# A Promising Avenue for High Resolution Remote Sensing of SSS from Space

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Presented at the 2026 Ocean Salinity Science and Technology Meeting

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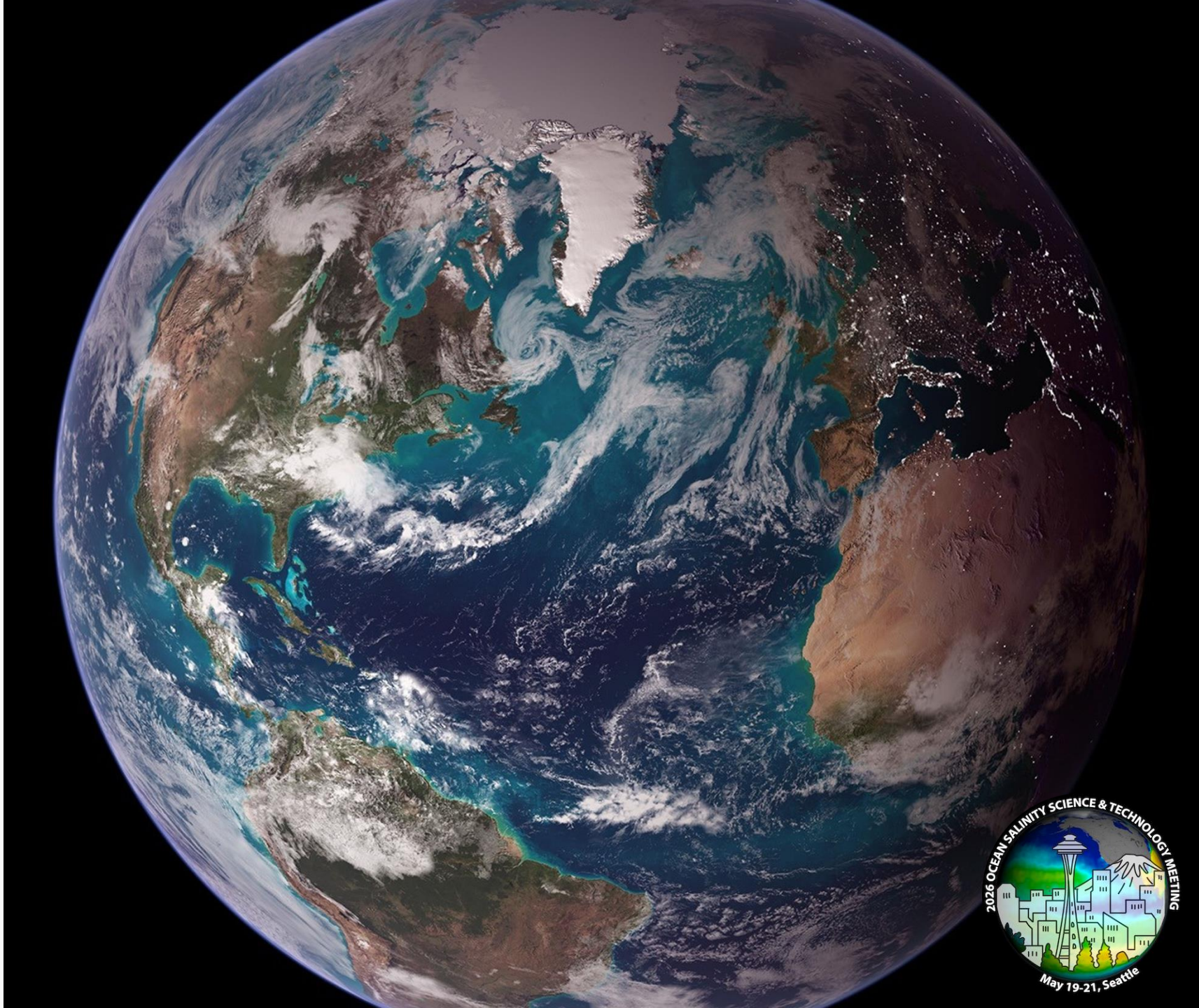
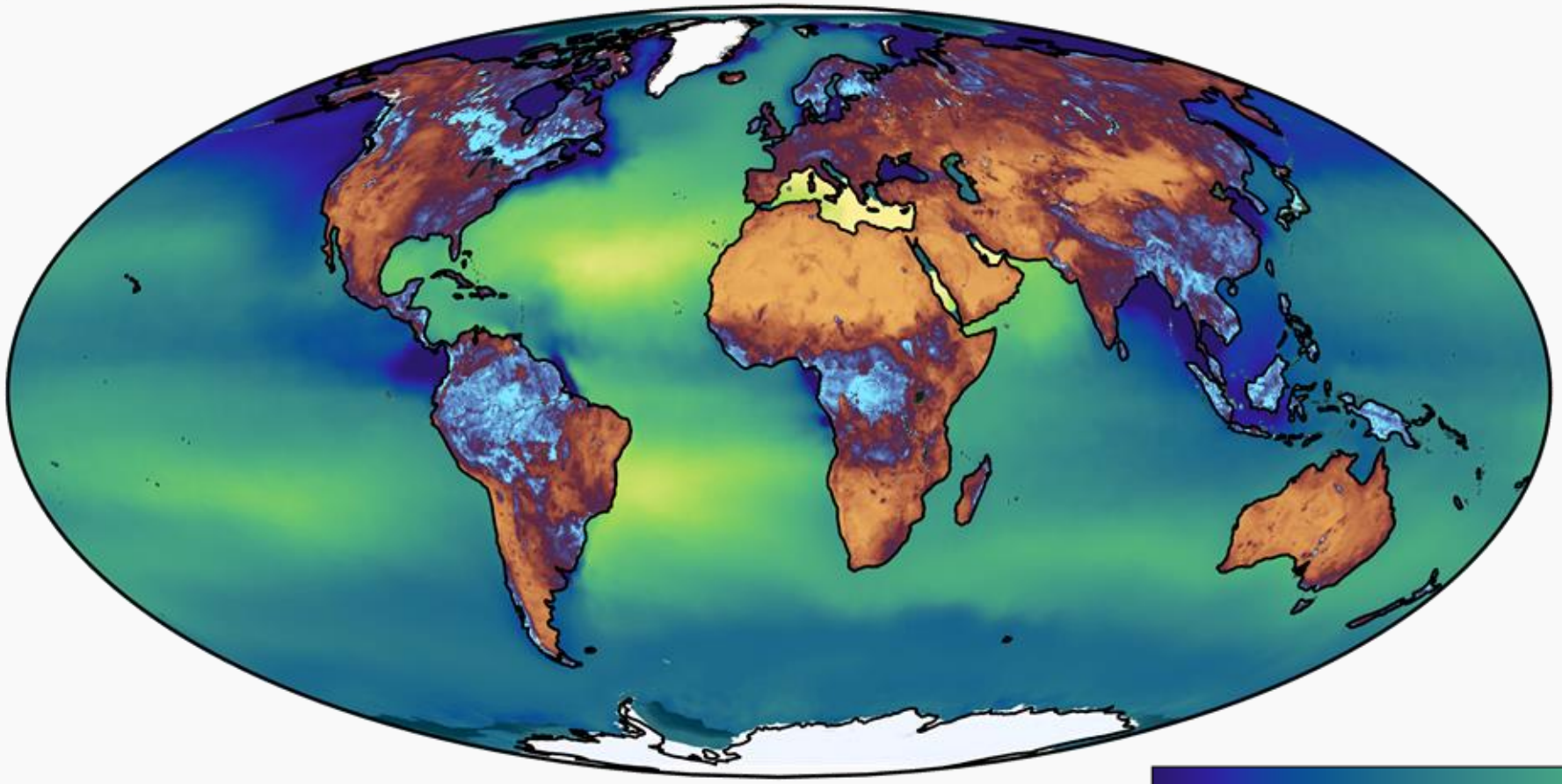
Jet Propulsion Laboratory
California Institute of Technology



