



SOCCOM

Southern Ocean Carbon and Climate Observations and Modeling



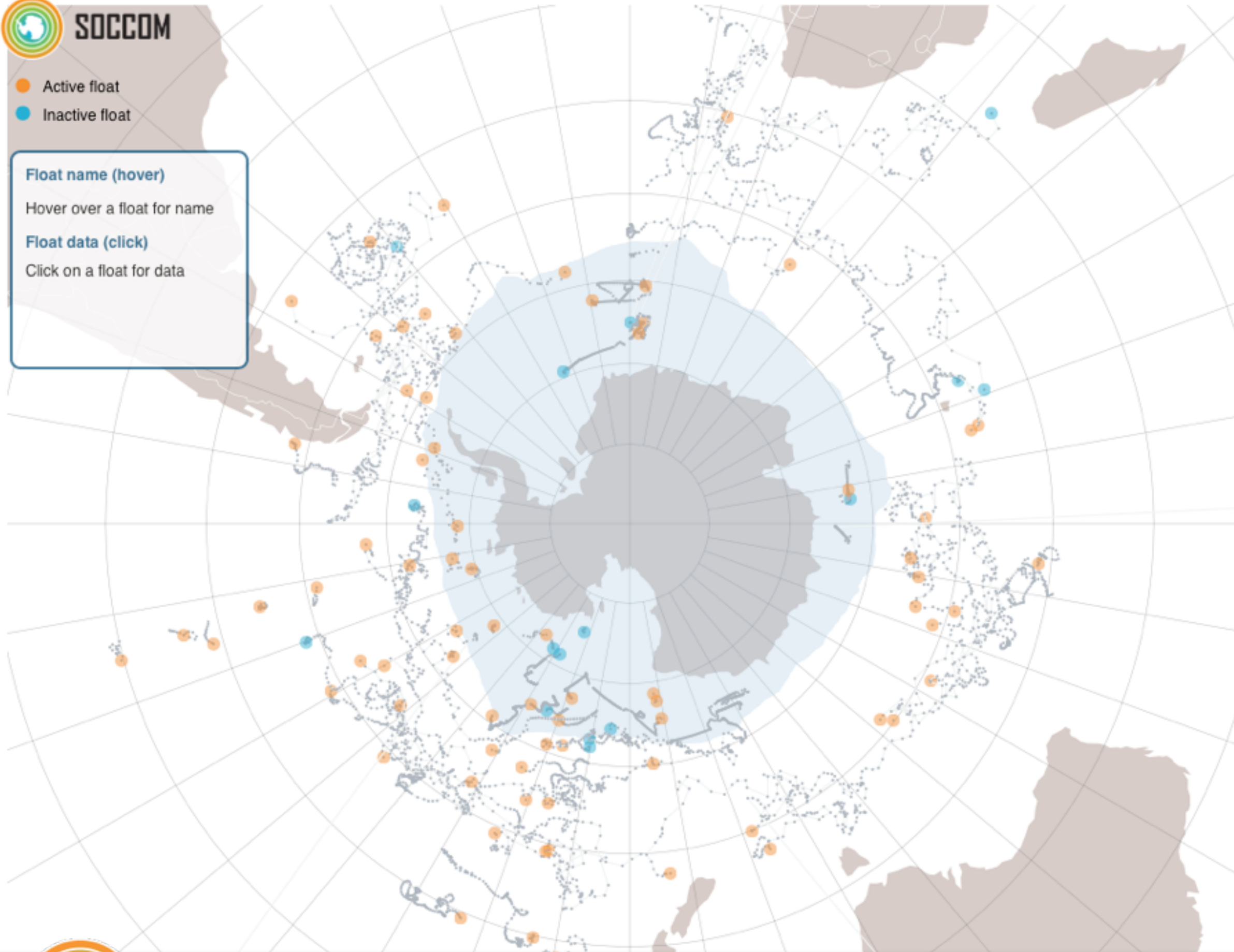
- Active float
- Inactive float

Float name (hover)

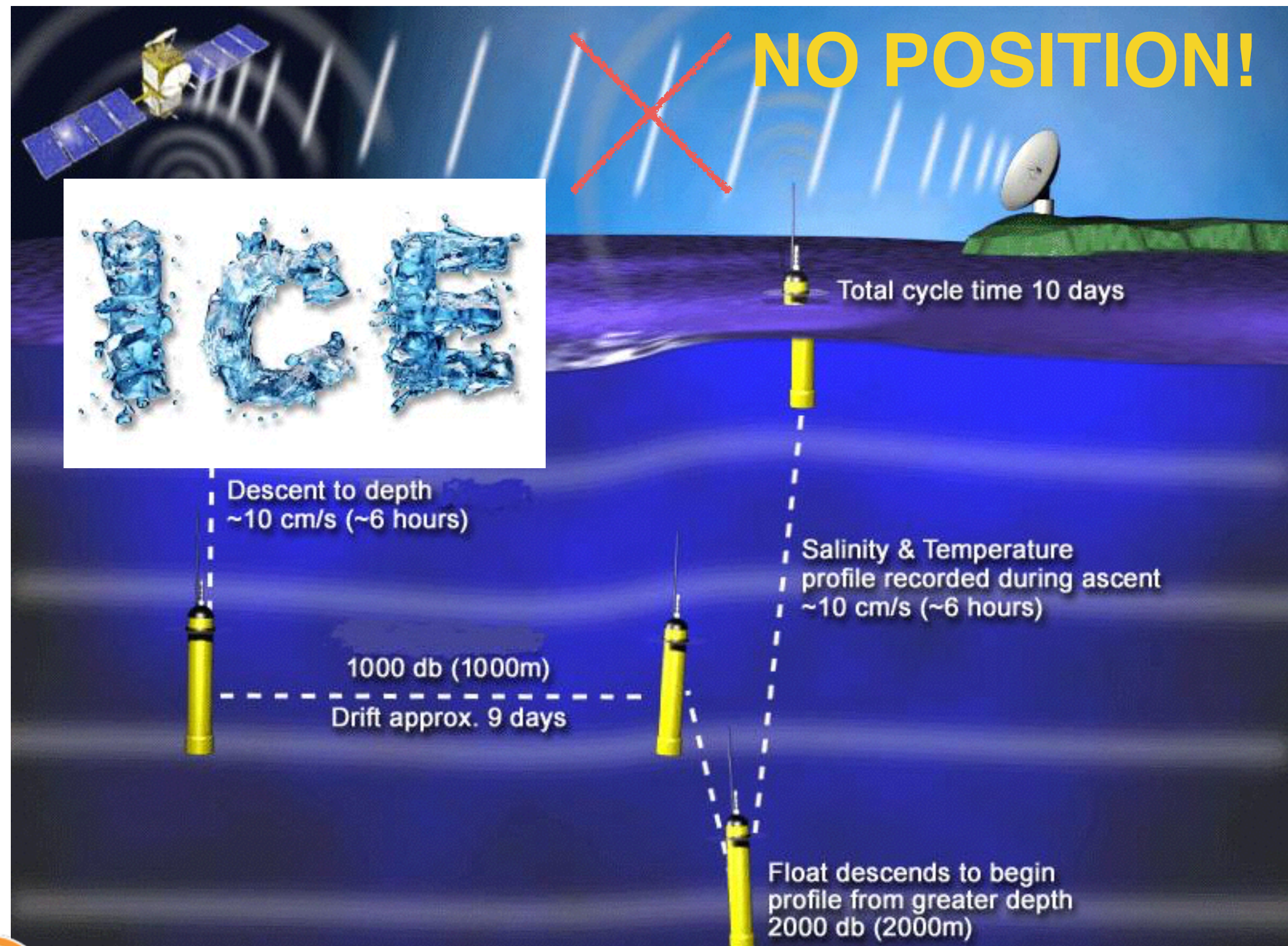
Hover over a float for name

Float data (click)

Click on a float for data



Argo Under Ice...

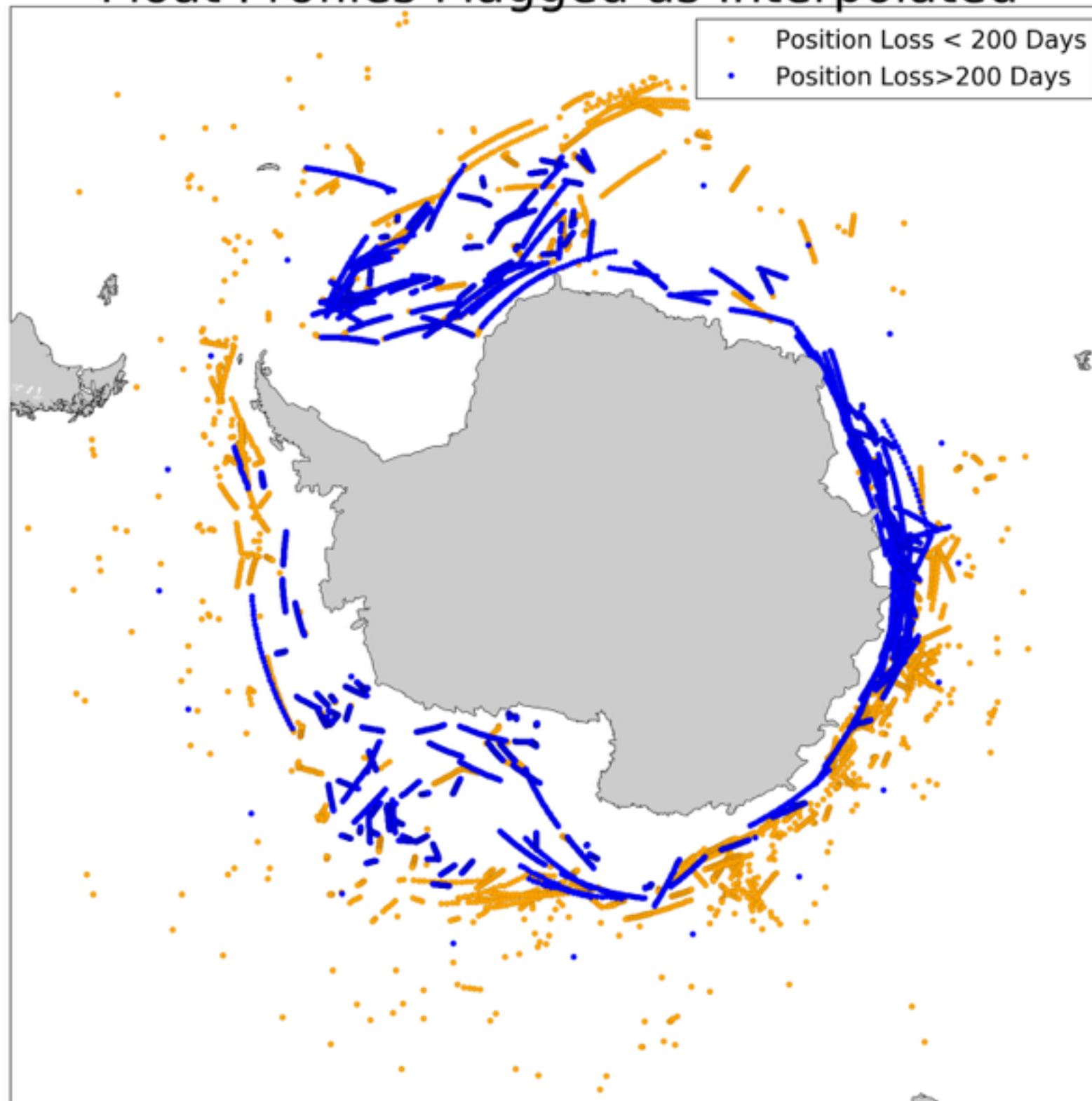


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credit: <http://www.argo.ucsd.edu/>

Motivation

Float Profiles Flagged as Interpolated



Complete
Argo Dataset
South of 50 S

Source: Argo float data and metadata from
Global Data Assembly Centre (Argo
GDAC), doi:10.17882/42182.

