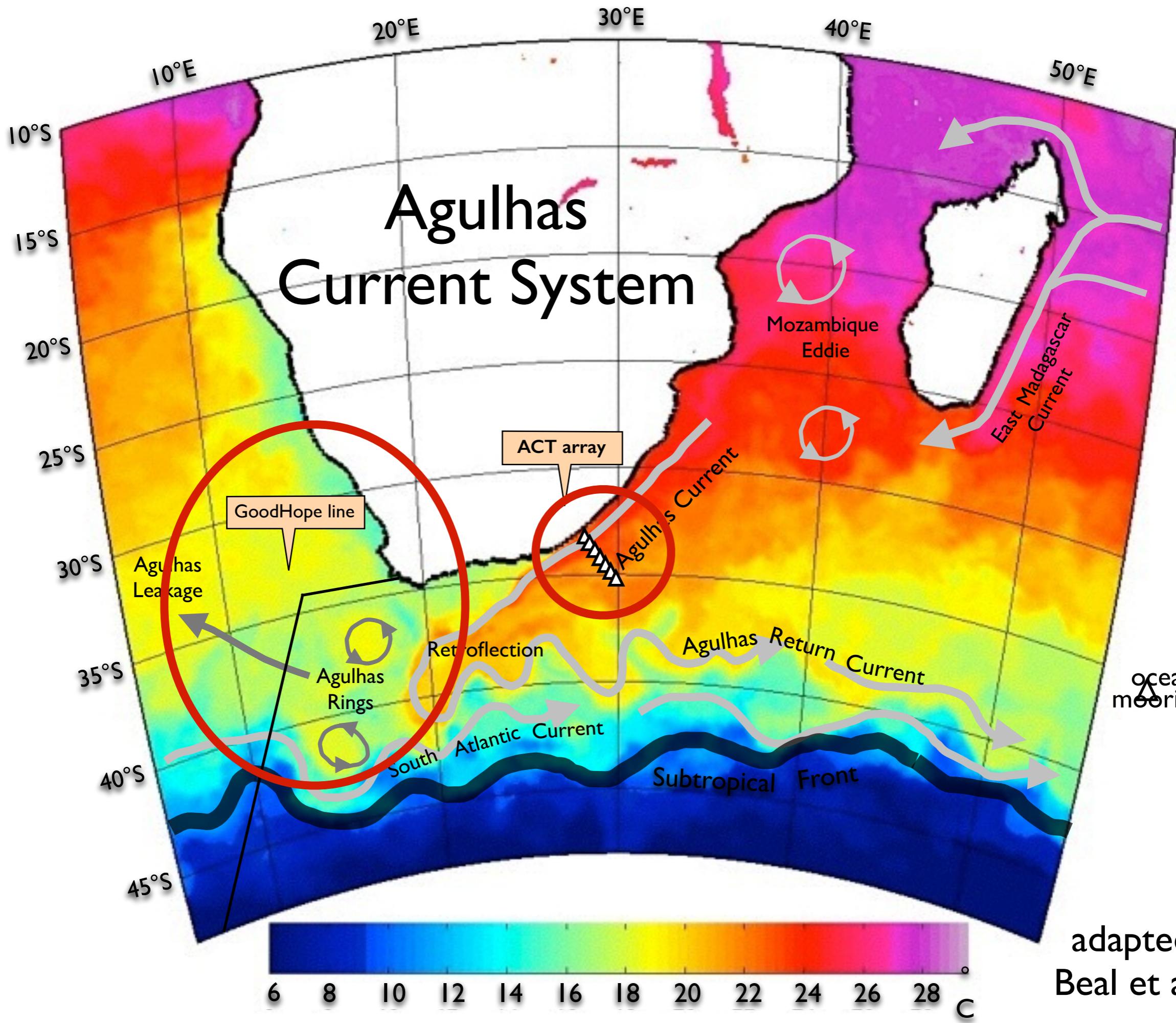


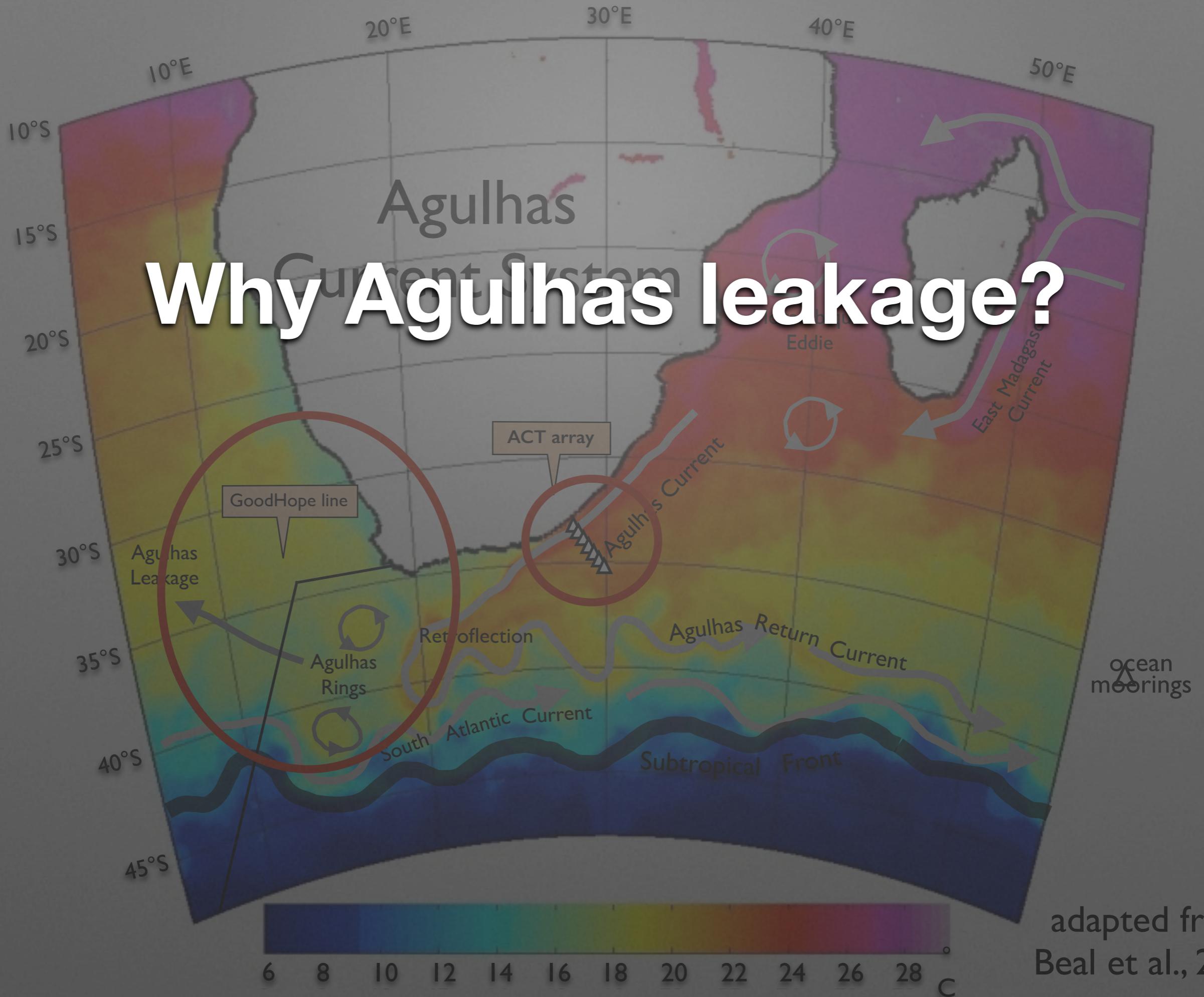
# AGULHAS LEAKAGE IN EDDY- RESOLVING CCSM: A LAGRANGIAN APPROACH

YU CHENG  
ADVISORS: LISA BEAL, BEN KIRTMAN



adapted from  
Beal et al., 2011

# Why Agulhas leakage?

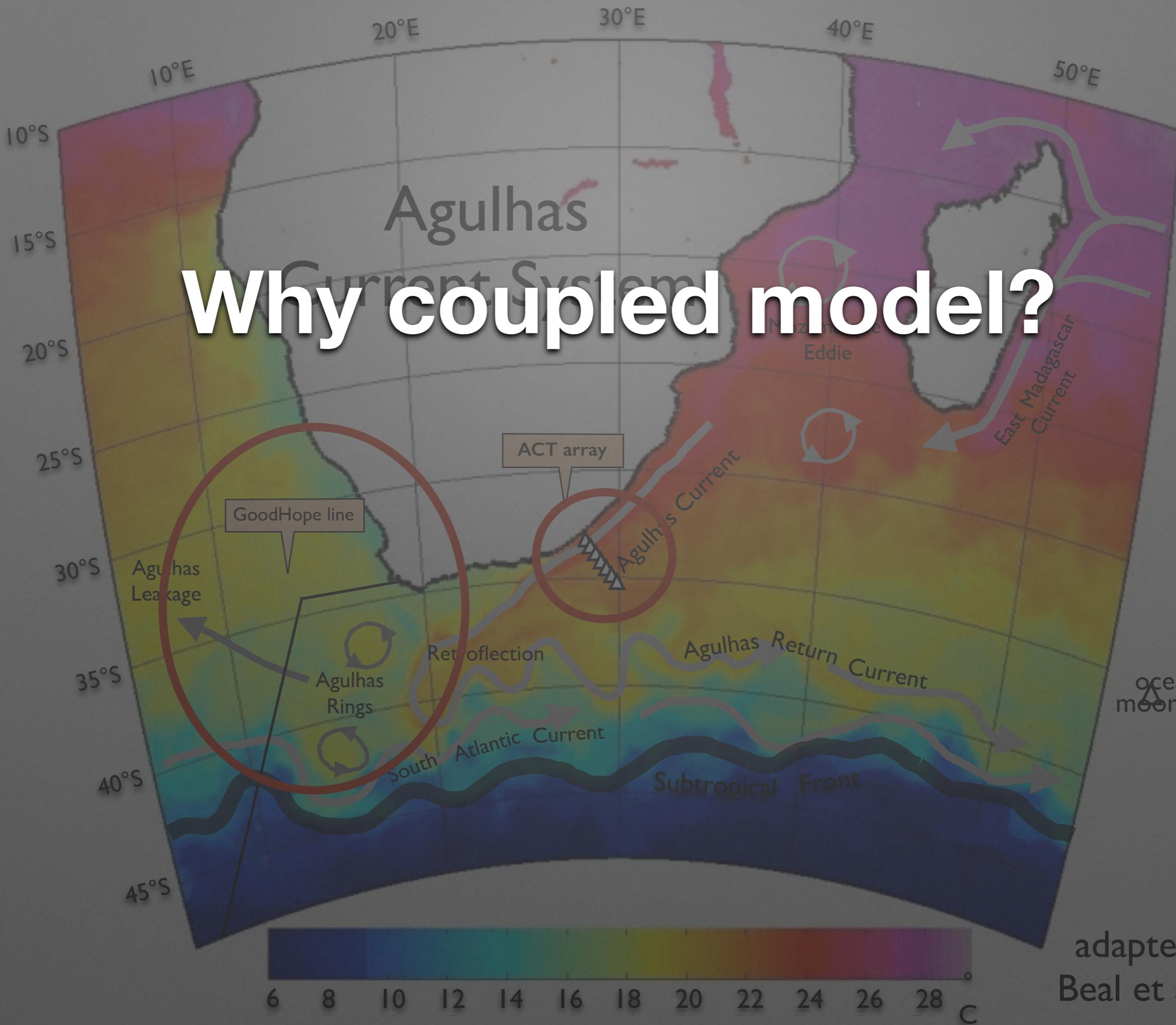