## Our current view of Earth's surface from SMAP and SMOS

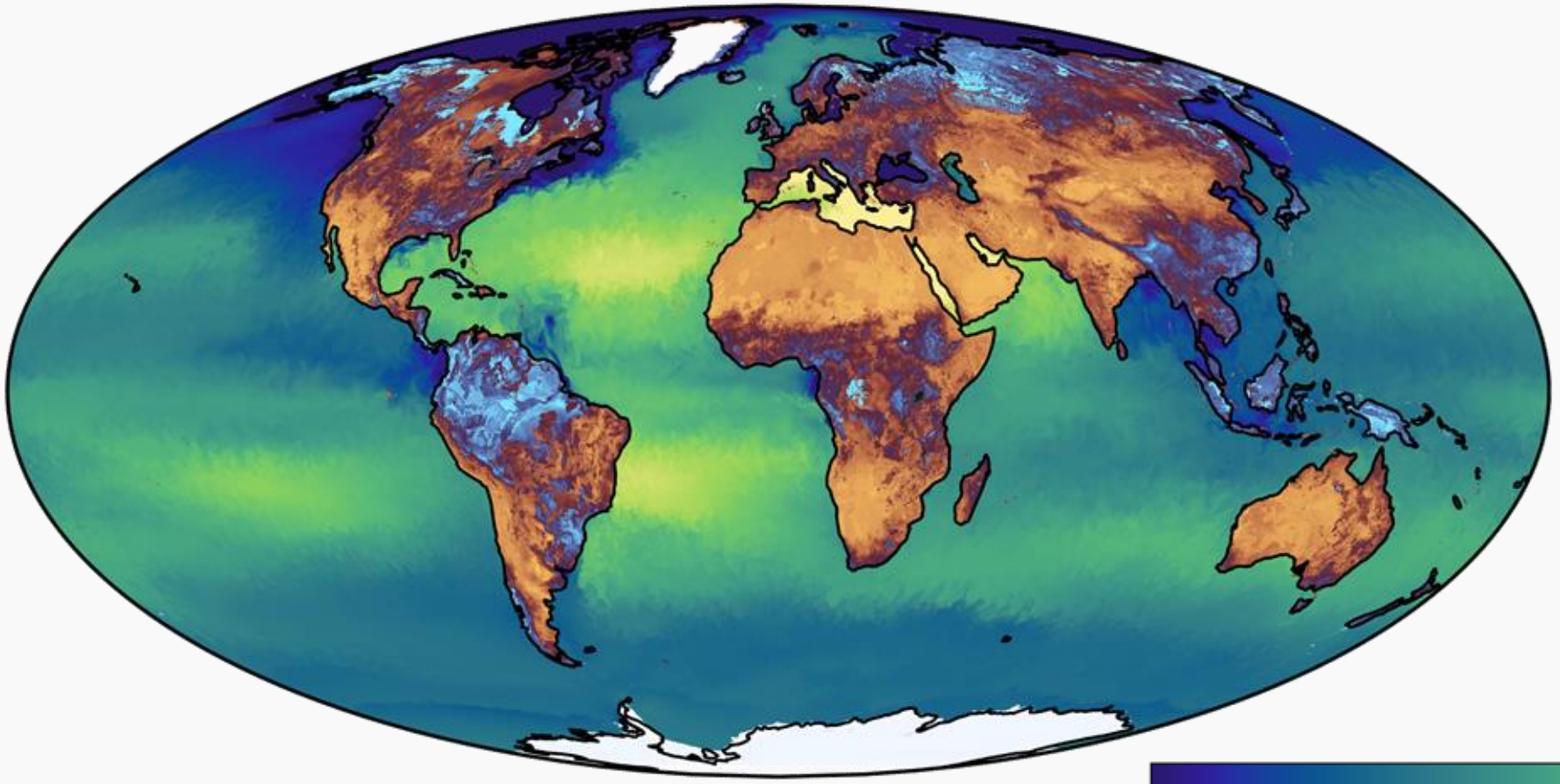



**2023***

OISSS Salinity
SMAP L3 Soil Moisture

**Average over 1 year*

## With 10-kilometer L band radiometry

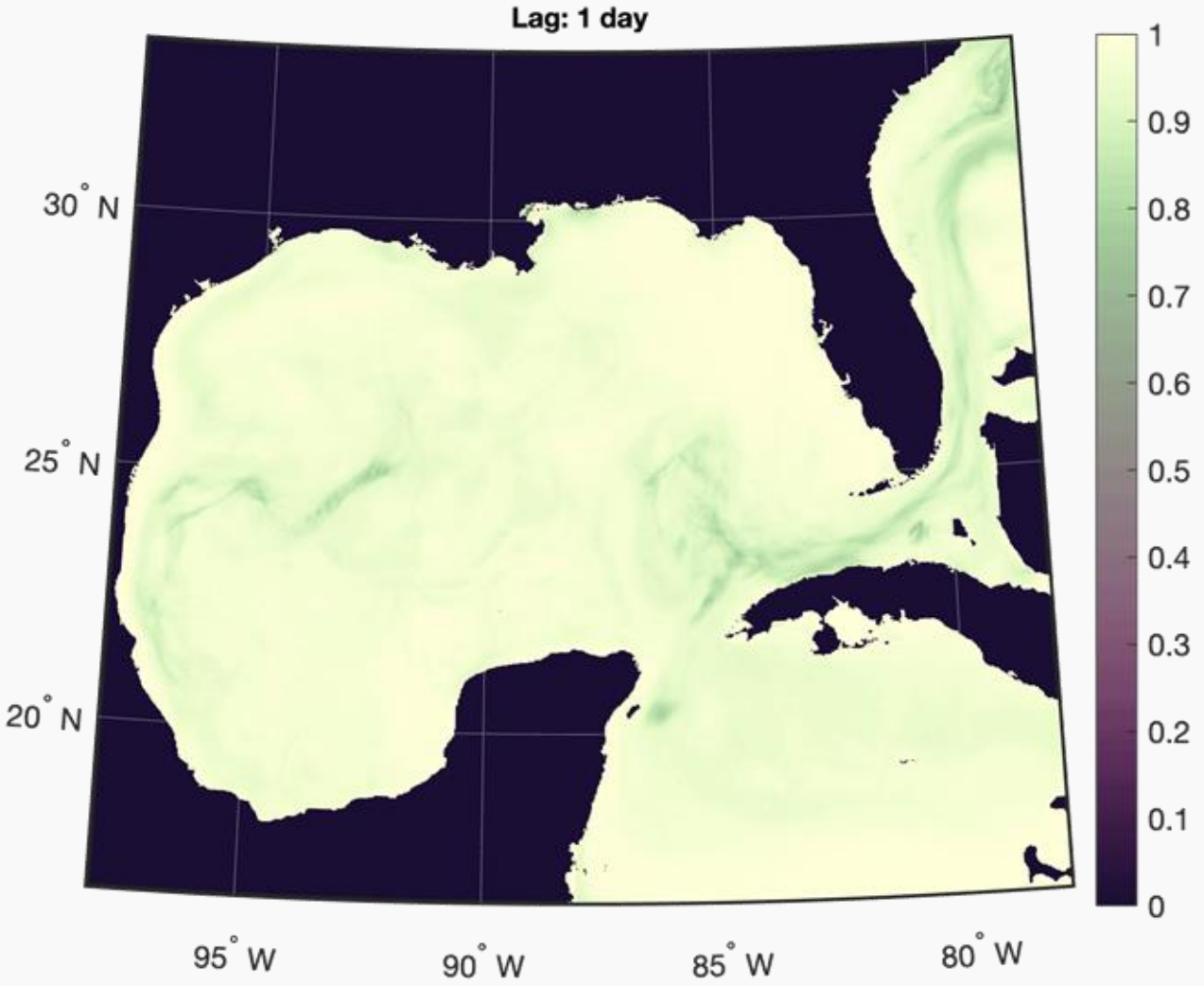



**2023⁺**

HYCOM
Soil Moisture Model (SMAP L4)

*⁺Average over 1 day*

## High resolution needs high sensitivity per visit



# Two paths for improving resolution

## Real aperture

- Challenging to keep a wide swath as aperture size increases, since angular momentum for a spinning reflector goes as $D^3$