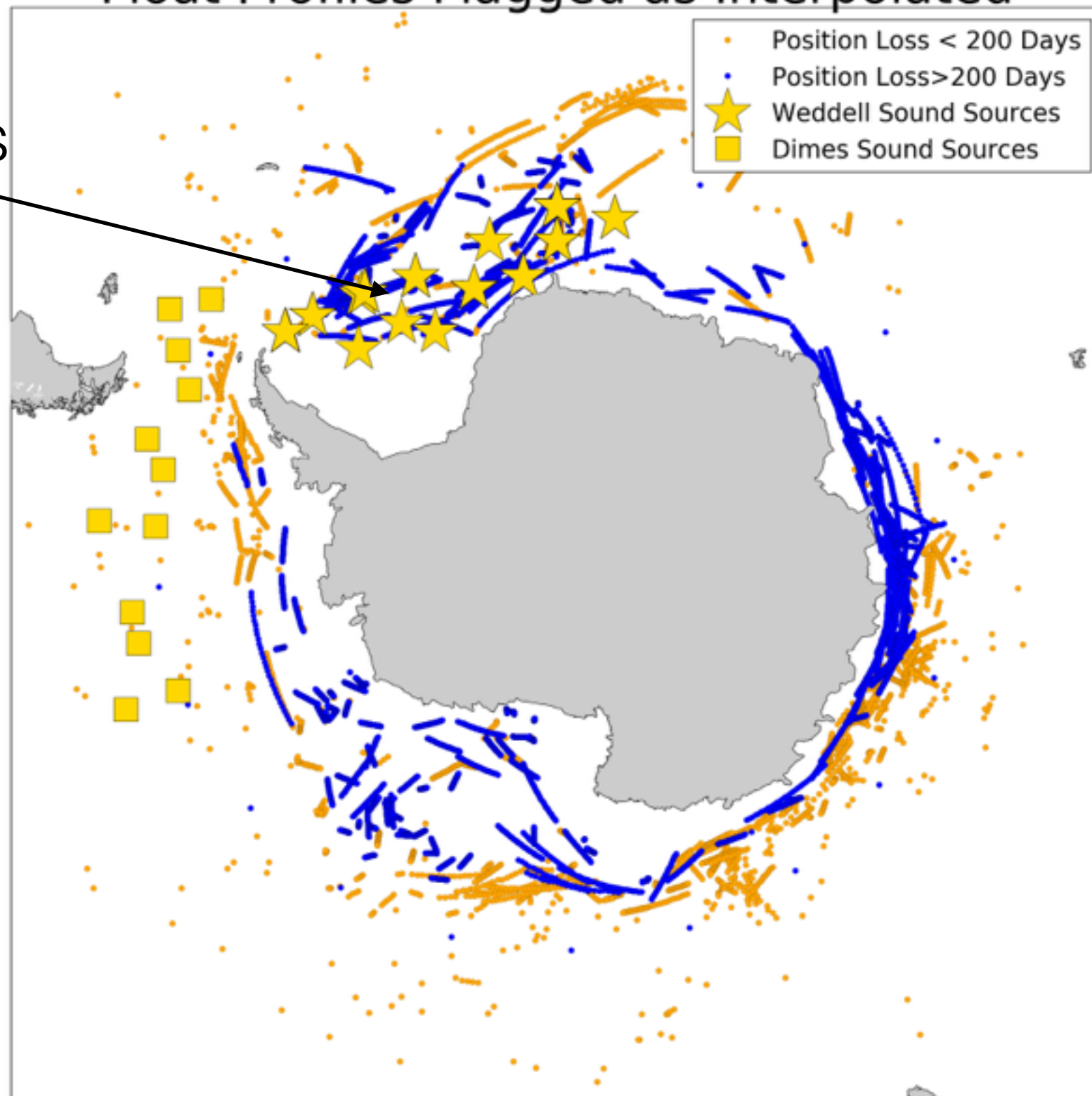


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Motivation

Float Profiles Flagged as Interpolated

AWI Sources

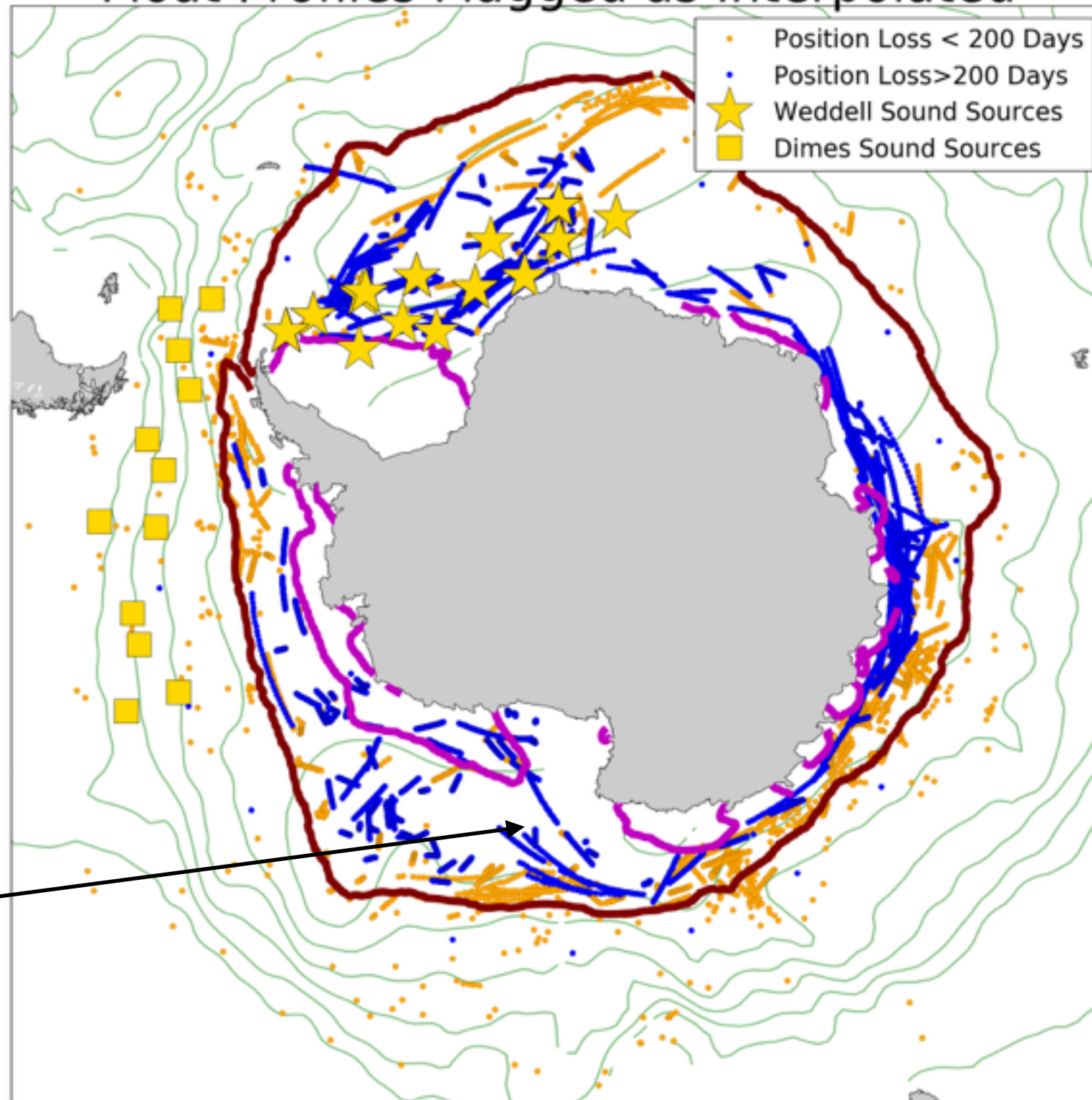


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Source: Klatt et al. 2007

Motivation

Float Profiles Flagged as Interpolated



Complete
Argo Dataset
South of 50 S

Linear
Interpolation

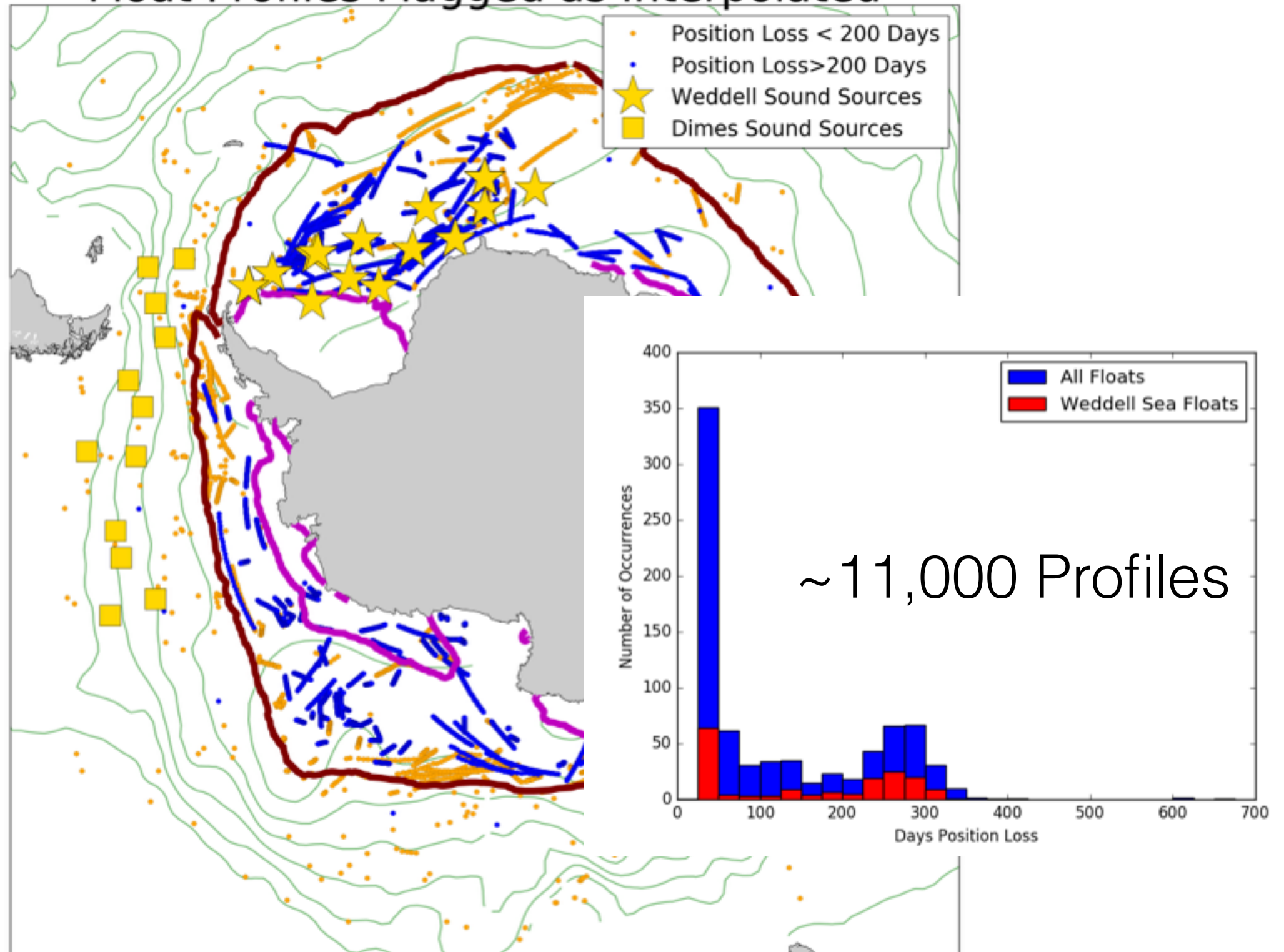


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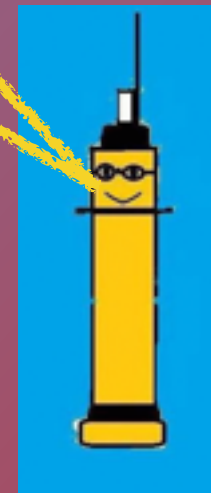
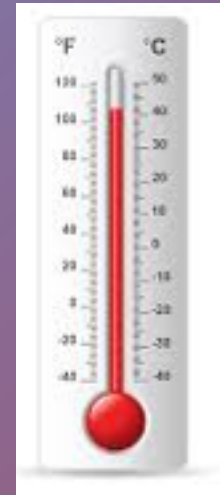
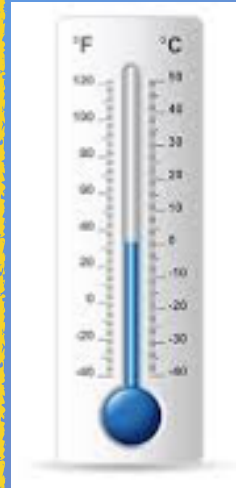
Source: SEANOE (2000), Gray and Riser (2014)

Motivation

Float Profiles Flagged as Interpolated



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interpolated
track

actual track

$\sigma^{??}$

Representation Error



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Observing the ice covered Weddell Sea with profiling floats: position uncertainties and correlation statistics