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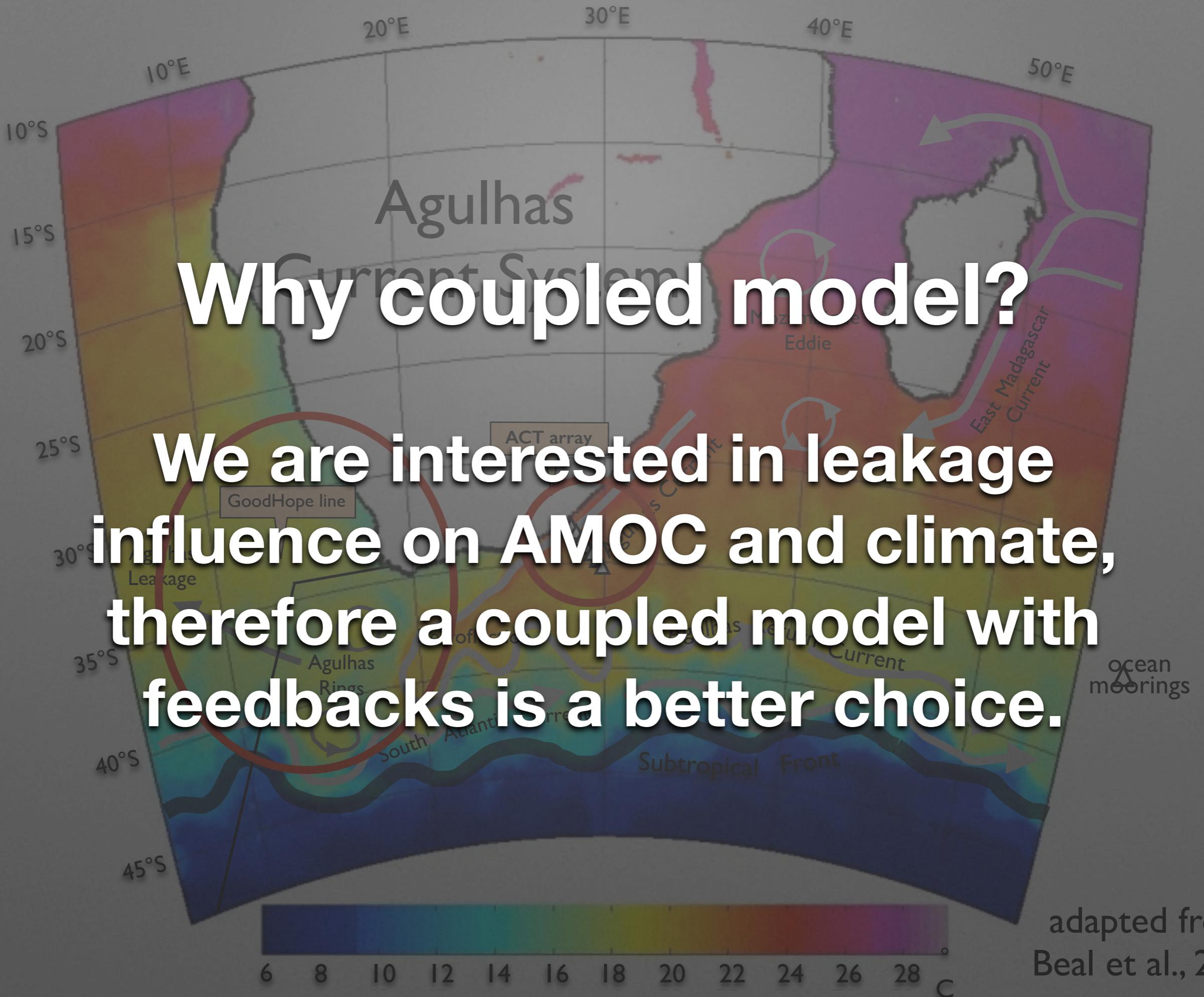
# Why Agulhas leakage?

Agulhas current is a choke point in the global thermohaline circulation, and the leakage may influence AMOC stability and climate.