## Synthetic aperture

- Trades mechanical challenges of a large real aperture for a more involved receiver configuration
- Complexity scales as number of array elements $N^2$

## A Promising Avenue for High Resolution Remote Sensing of SSS from Space

SMOS,
~ 40 km resolution
~ 900 km swath
~ 0.4 K dwell sensitivity
~60 antenna elements

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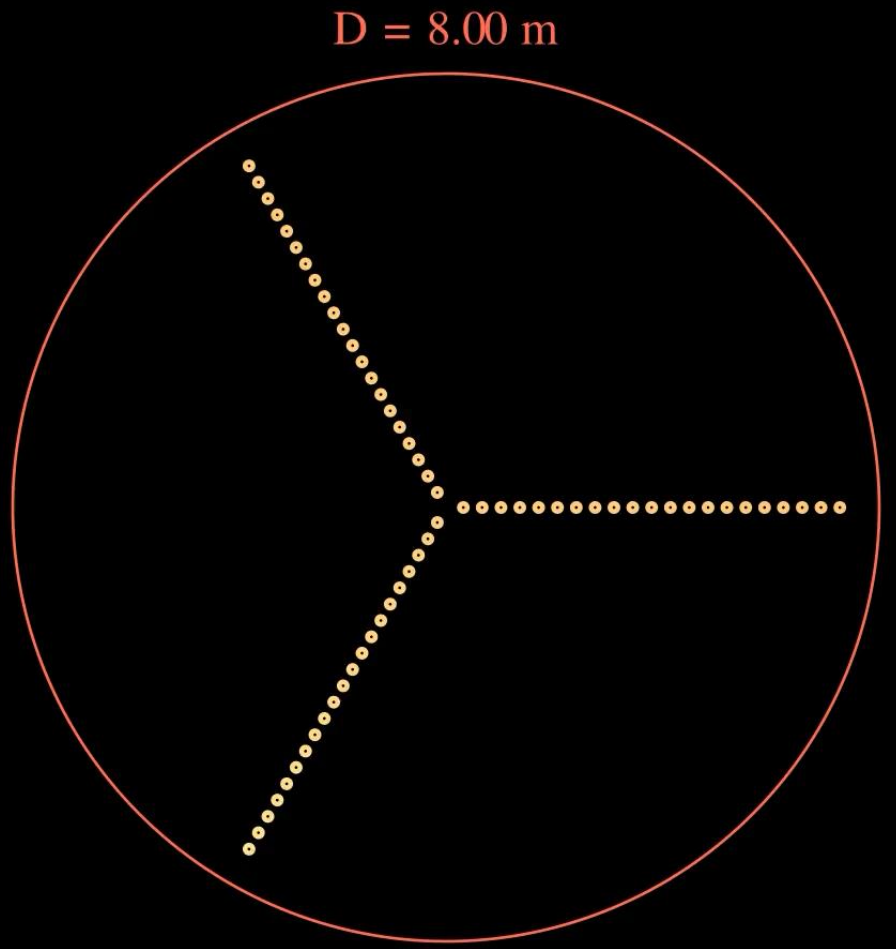


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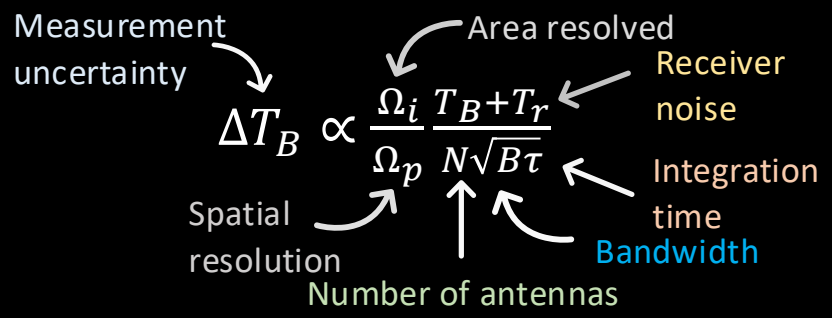
## A Promising Avenue for High Resolution Remote Sensing of SSS from Space