**Paul Chamberlain,
Lynne D. Talley,
Matthew Mazloff,
Stephen Riser,
Kevin Speer,
Alison R. Gray**

Recap

SOUND SOURCES



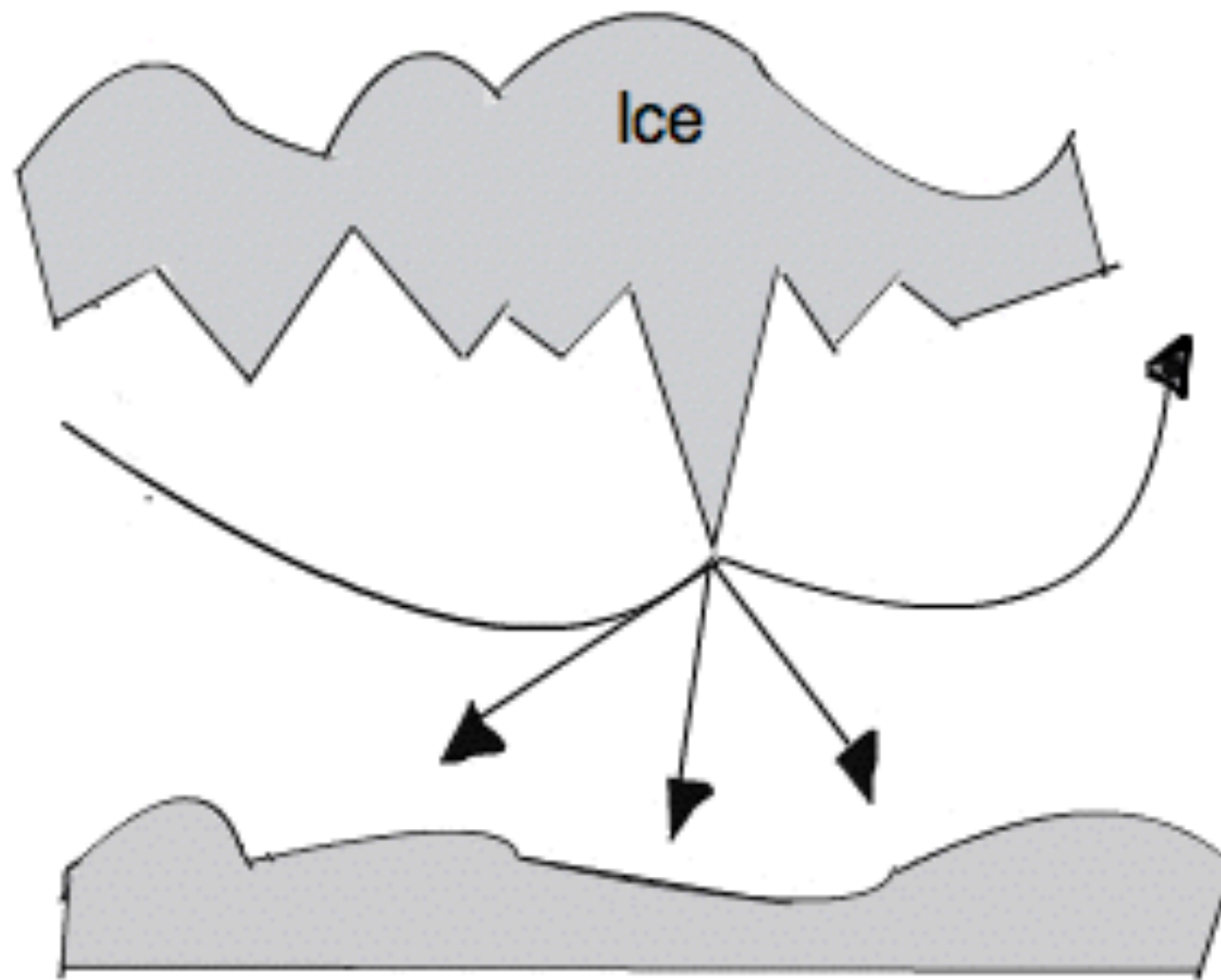
LINE OF POSITION

FLOAT

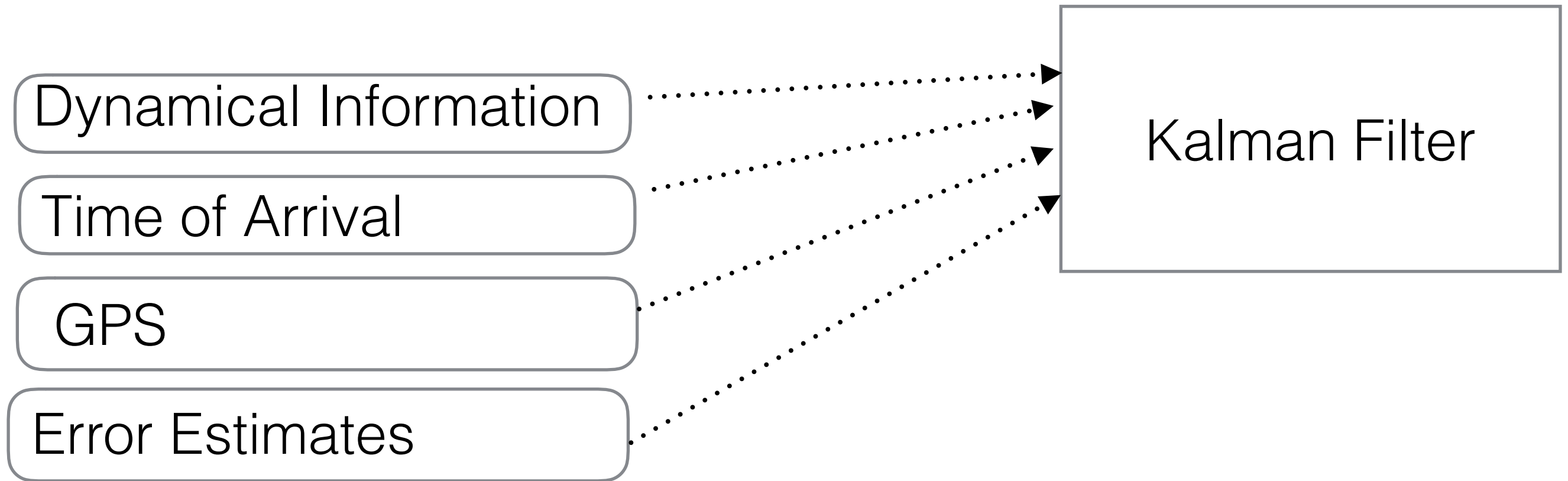


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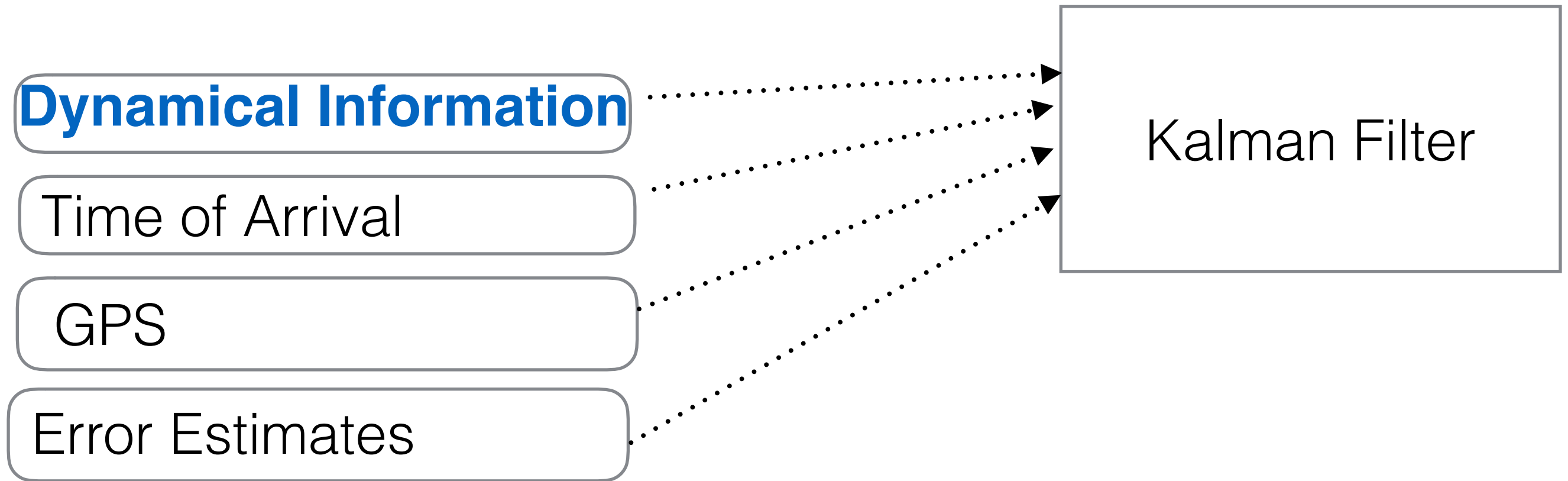
Recap