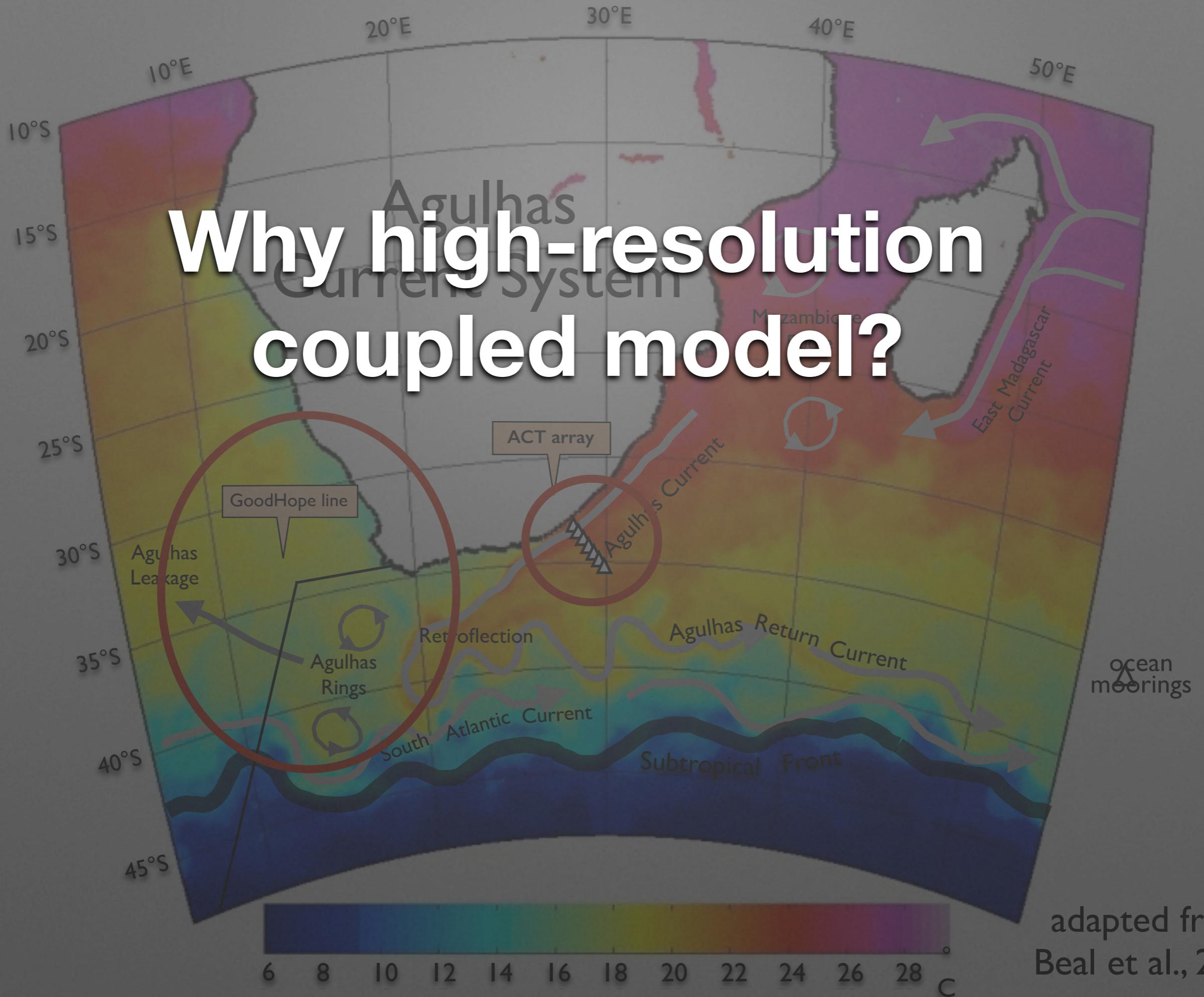
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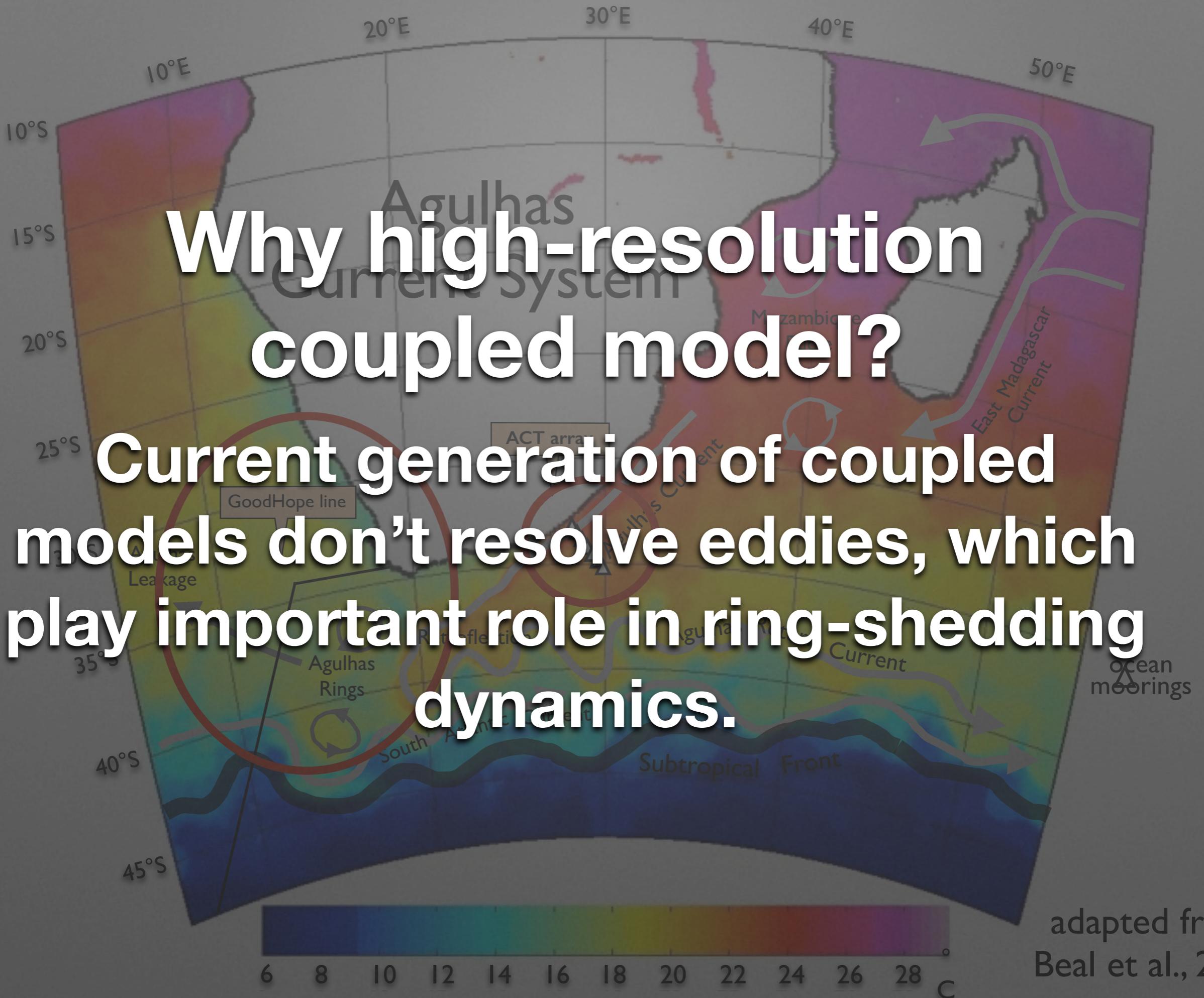
