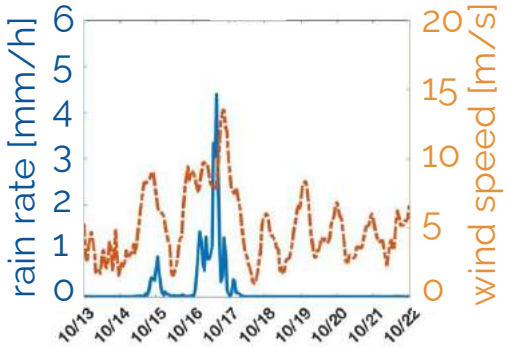
The MITgcm is run for three different studies:

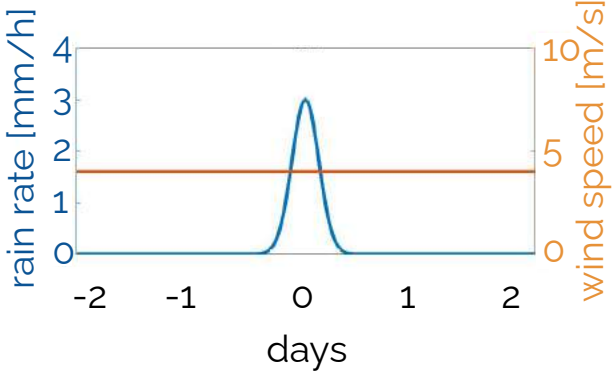
(i) seasonal studies



(ii) event case studies



(iii) event sensitivity studies



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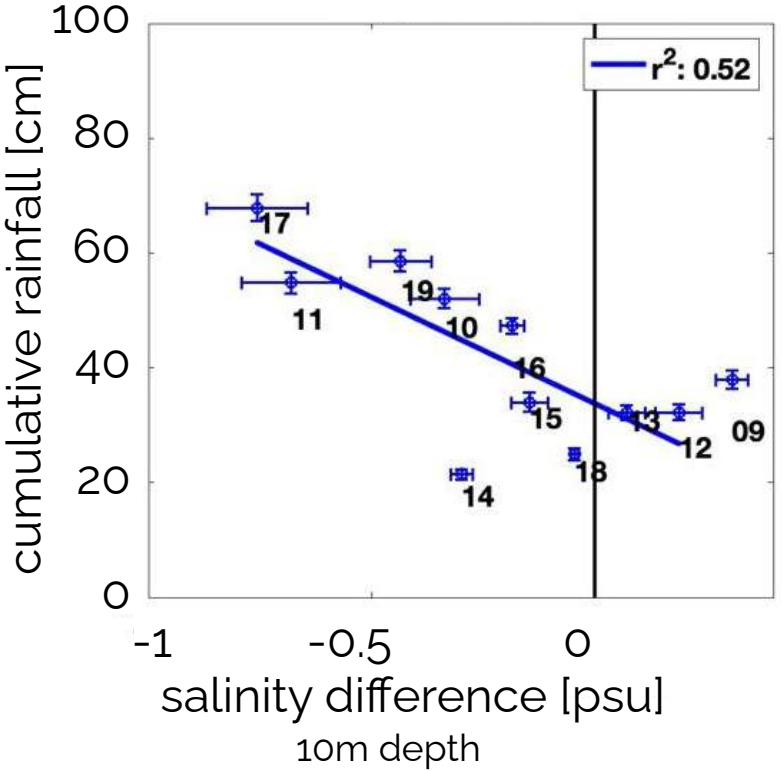
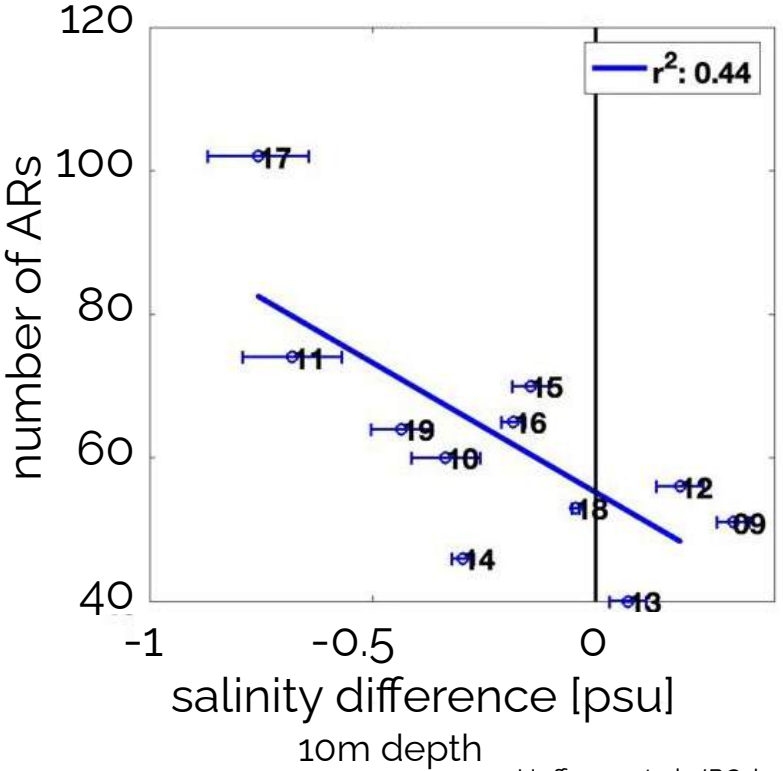
Seasonal Response

Rainfall from atmospheric rivers contributes to a seasonal surface ocean freshening.