Framework



Framework



$$x(t + 1) = x(t) + \Delta t \times \dot{x}(t)$$



Framework

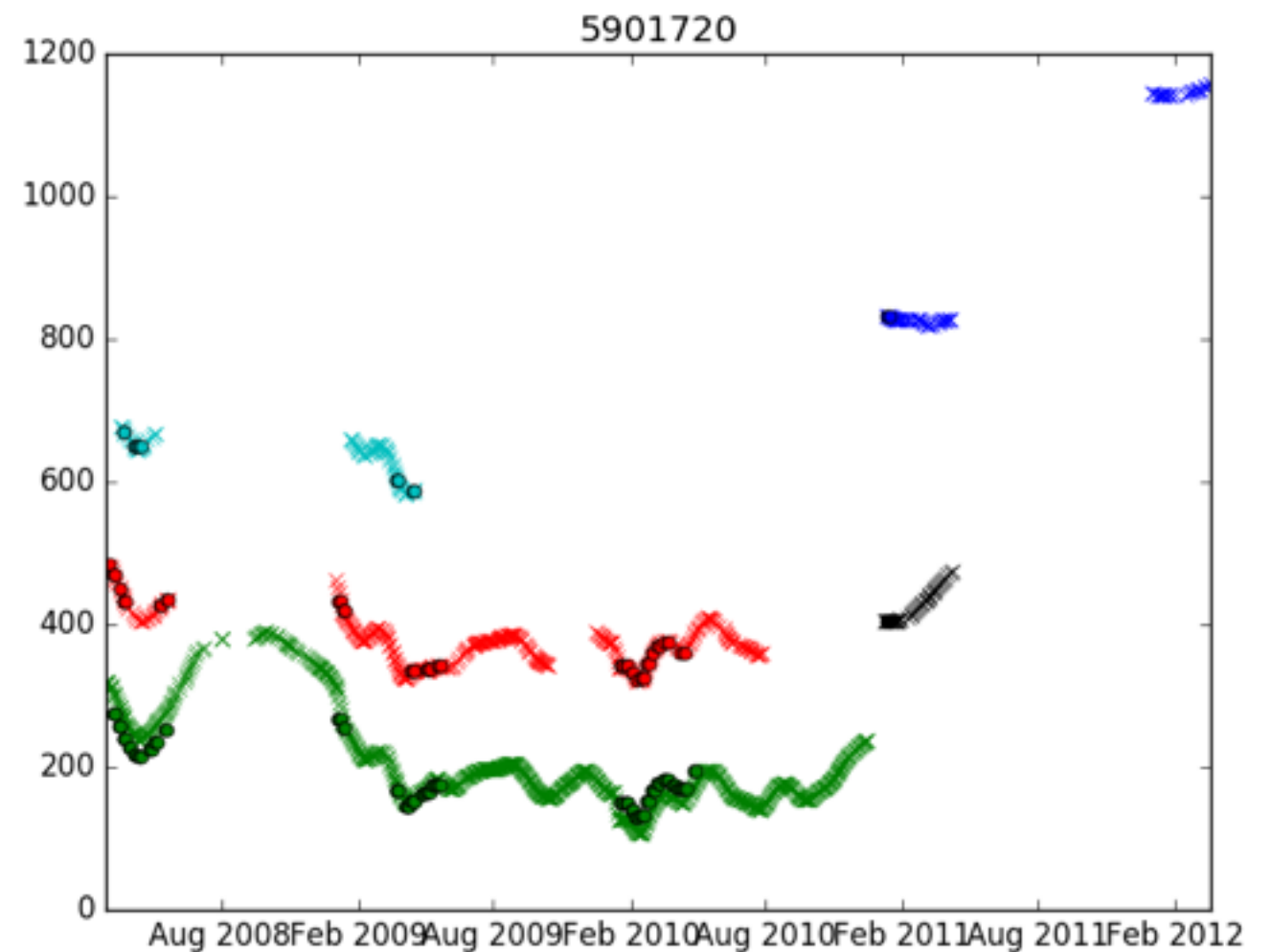
Dynamical Information

Time of Arrival

GPS

Error Estimates

Kalman Filter



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Framework

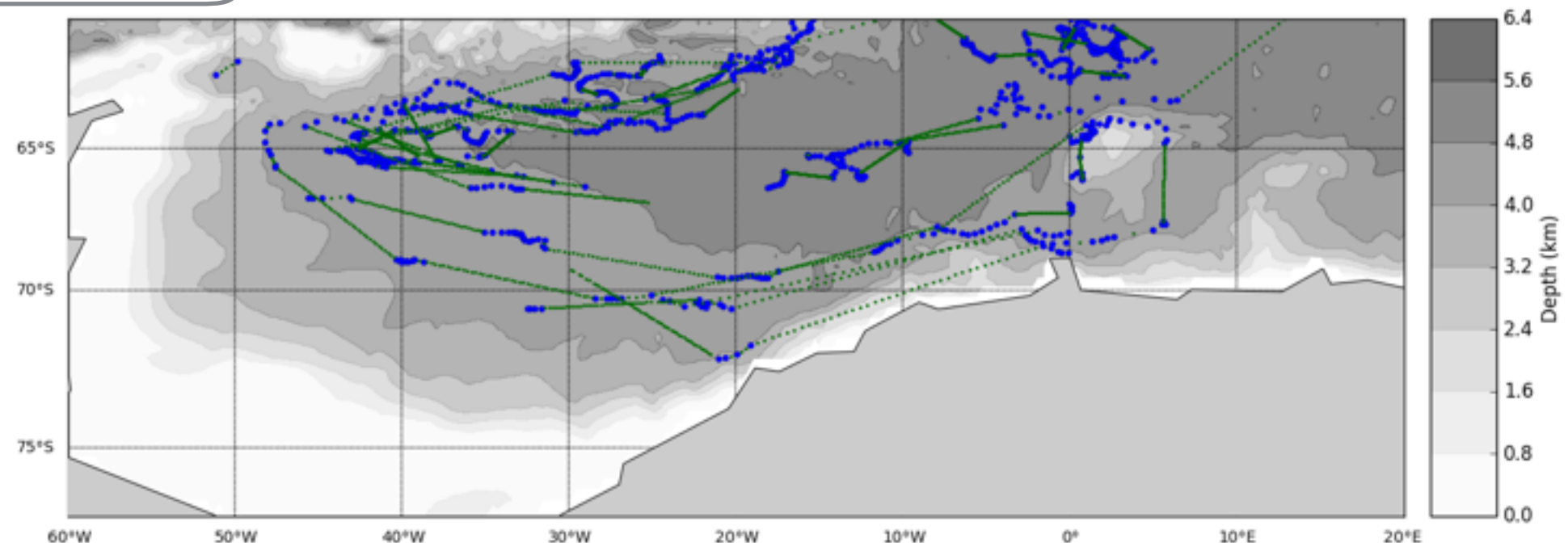
Dynamical Information

Time of Arrival

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Error Estimates

Kalman Filter



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Framework

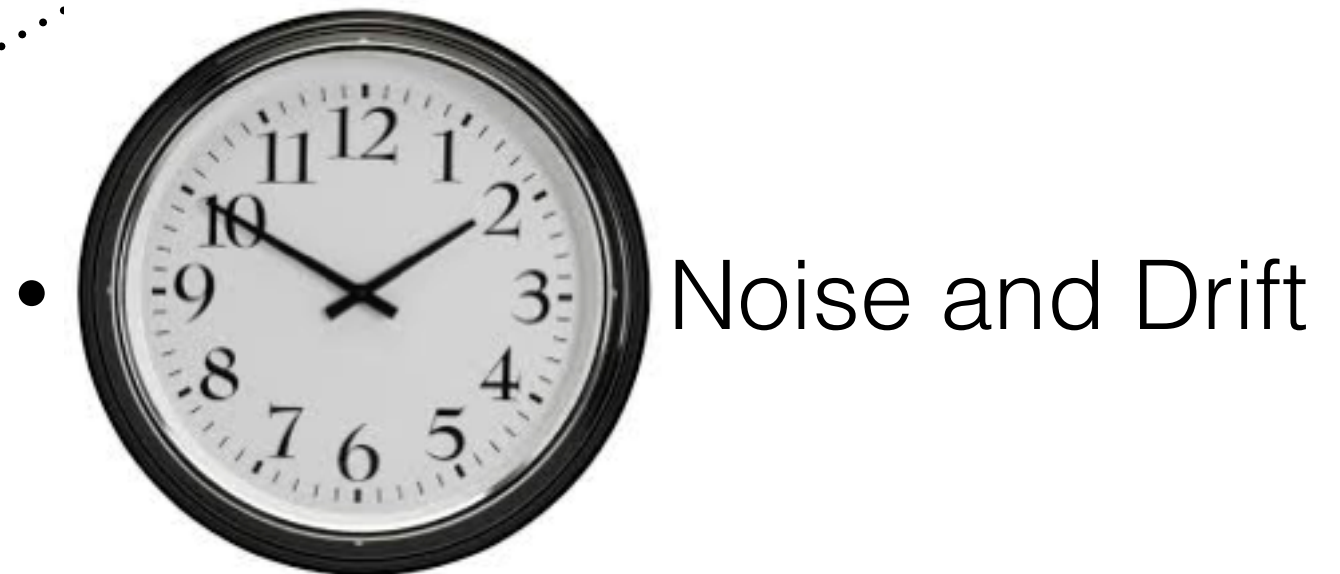
Dynamical Information

Time of Arrival

GPS

Error Estimates

Kalman Filter



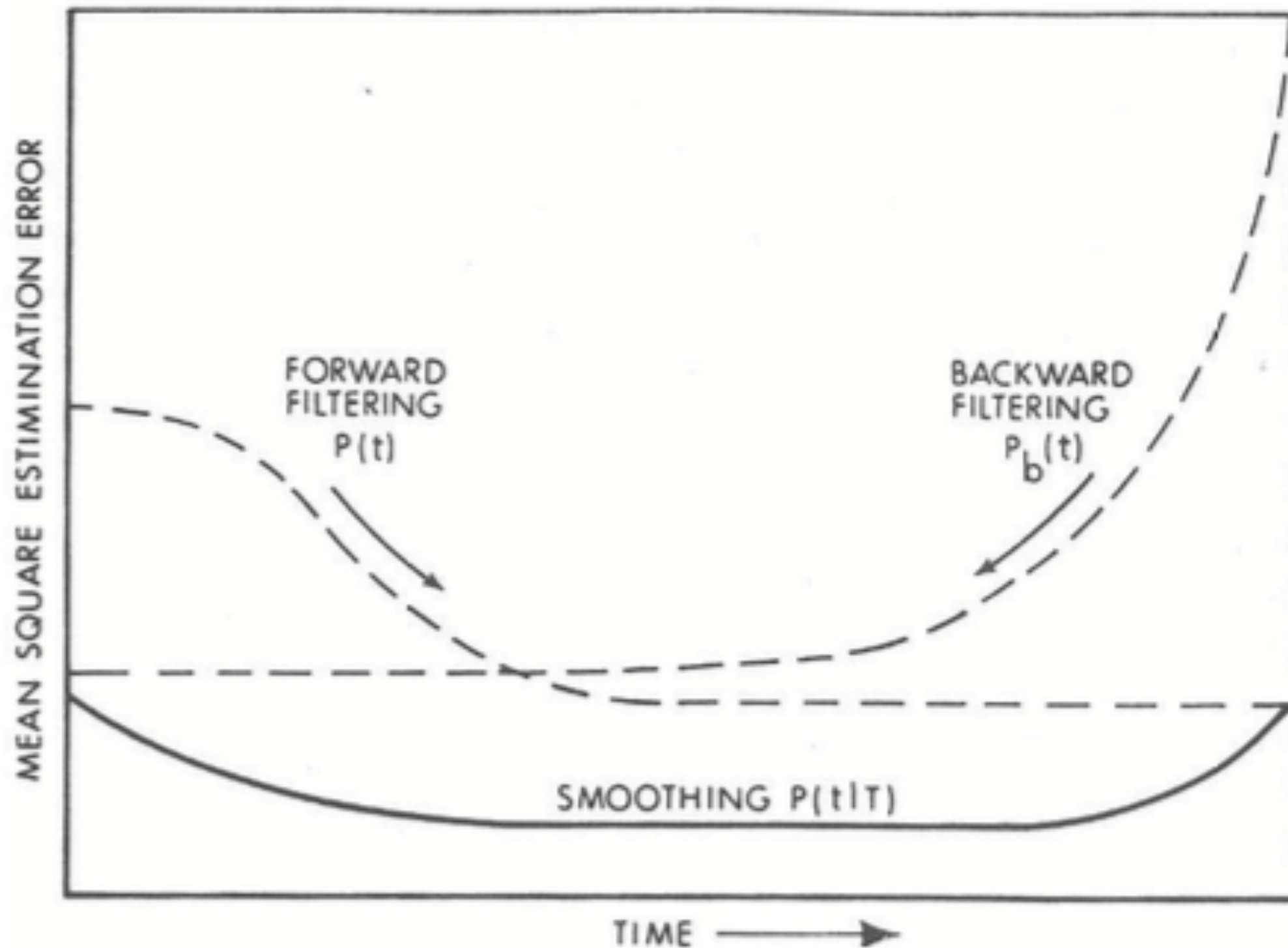
• Noise and Drift

- Process Position Noise
- Process Velocity Noise



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Framework



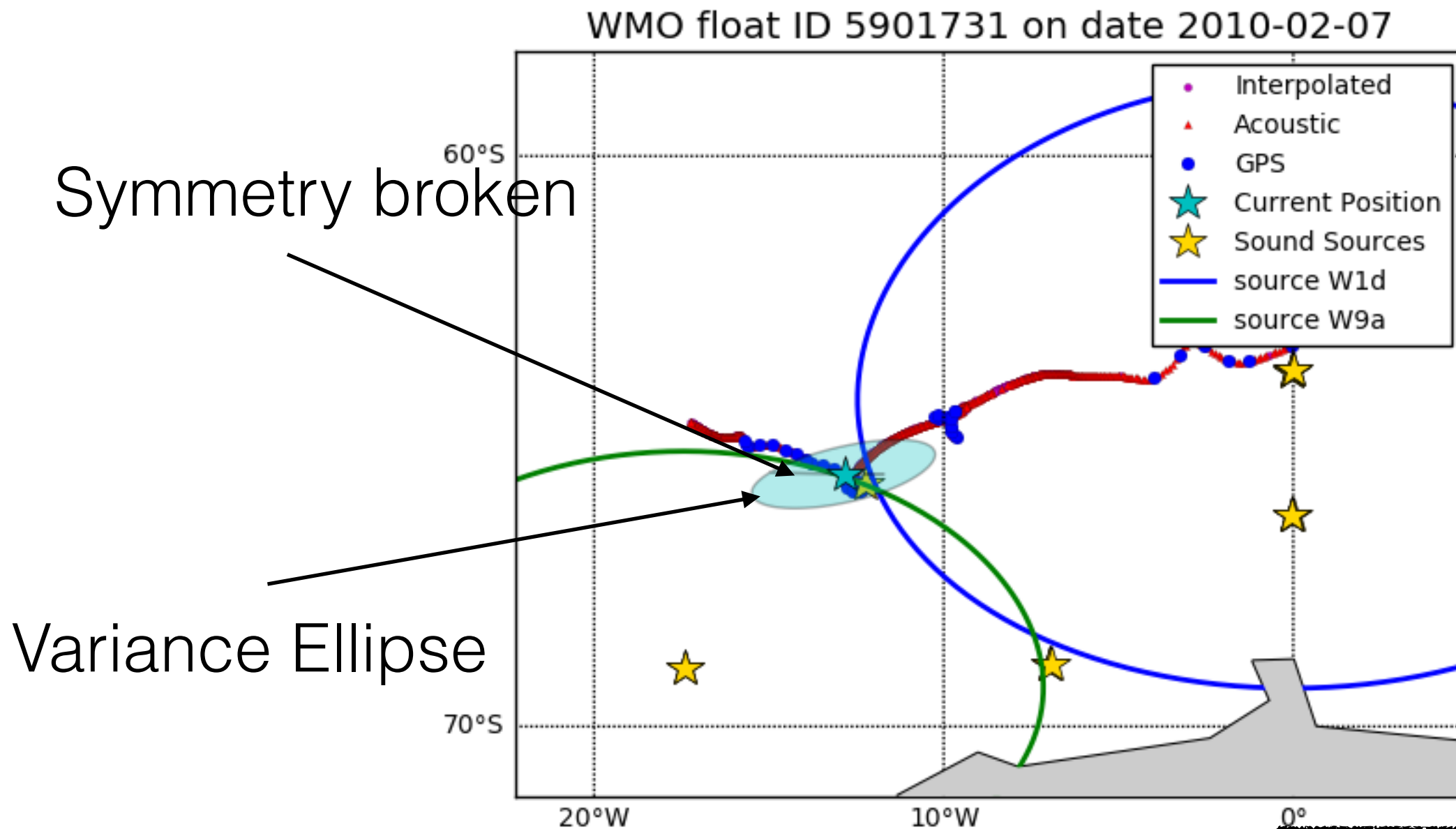


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Application of a Kalman Smoother to Acoustic Time of Arrival Data in the Weddell Sea (In progress).