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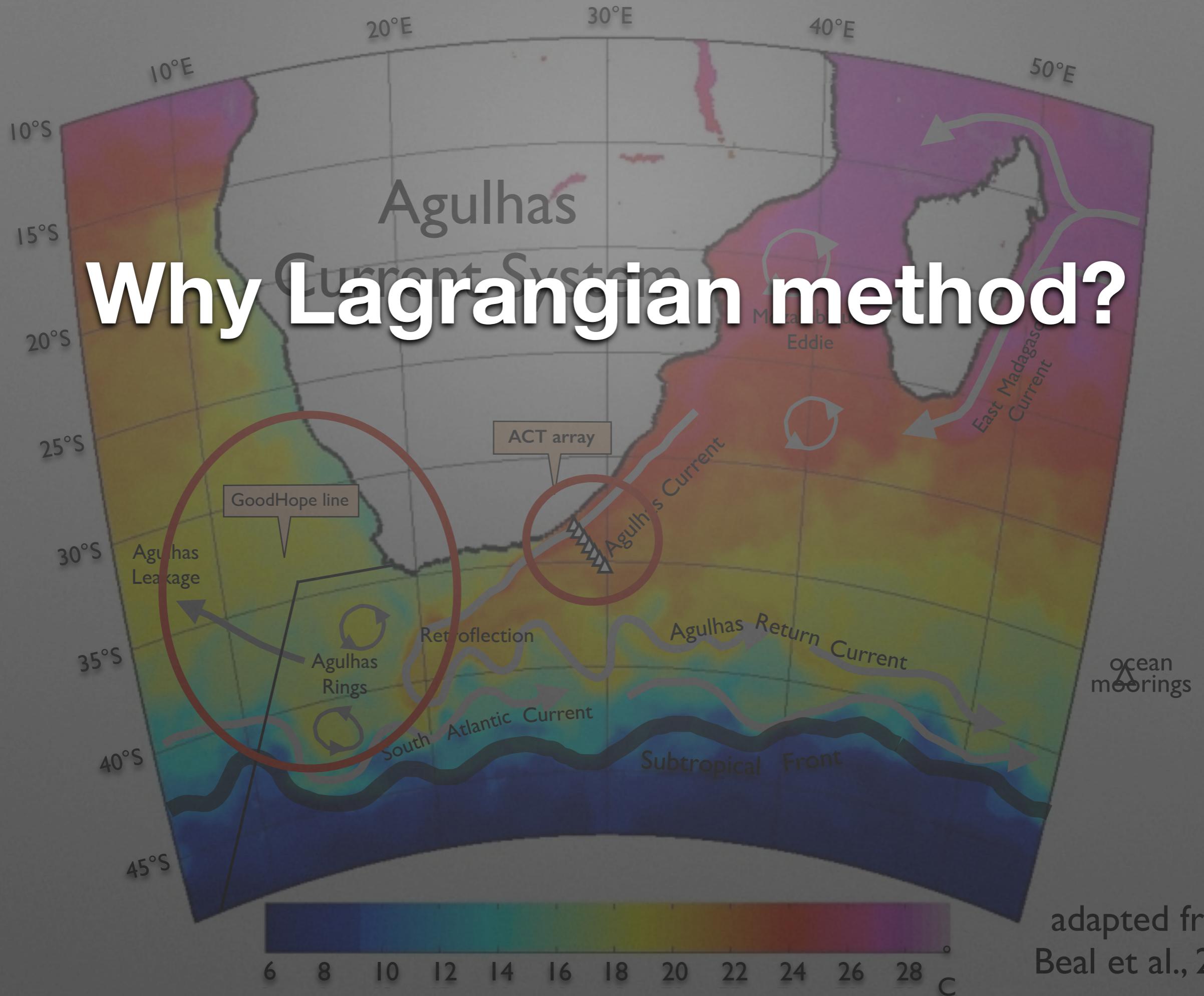
# Why high-resolution coupled model?