Our concept,
~ 10 km resolution
~ 1000 km swath
~ 0.1 K dwell sensitivity
~2400 antenna elements



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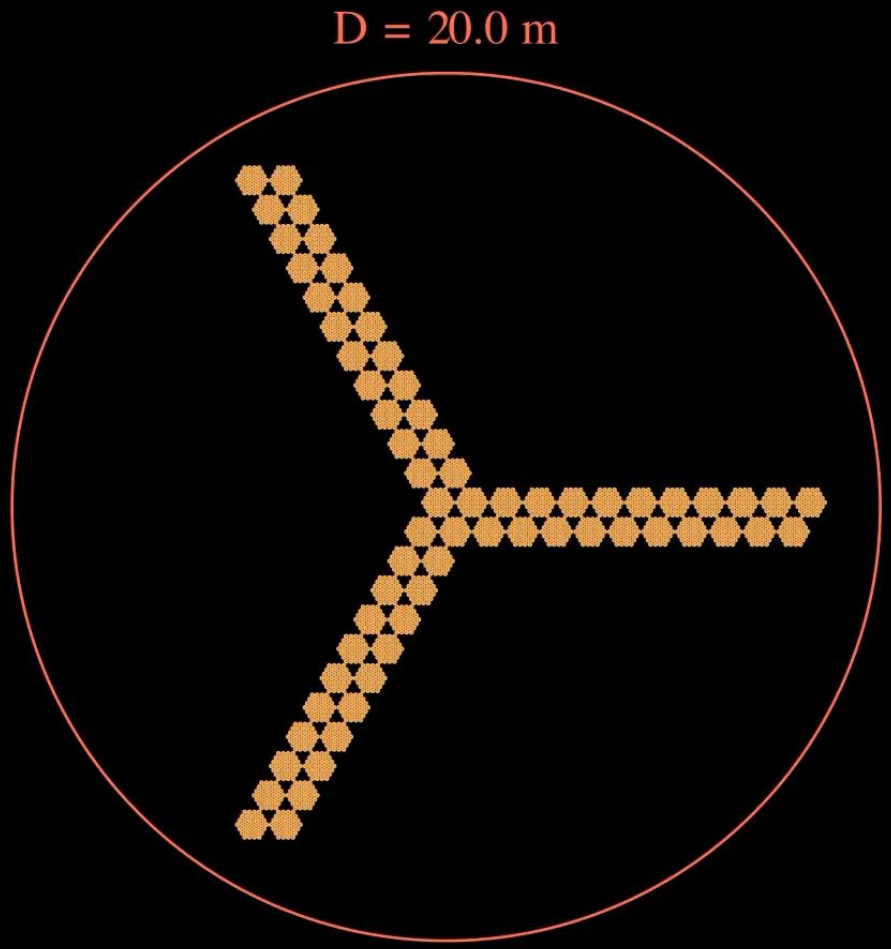


Our concept,
~ 10 km resolution
~ 1000 km swath
~ 0.1 K dwell sensitivity
~2400 antenna elements

Measurement uncertainty

$$\Delta T_B \propto \frac{\Omega_i}{\Omega_p} \frac{T_B + T_r}{N\sqrt{B\tau}}$$

Area resolved
Receiver noise
Integration time
Bandwidth
Spatial resolution
Number of antennas

## A Promising Avenue for High Resolution Remote Sensing of SSS from Space

Our concept,
~ 10 km resolution
~ 1000 km swath
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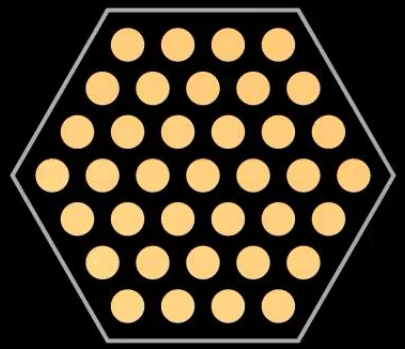
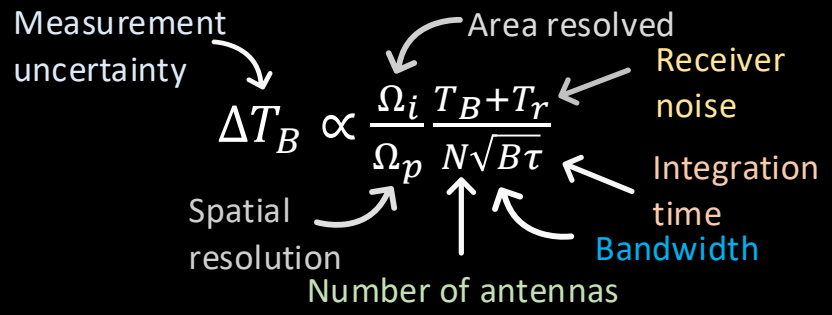
~2400 antenna elements