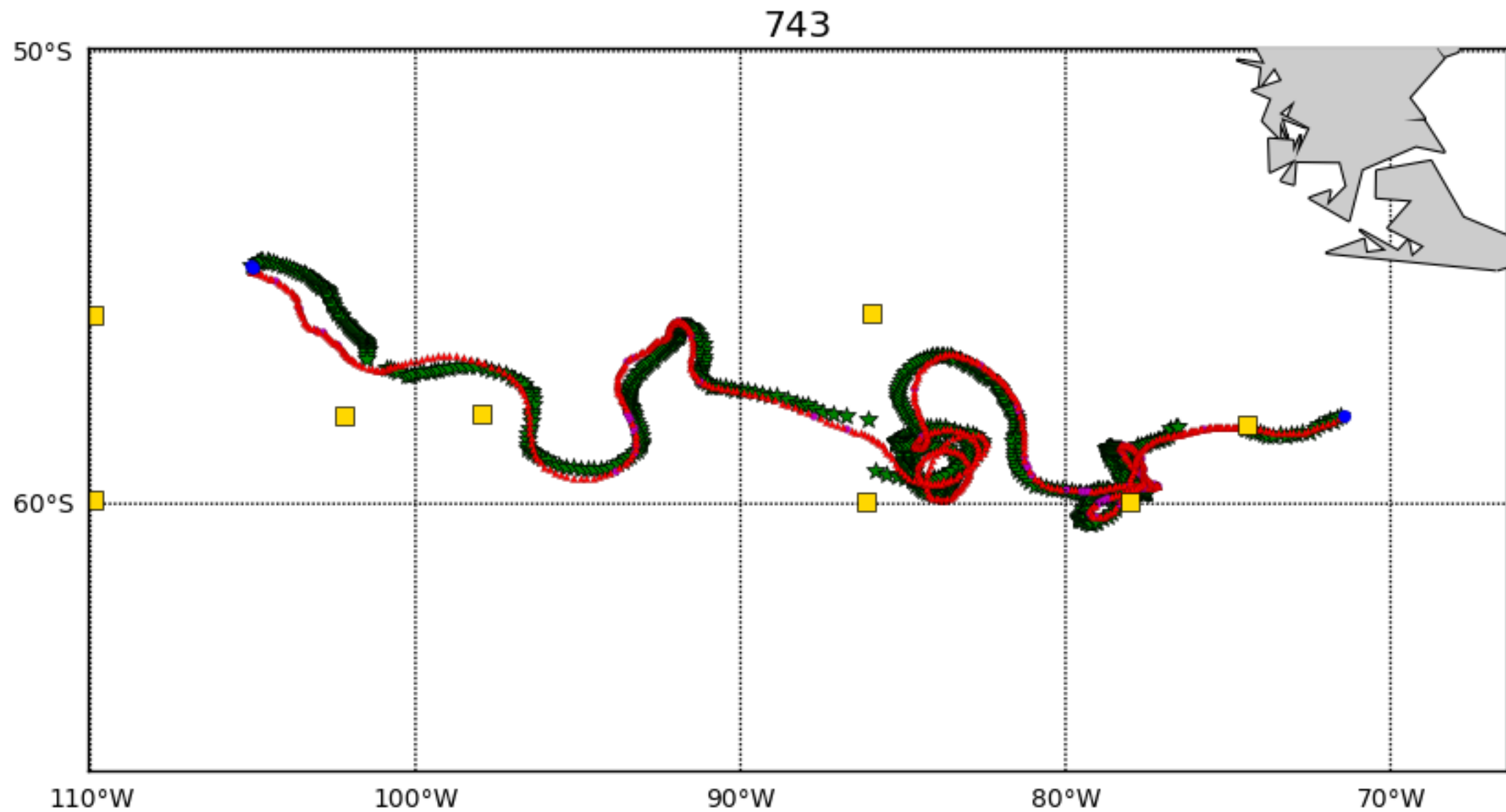
**Paul Chamberlain,
Bruce Cornuelle,
Lynne D. Talley,
Kevin Speer,
Cathrine Hancock,
Steve Riser**

Individual Tracking



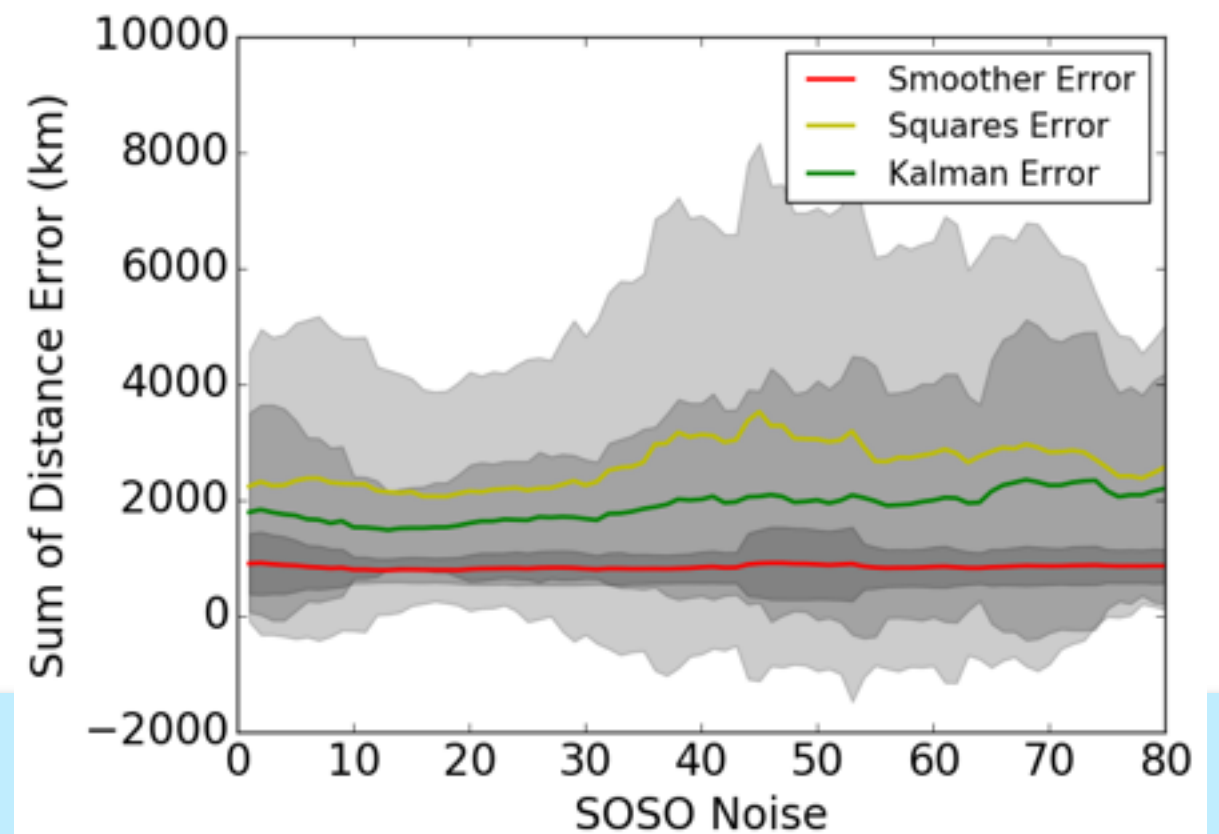
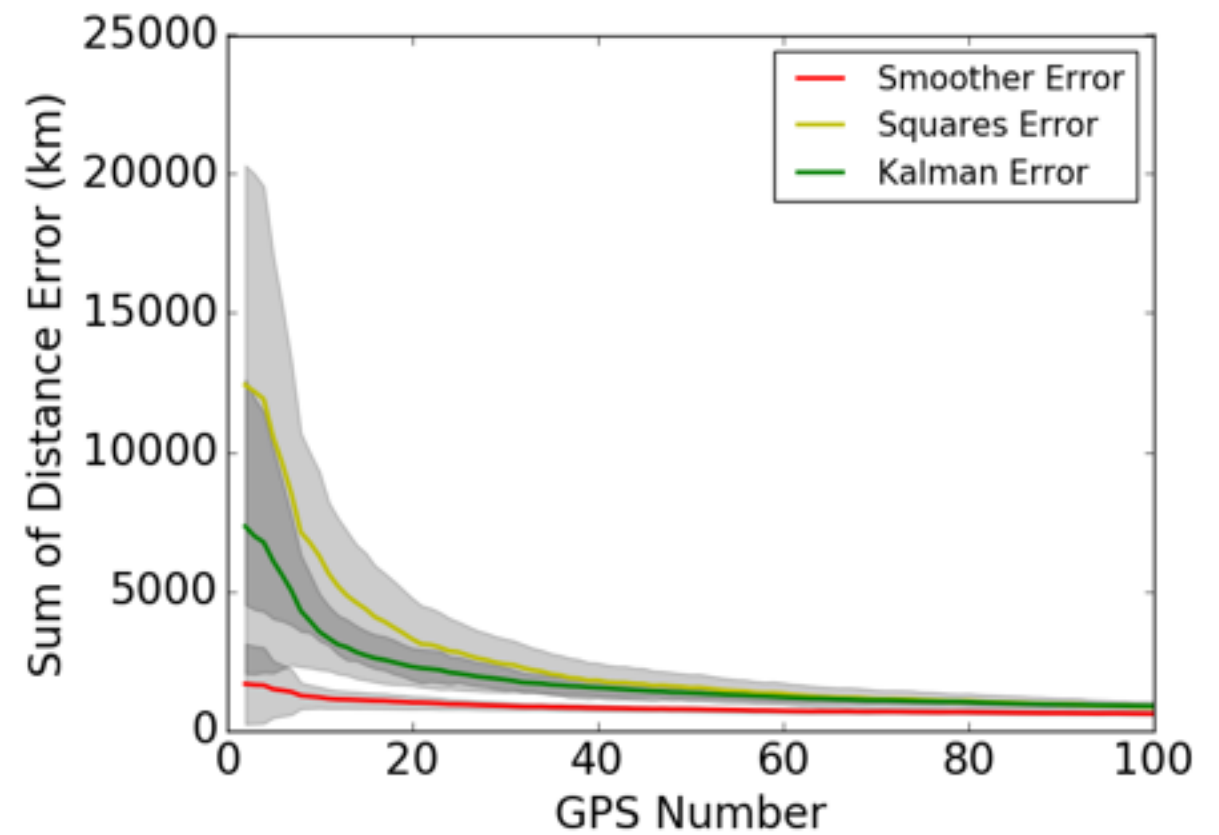
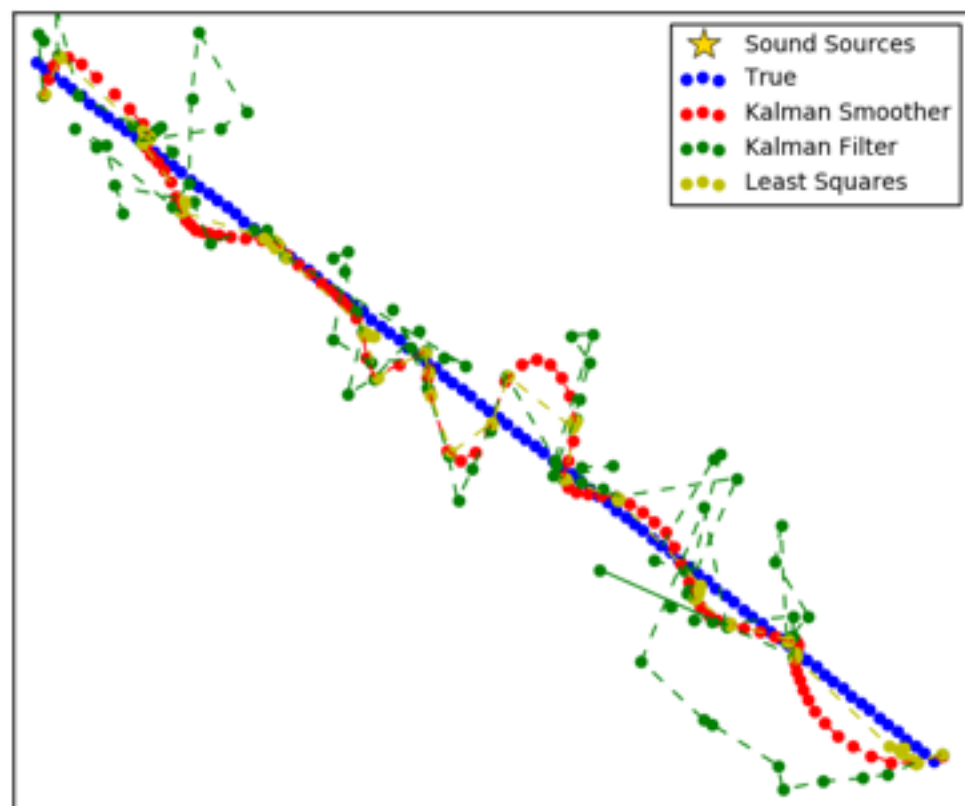
Riser and Speer
Experiment
(2009-2012)