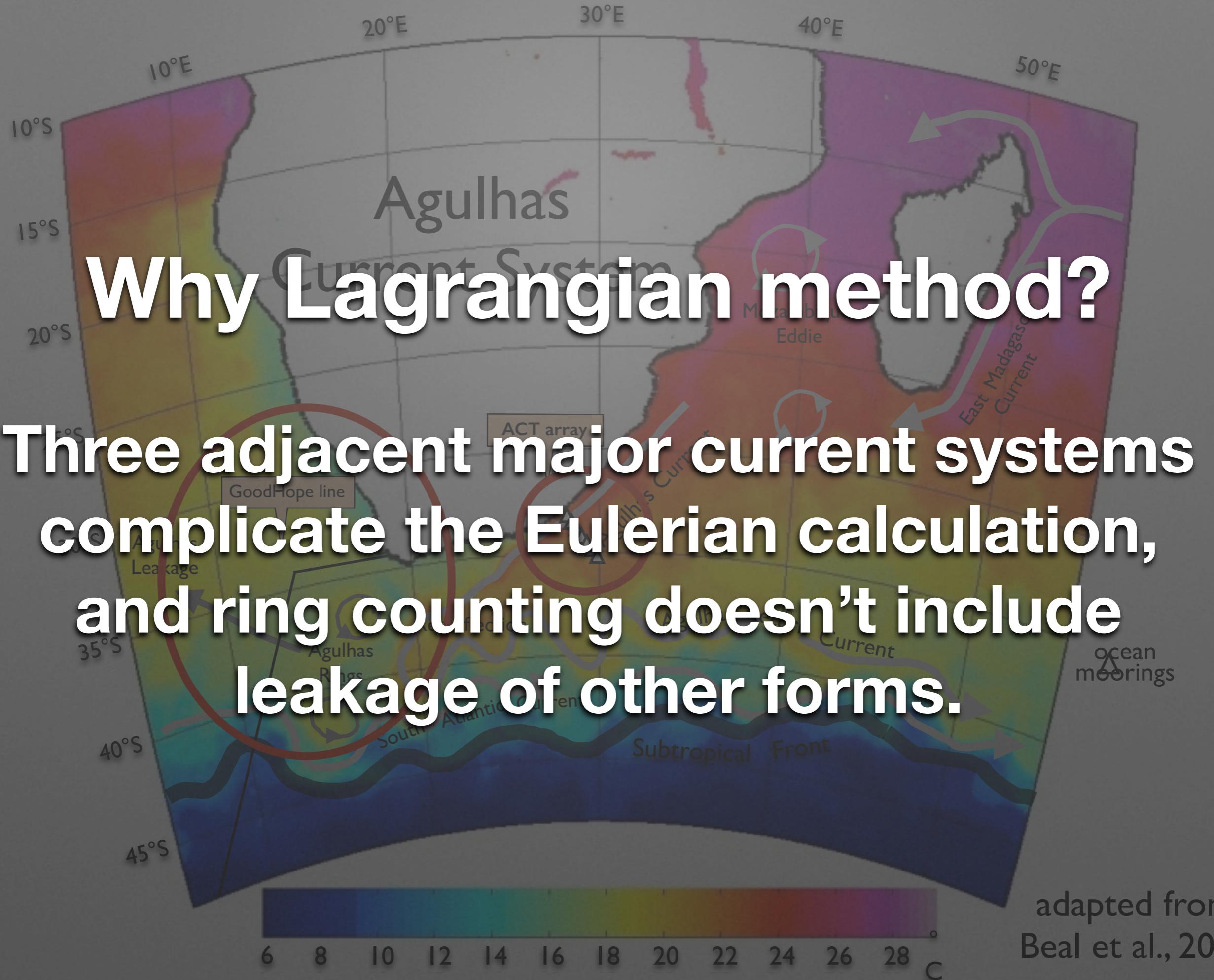
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# Why Lagrangian method?



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Beal et al., 2011



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- Find the proper Lagrangian experiment setup for estimating Agulhas leakage transport
- Find possible relation between Agulhas leakage and Agulhas current transport

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- Community Climate System Model ver. 3.5 (CCSM 3.5) with 0.5° resolution for Atmosphere and 0.1° for Ocean (Kirtman et al. 2012)

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- Connectivity Modeling System (CMS): Lagrangian tracking package (Paris et al. 2013)