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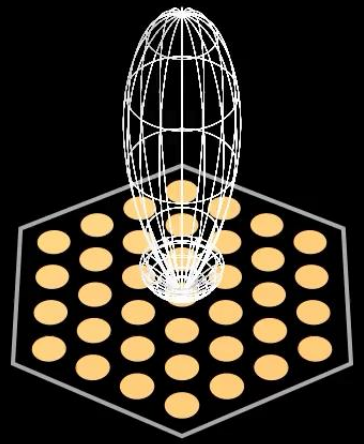
Our concept,
~ 10 km resolution
~ 1000 km swath
~ 0.1 K dwell sensitivity
~2400 antenna elements



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$$\Delta T_B \propto \frac{\Omega_i}{\Omega_p} \frac{T_B + T_r}{N\sqrt{B\tau}}$$

Area resolved

Receiver noise

Integration time

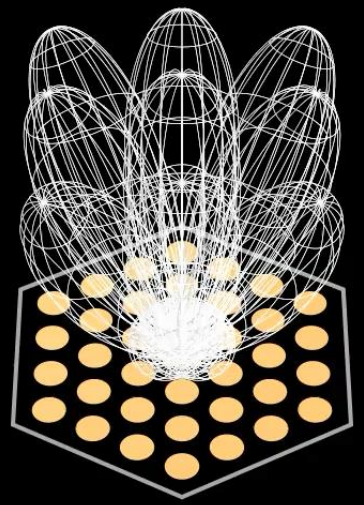
Bandwidth

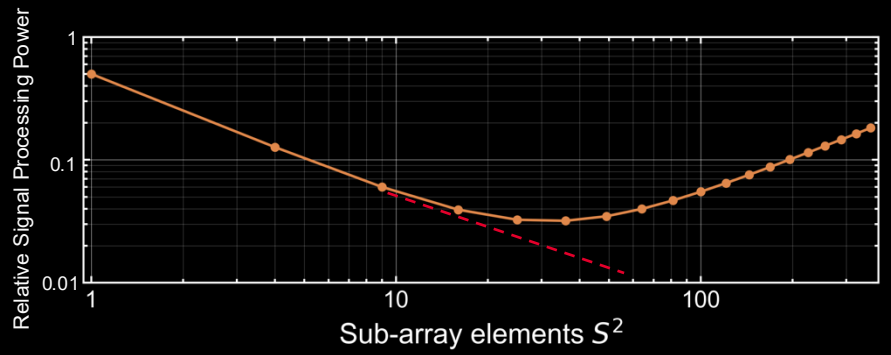
Spatial resolution

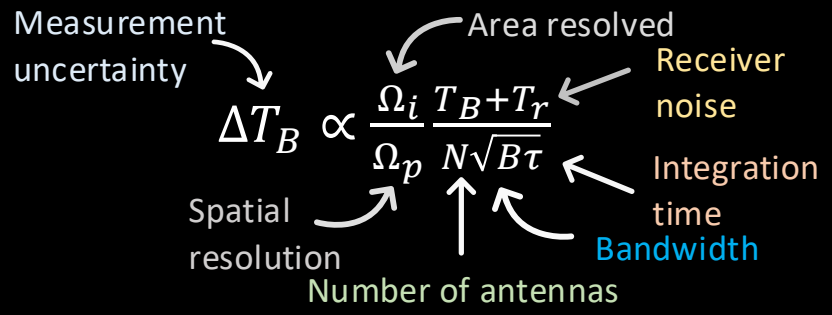
Number of antennas

## A Promising Avenue for High Resolution Remote Sensing of SSS from Space

Our concept,
~ 10 km resolution
~ 1000 km swath
~ 0.1 K dwell sensitivity
~50*M antenna elements