Validation

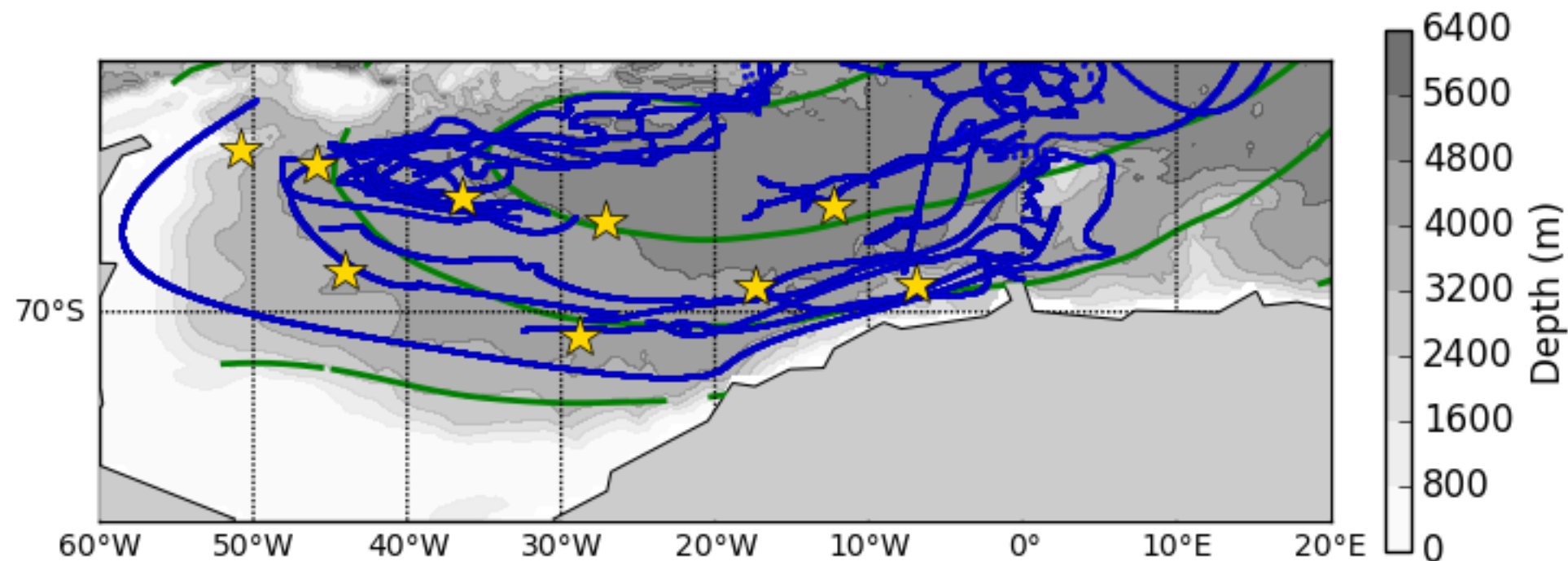


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Validation



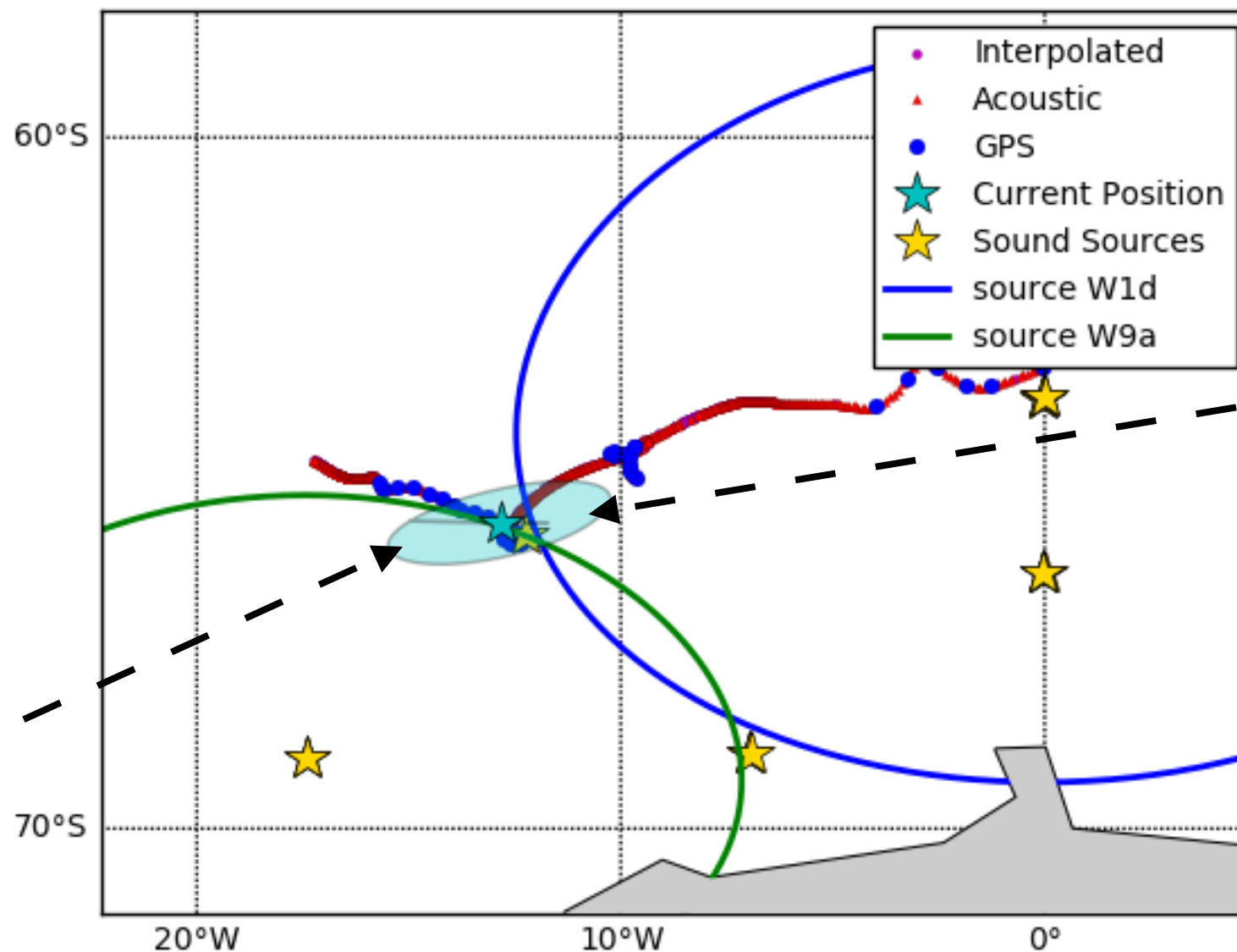
Weddell Sea Acoustically Tracked Profiling Floats (21)



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Individual Tracking

WMO float ID 5901731 on date 2010-02-07



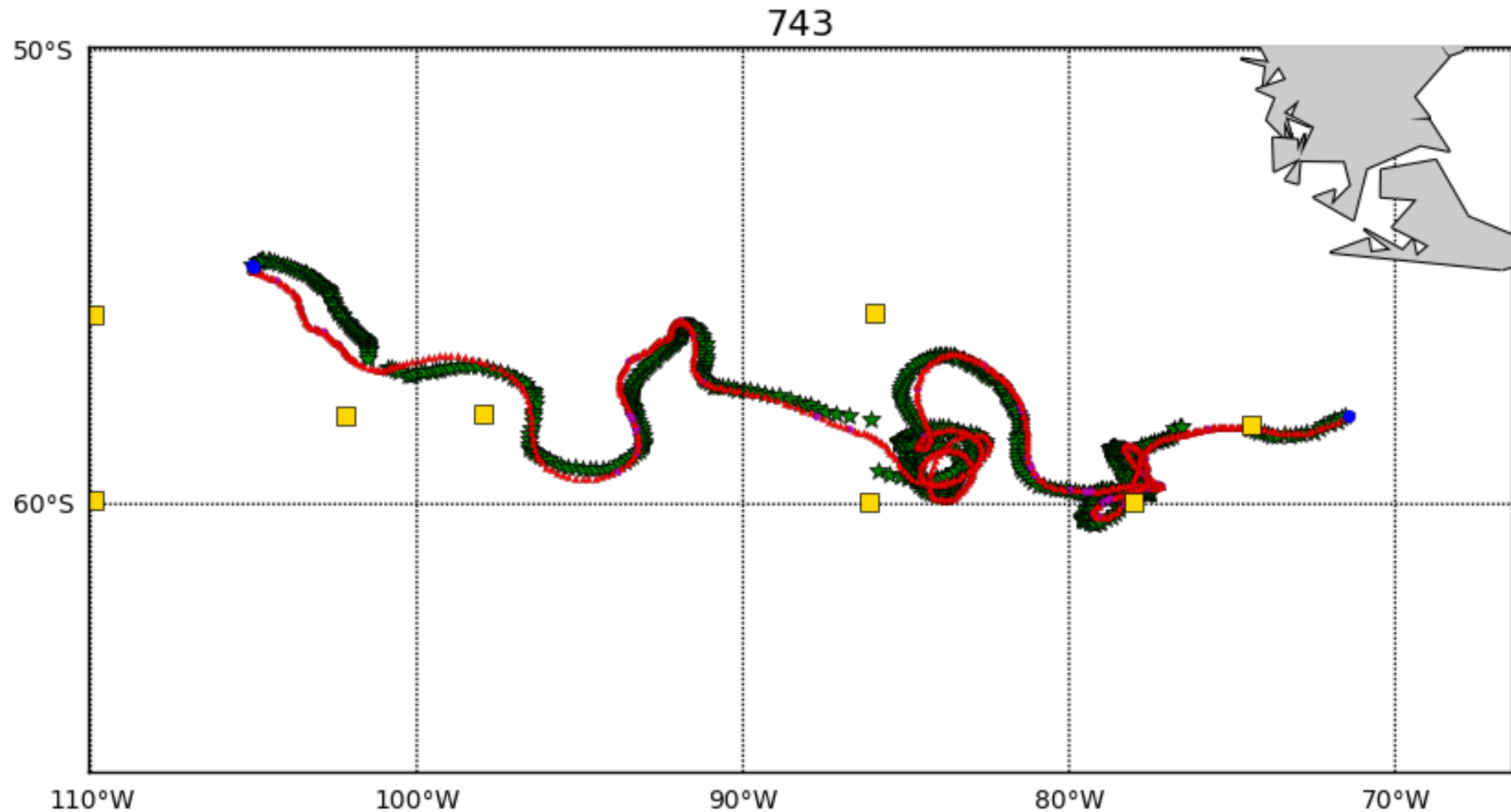
ambiguity
broken

Variance
ellipse



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DIMES inter comparison



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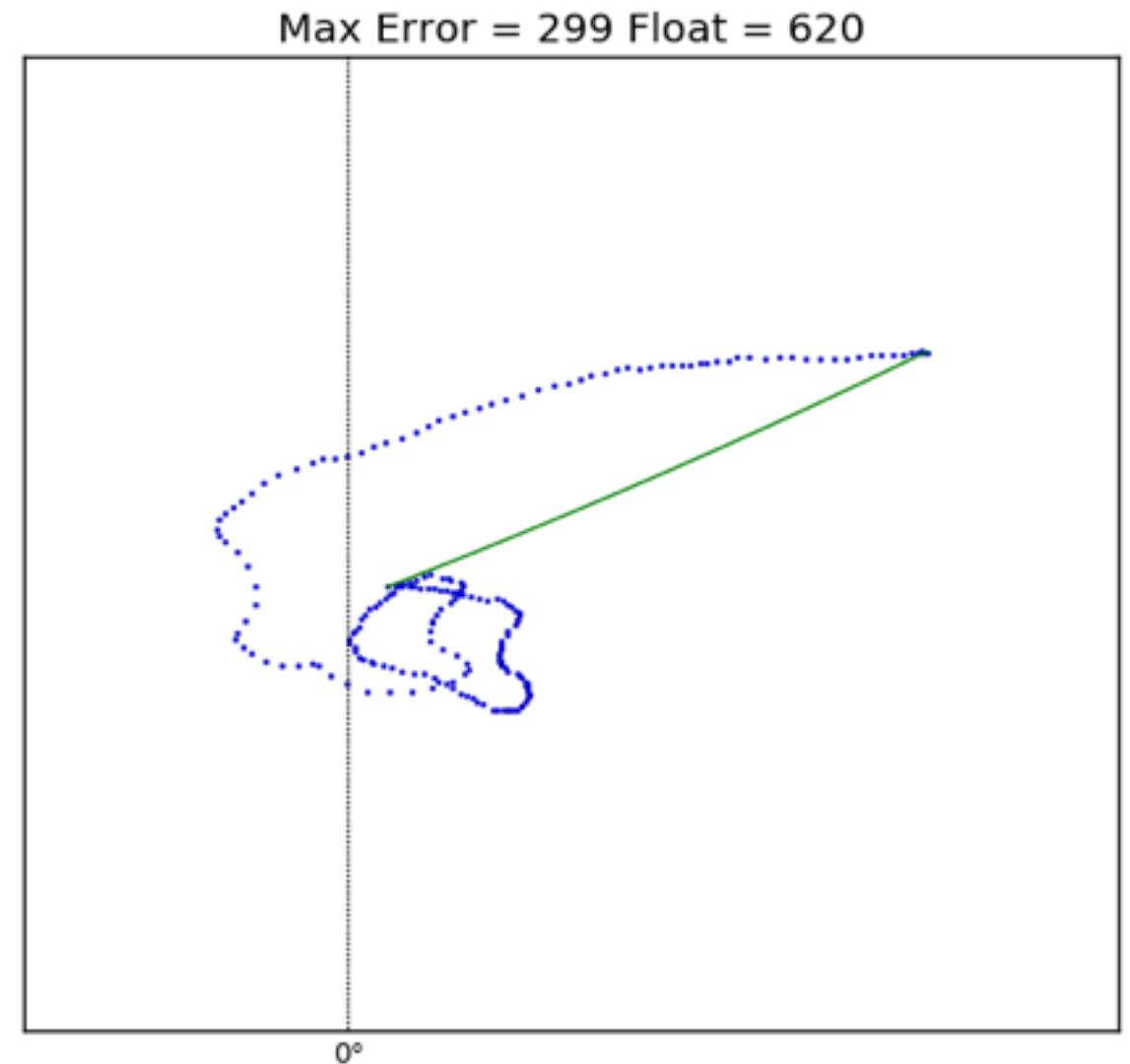
Summary