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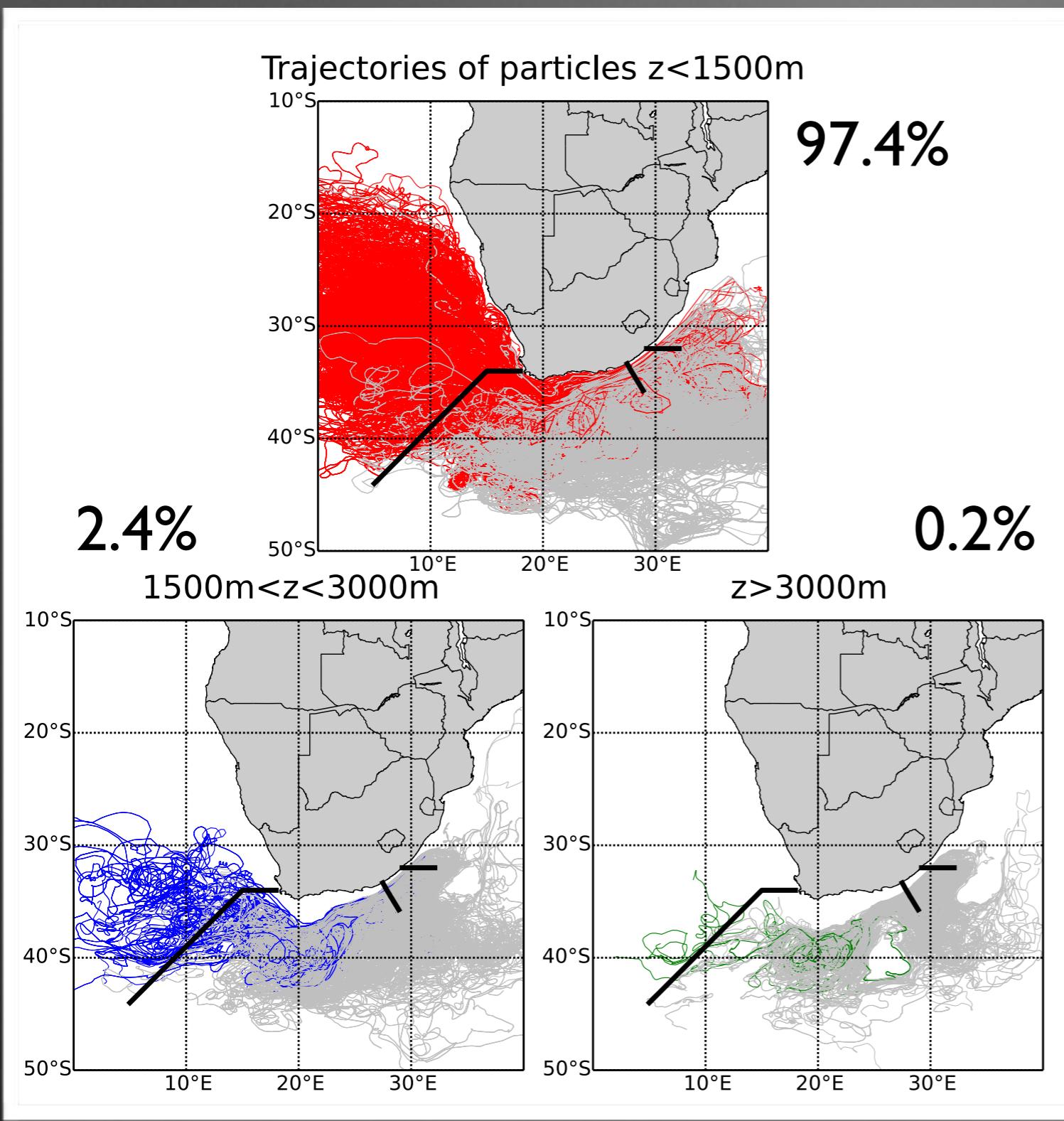
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- Test the sensitivity of the turbulent module in CMS

# Why turbulent module?

- To mimic turbulent diffusion for coarse resolution data
- Without turbulent, all particles released at same time and location follow the same trajectory.
- Our temporal resolution is low.