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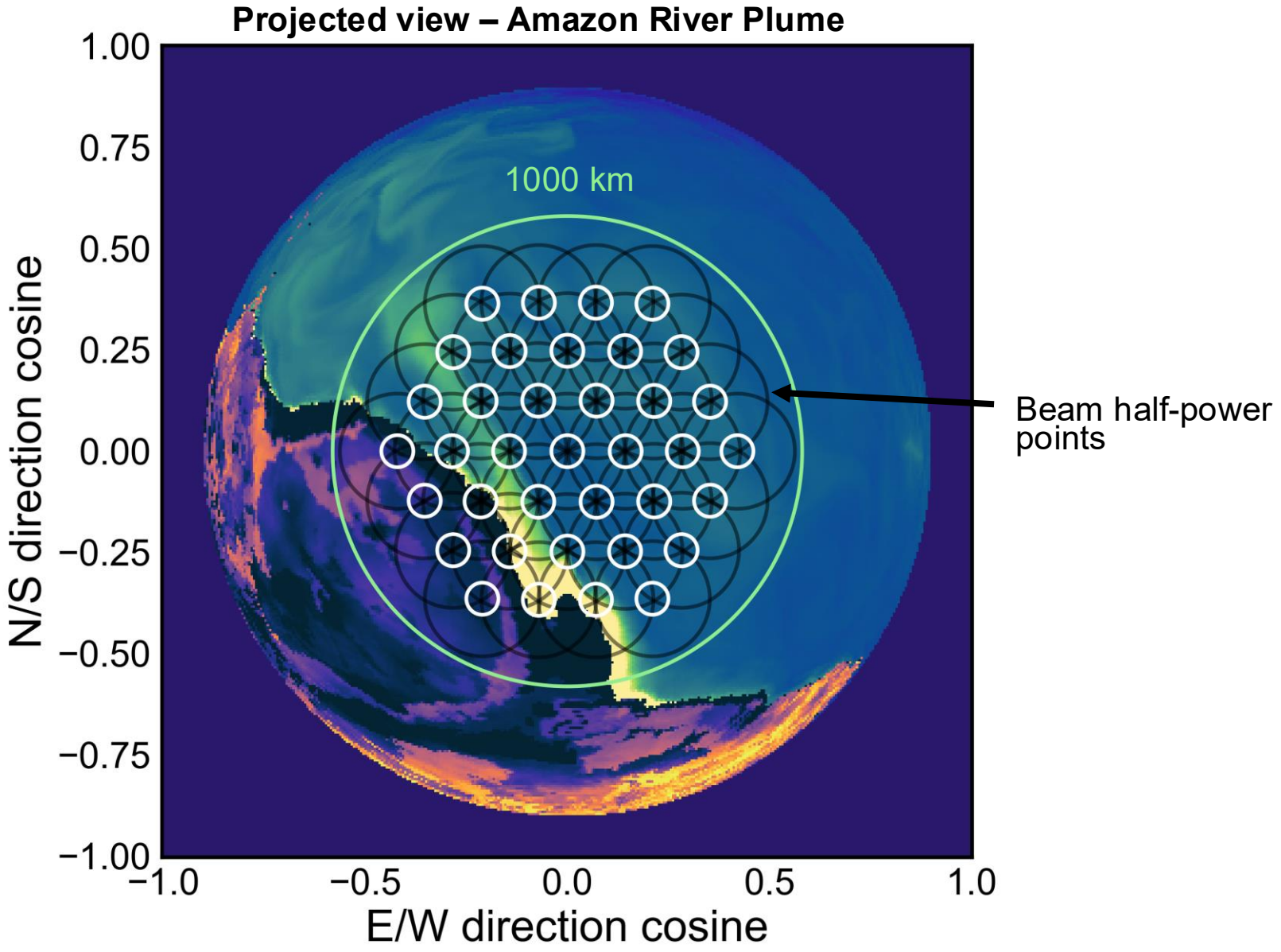