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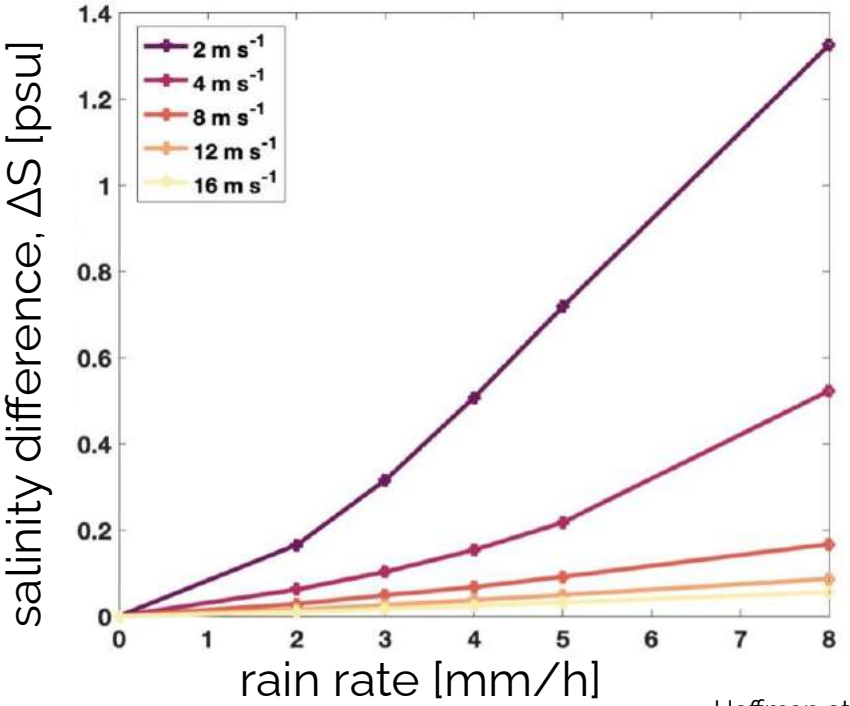
Event-based Response

The salinity response to rain events characteristic of atmospheric rivers is linearly dependent on rain rate and inversely dependent on wind speed.

$$\Delta S = ARU^{-b}$$

- **ΔS**: maximum salinity difference [psu] from initial timestep @ 0.01m depth
- **R**: max rain rate [mm/hr]
- **U**: wind speed [m/s]
- ***A* & *b***: constants