# RESULTS

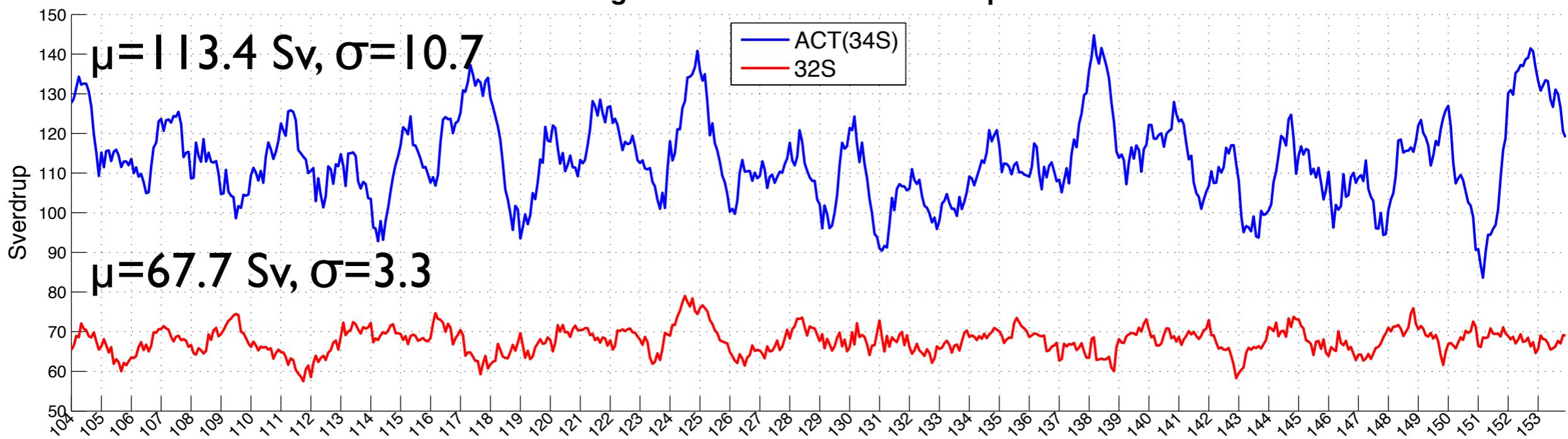


All trajectories of the first year

Particles in upper layer move faster, spread wider

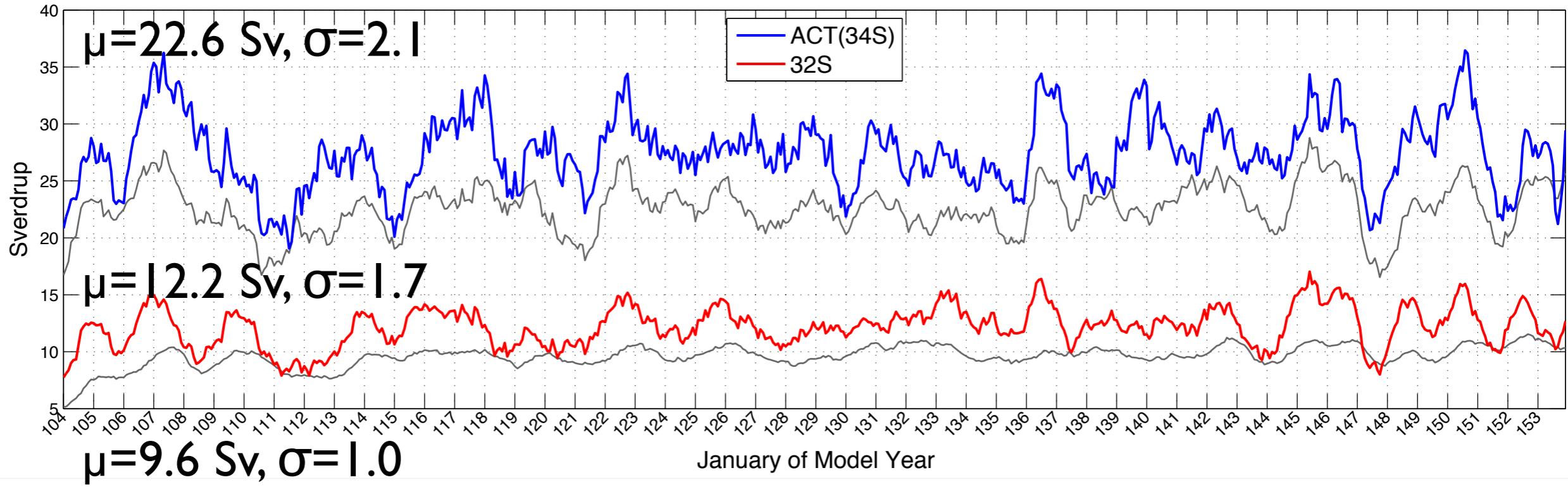
Almost no leakage  
 $> 3000\text{m}$

### Agulhas Current Volume Transports

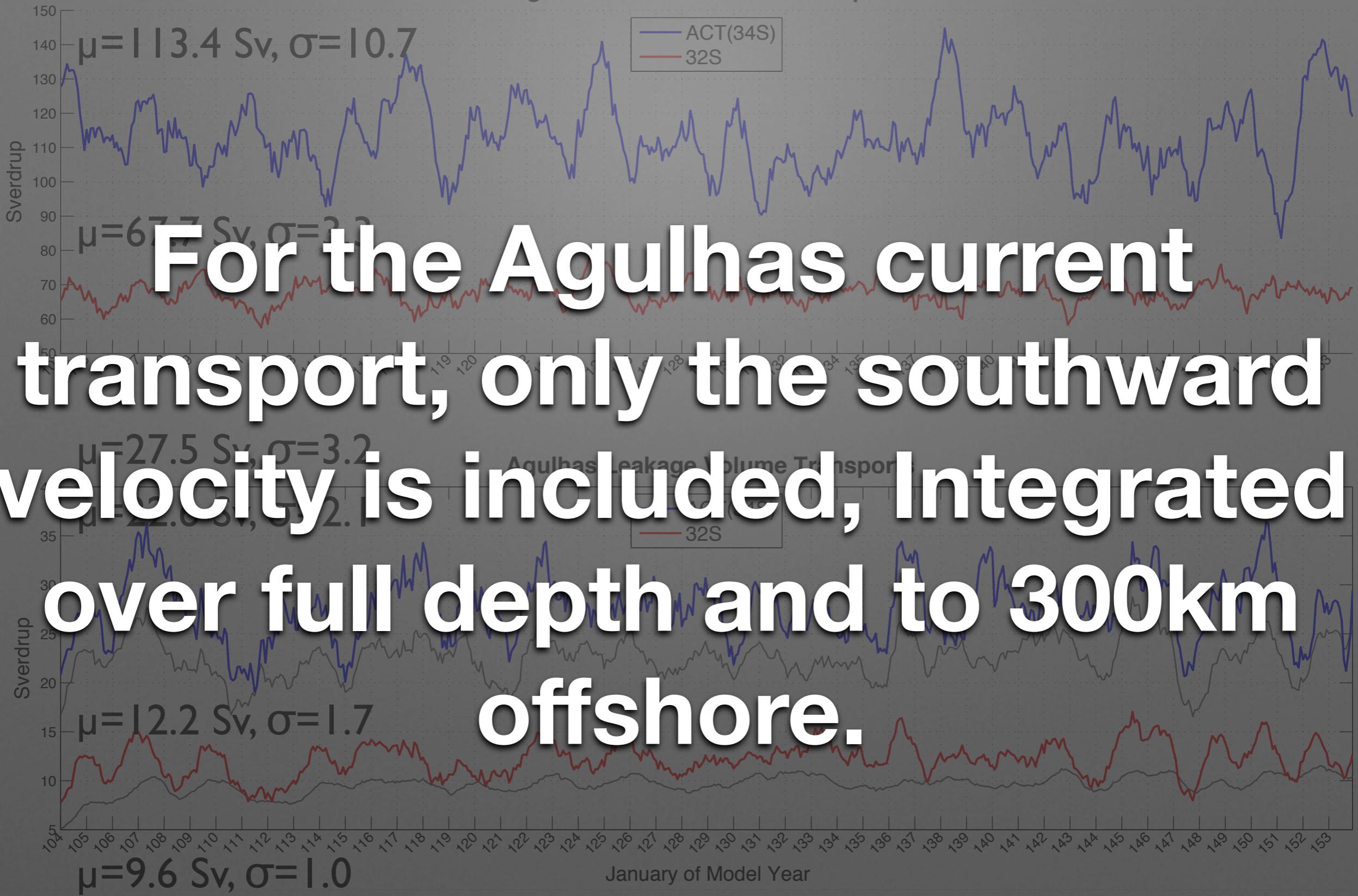


$\mu = 27.5 \text{ Sv}, \sigma = 3.2$