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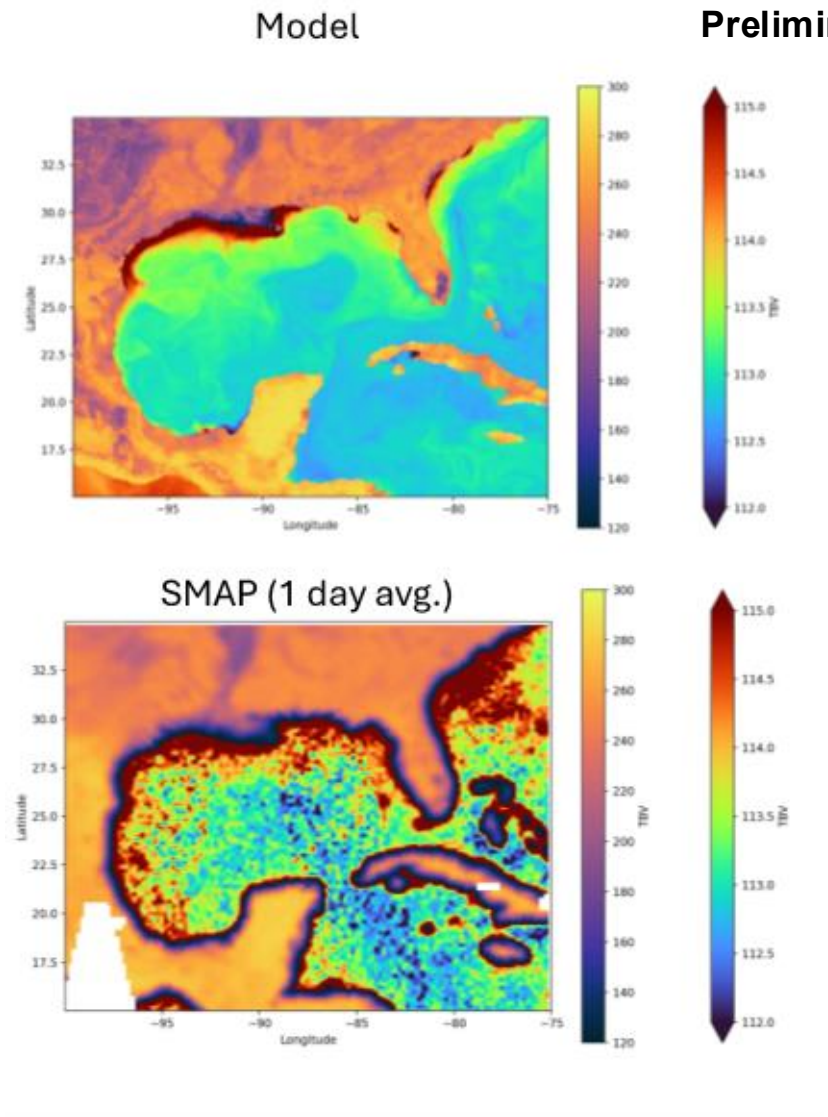
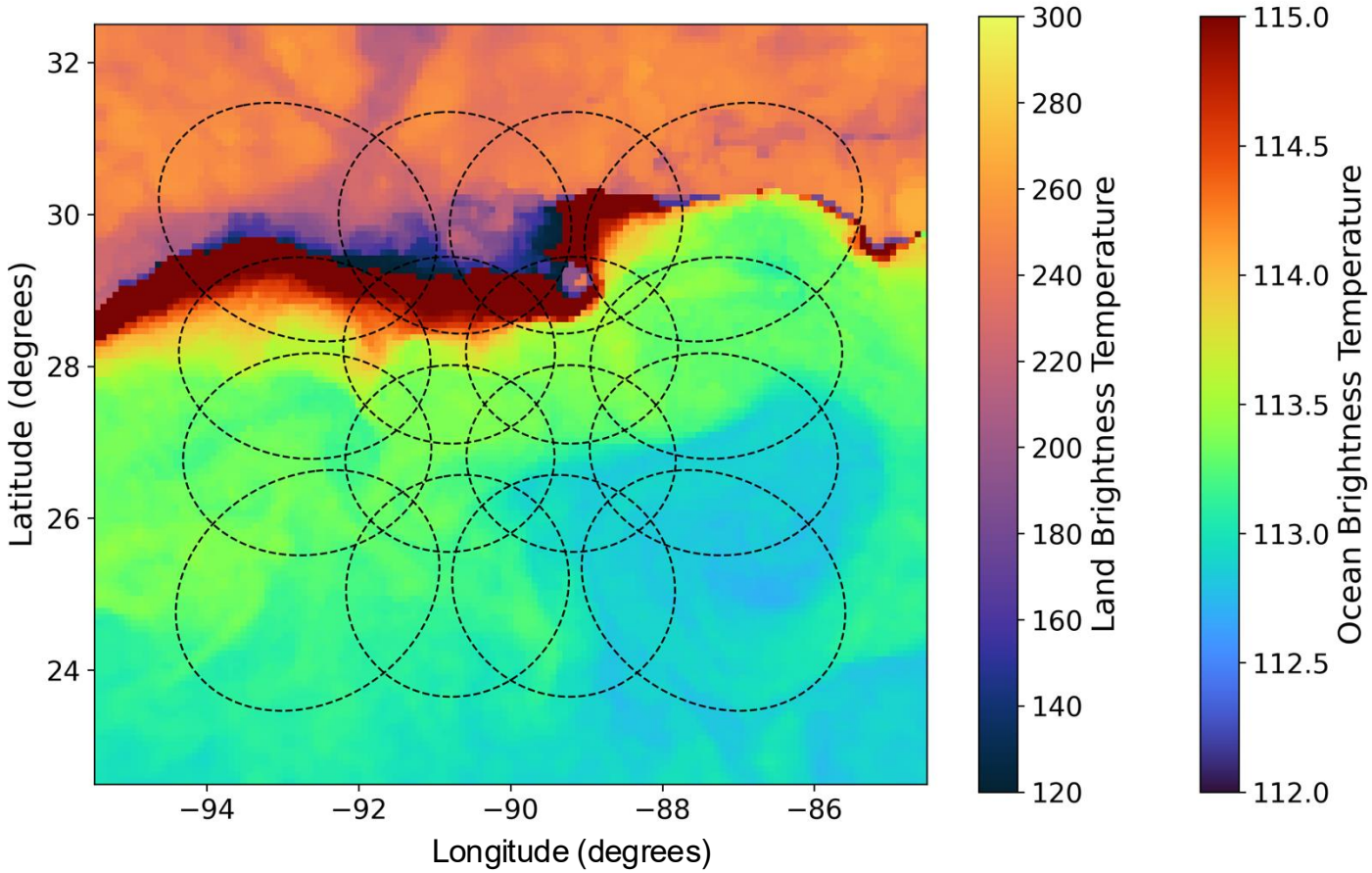



**Preliminary observing system simulation**



# Path forward

## On our end

- Complete system architecture specification (emphasis on first-order size, weight power requirements)
- Complete imaging system simulations with component level deviations to estimate thermal/position tolerance requirements beyond ROM
- Design integrated tile units, including beamforming, RFE, and correlator transmission architecture
- Proceed up the Technology Readiness Level ladder with further testing

## From the community

- Continue to investigate what we can learn from high resolution SSS from space
- Let us know requirements for your science (i.e. open ocean mesoscale vs. lower-latitude coastal vs. polar oceans

## Thank you!