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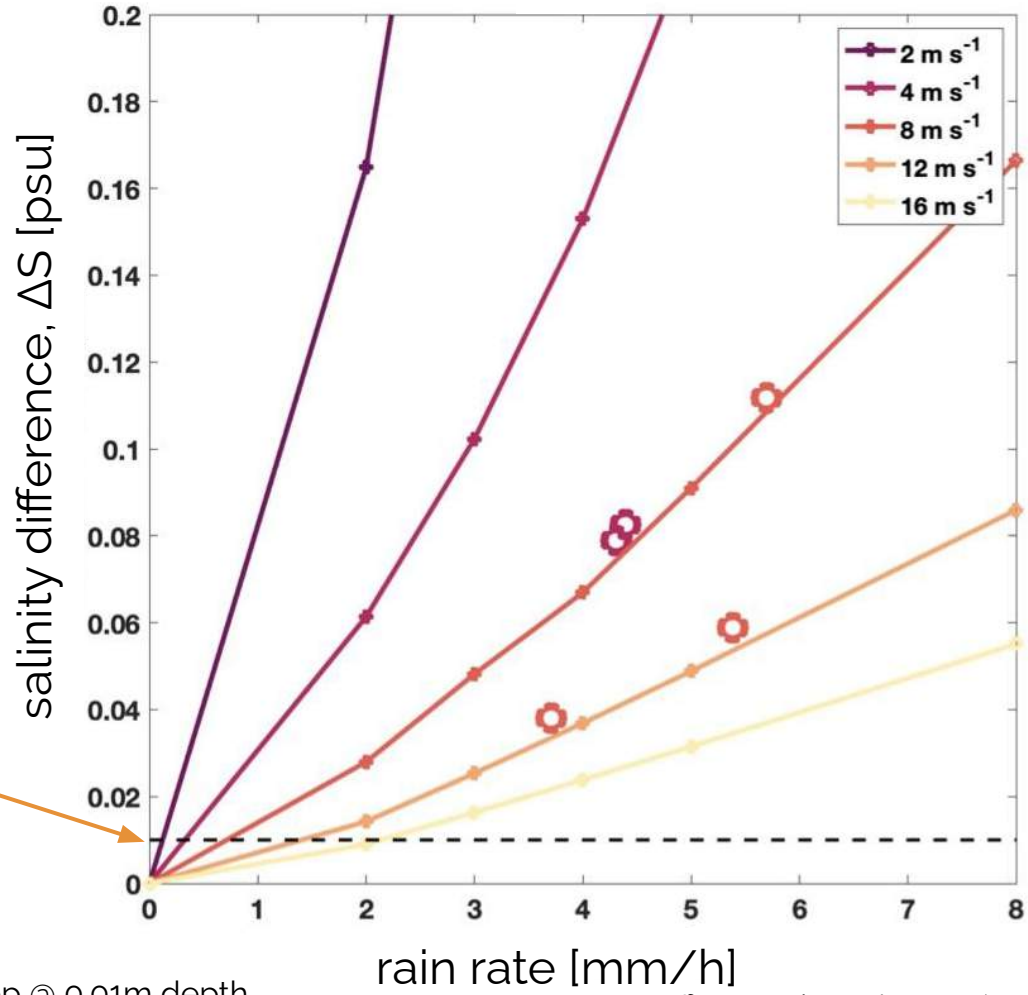
Rainfall from atmospheric river events produces salinity changes that are detectable by ocean instruments.

The detectable salinity limit for CTD instruments is 0.01psu.



*ΔS: maximum salinity difference [psu] from initial timestep @ 0.01m depth

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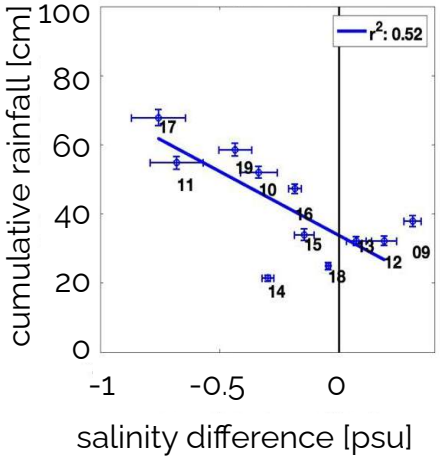
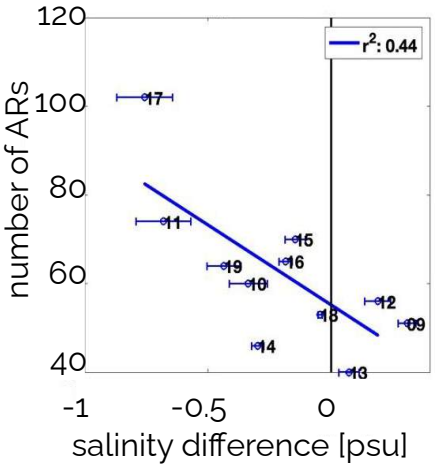
Rain from atmospheric rivers causes upper ocean salinity changes on seasonal and event timescales.

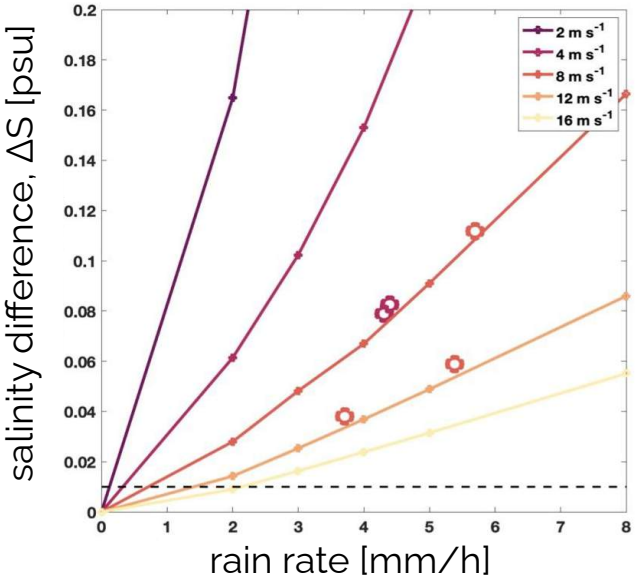
seasonal





Rainfall from atmospheric rivers explains a significant portion of the variance in seasonal salinity changes.

event



Atmospheric river events produce salinity anomalies that are detectable by ocean instruments.

lahoffma@eng.ucsd.edu

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Scan for more info!

lahoffma@eng.ucsd.edu