- Representation error in temperature and salinity of linear interpolation can be significant
- Sea ice attenuates sound signals
- Kalman smoother successfully estimates float tracks

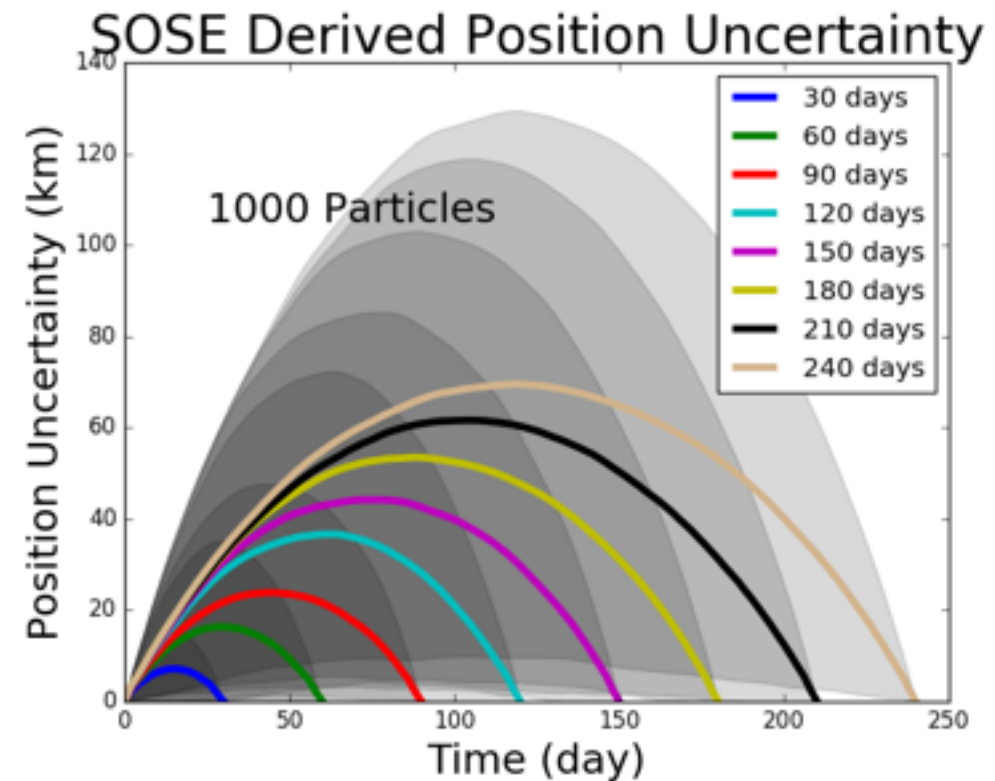
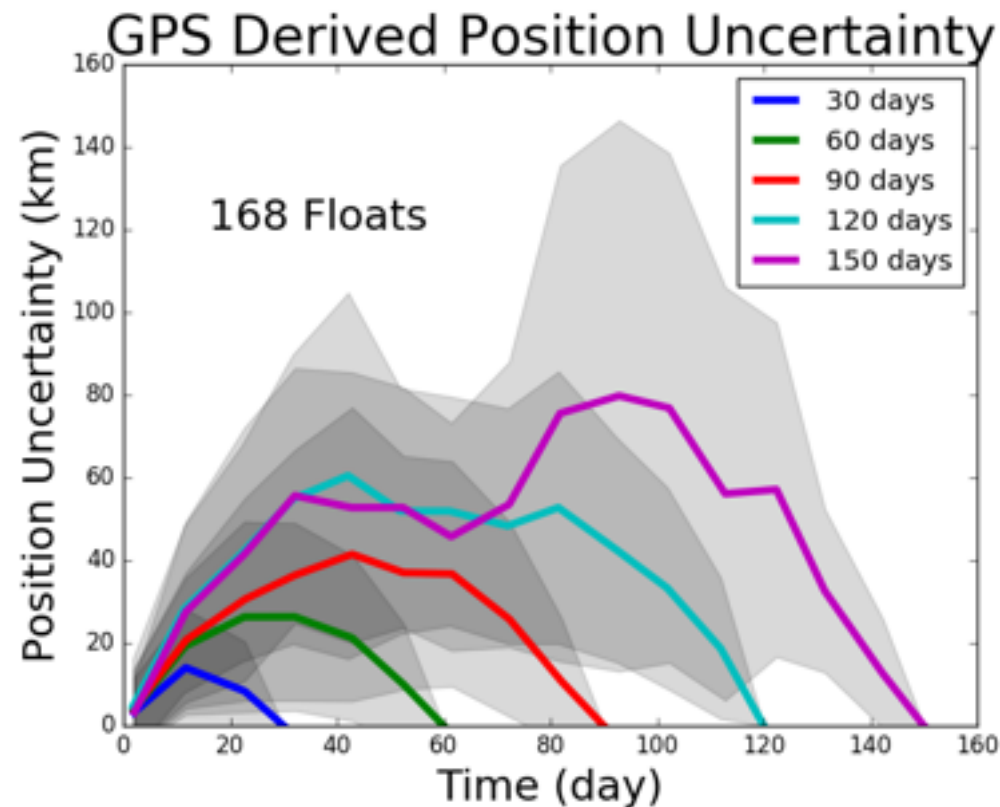


Position Uncertainty Experiment

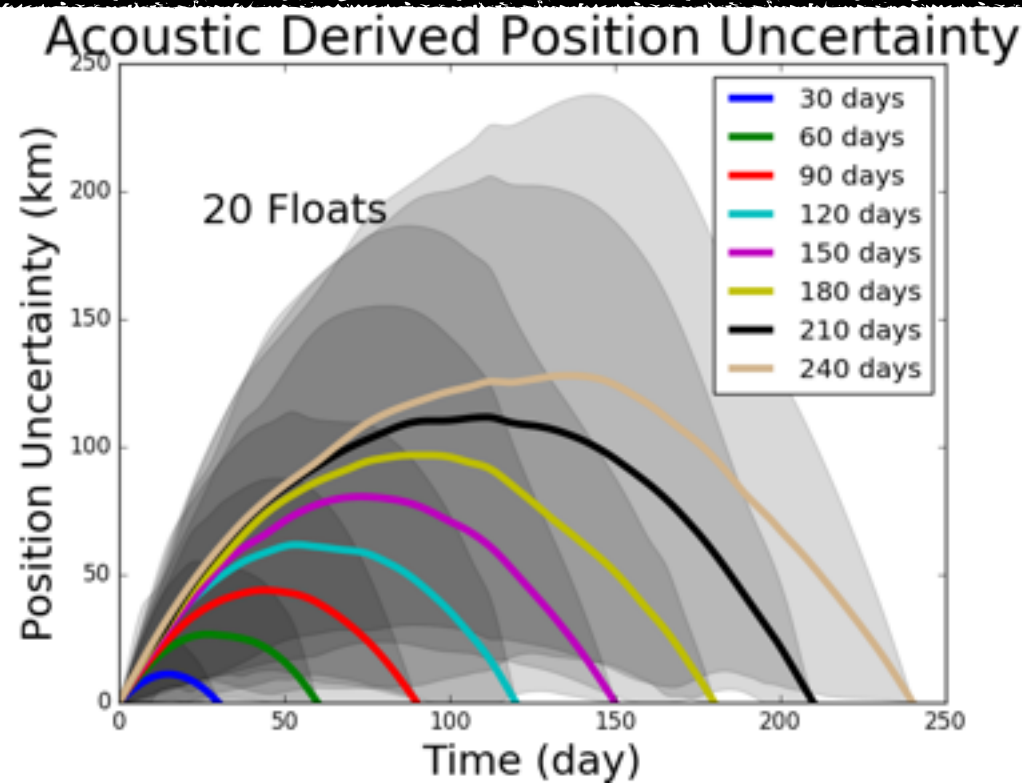
- Data withholding experiment:
 - Withhold position information in monthly intervals
 - Compare true position to linear interpolation
 - Run 1000 times
 - Average statistics
- GPS Argo = 10 day Interval
- Acoustic = Daily Interval
- SOSE = 2 day interval



Position Uncertainty Results

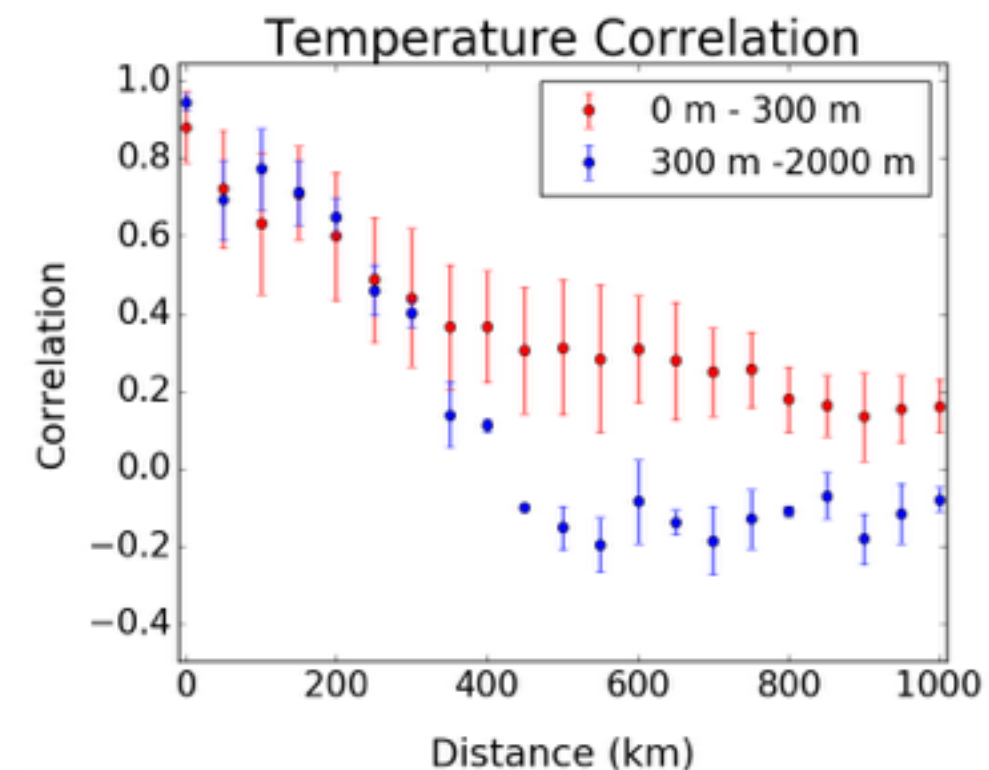
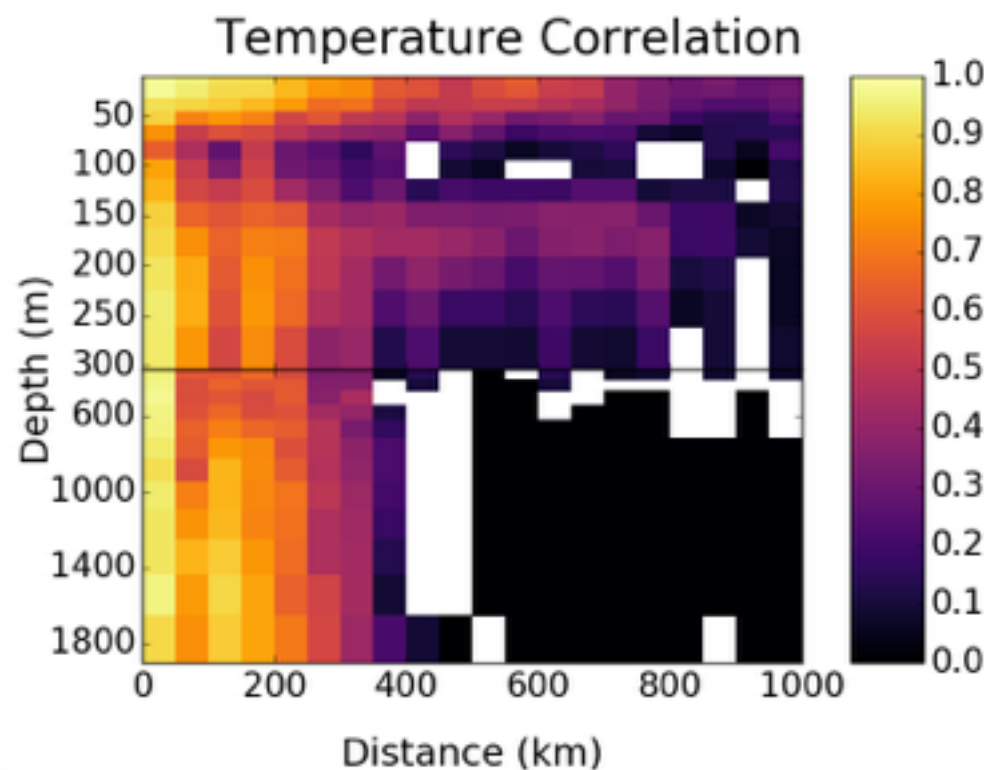
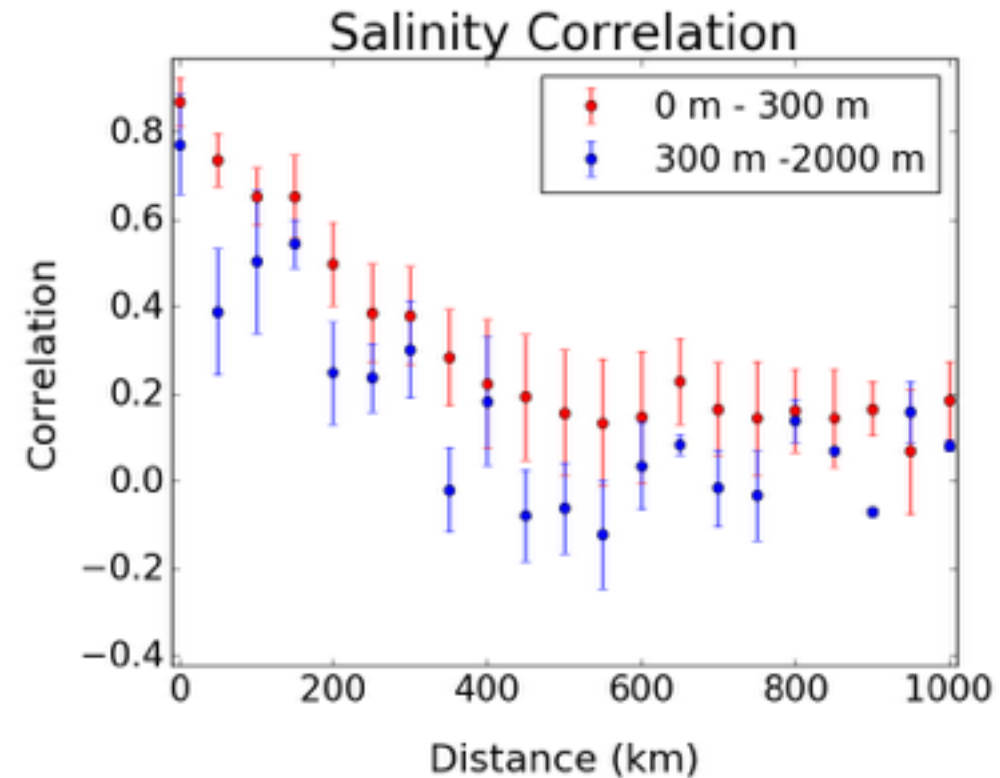
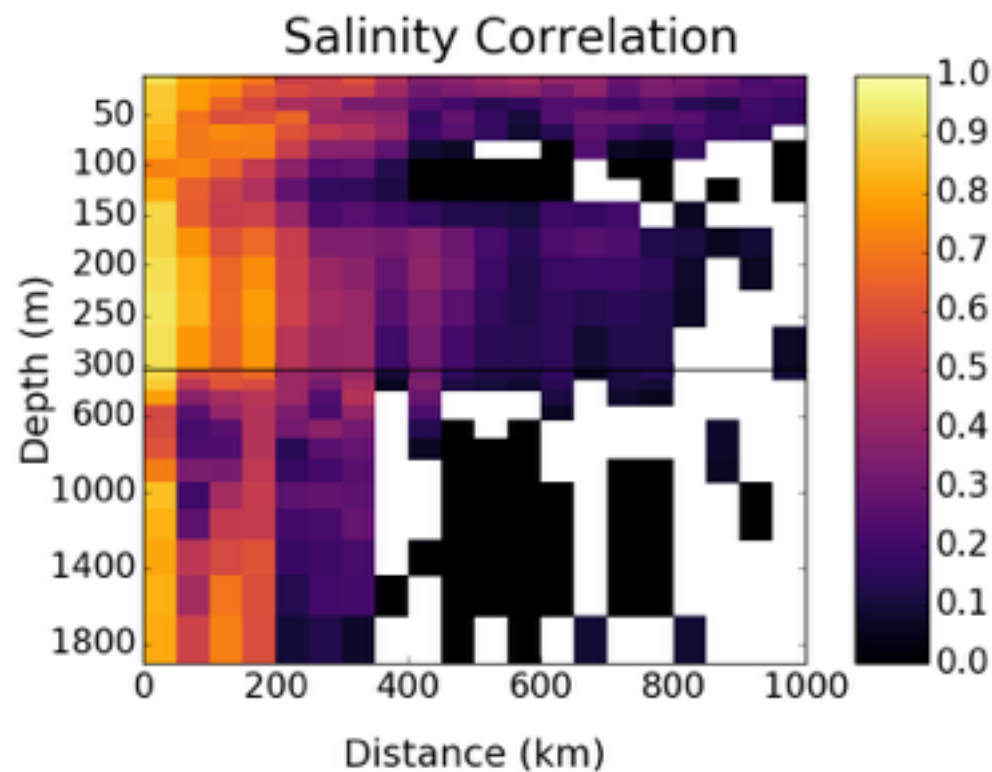


8 months under ice: ~120 km of error

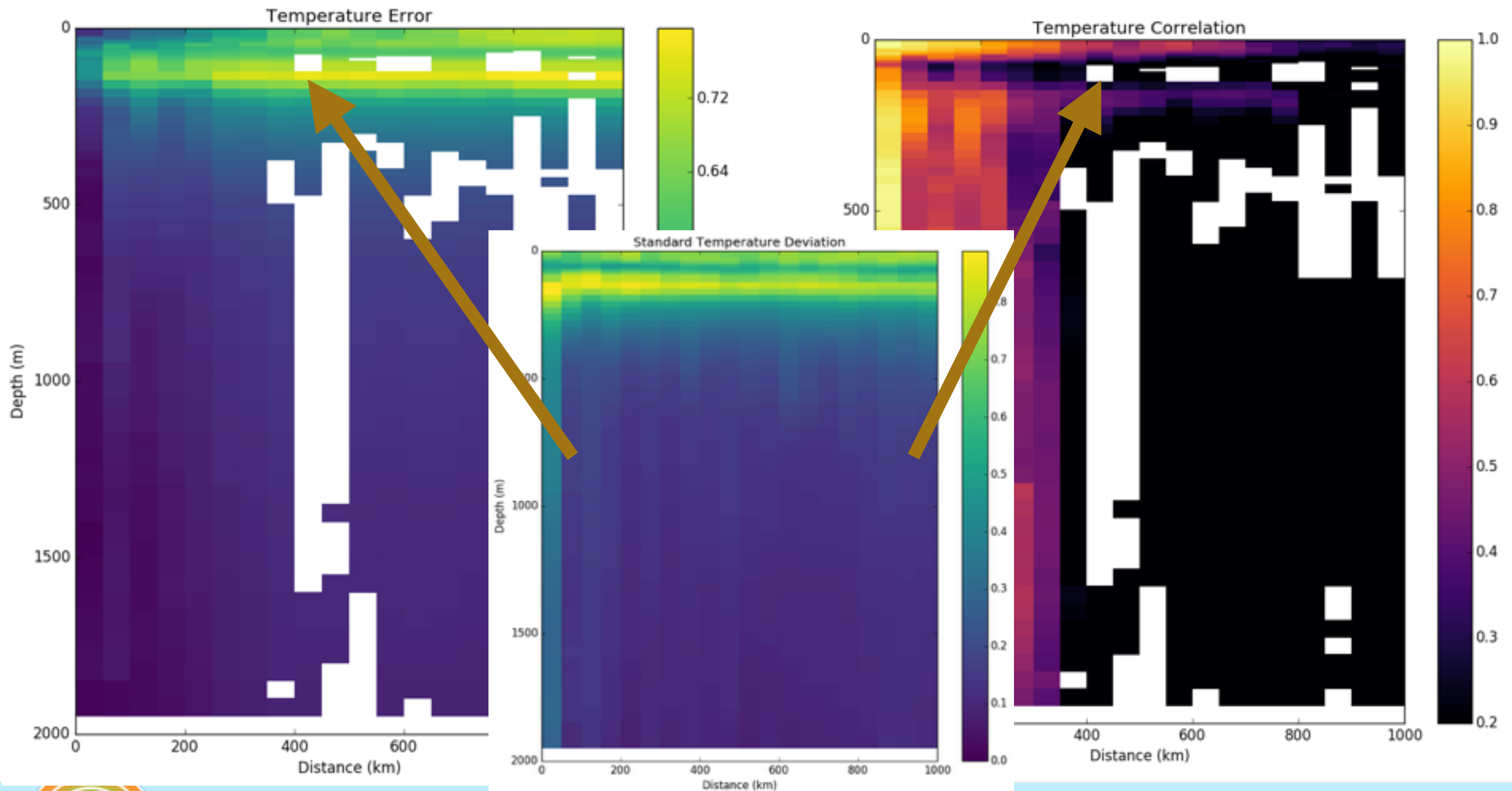


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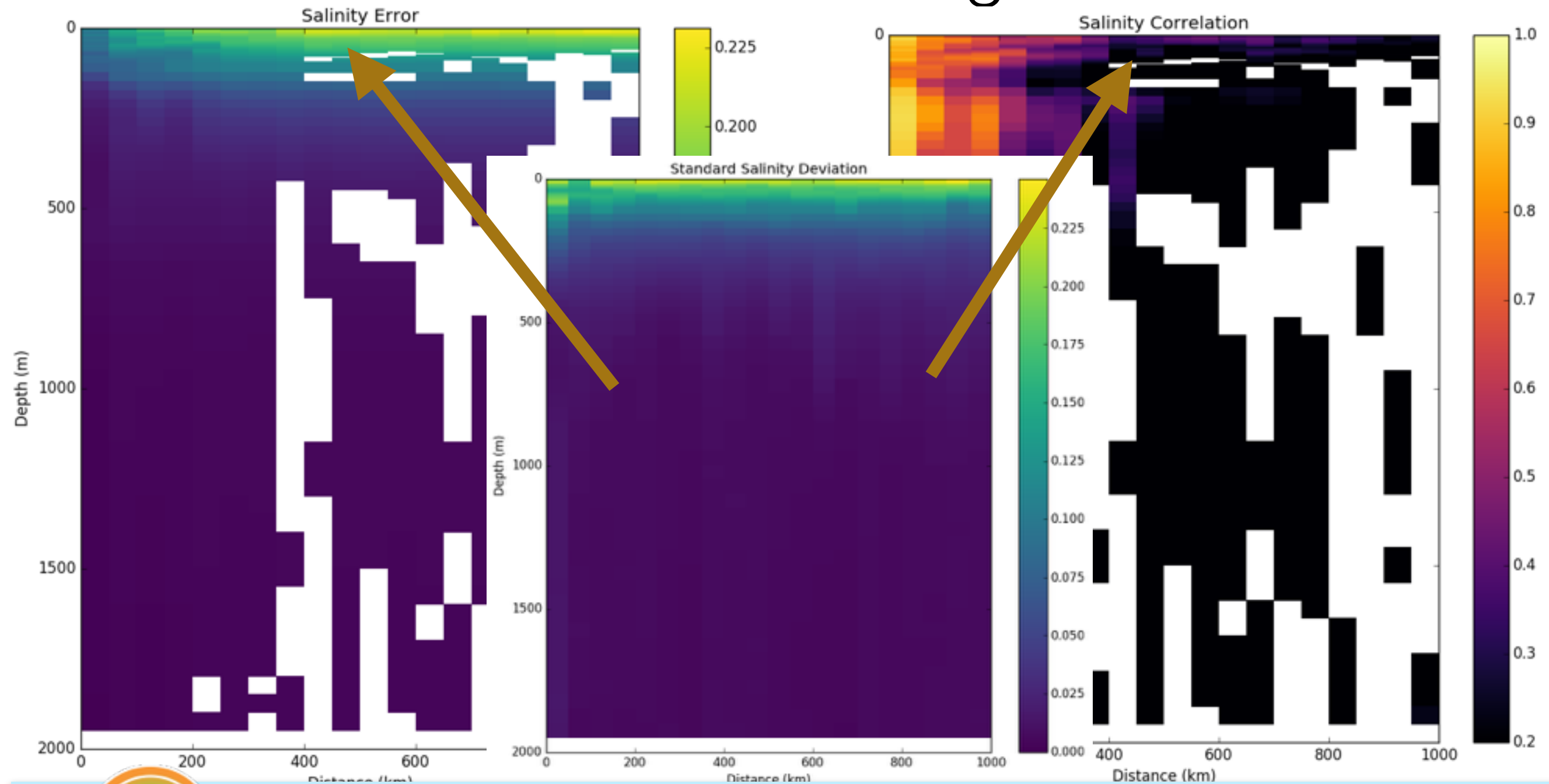
Correlation Results



Higher variability in the upper ocean makes representation error - even though correlation is higher



Higher variability in the Upper ocean makes representation error - even though correlation is higher



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Temperature and Salinity Uncertainties of Position Loss in Weddell Sea