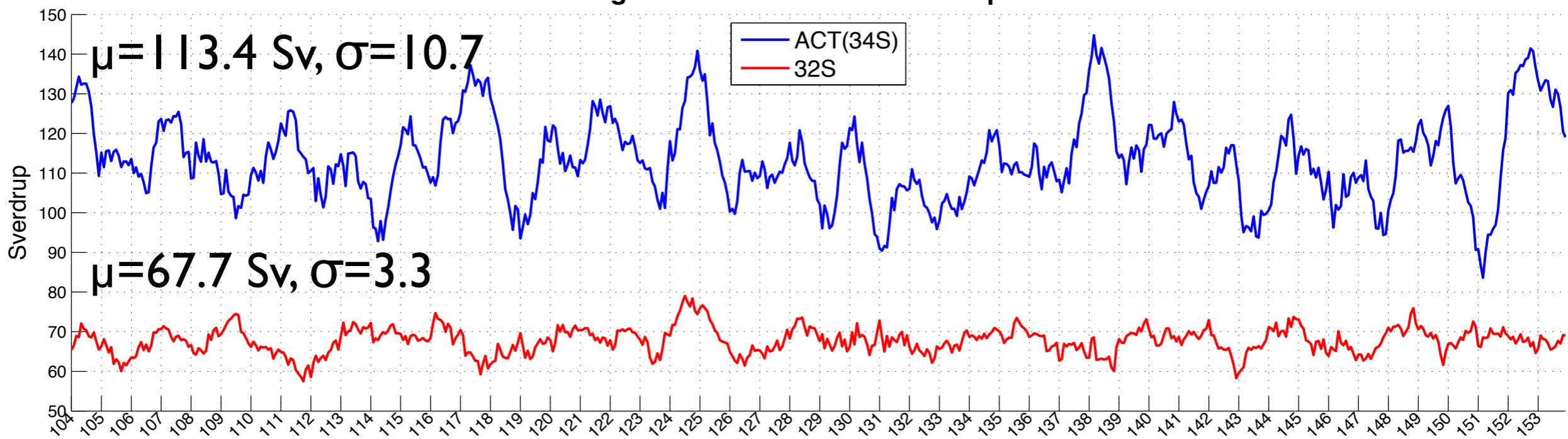
### Agulhas Leakage Volume Transports



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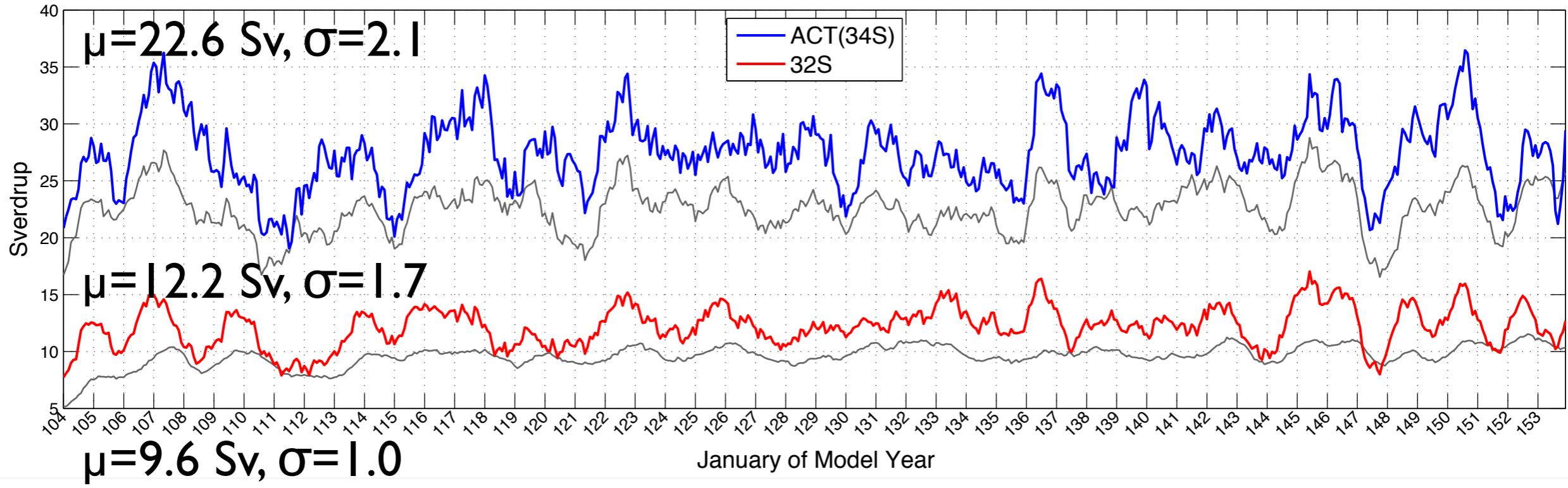


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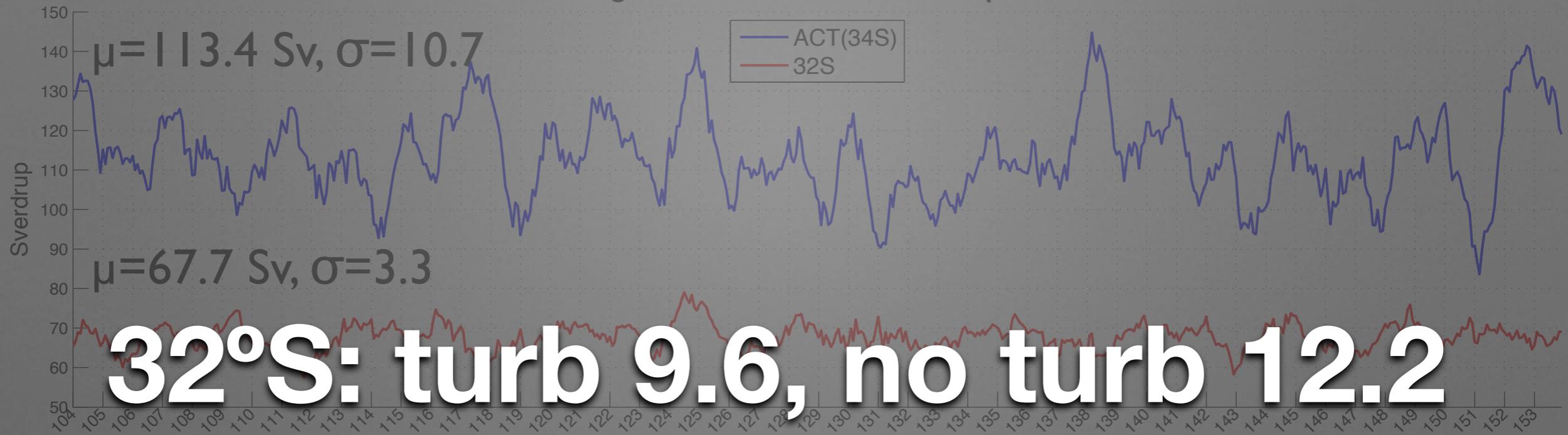


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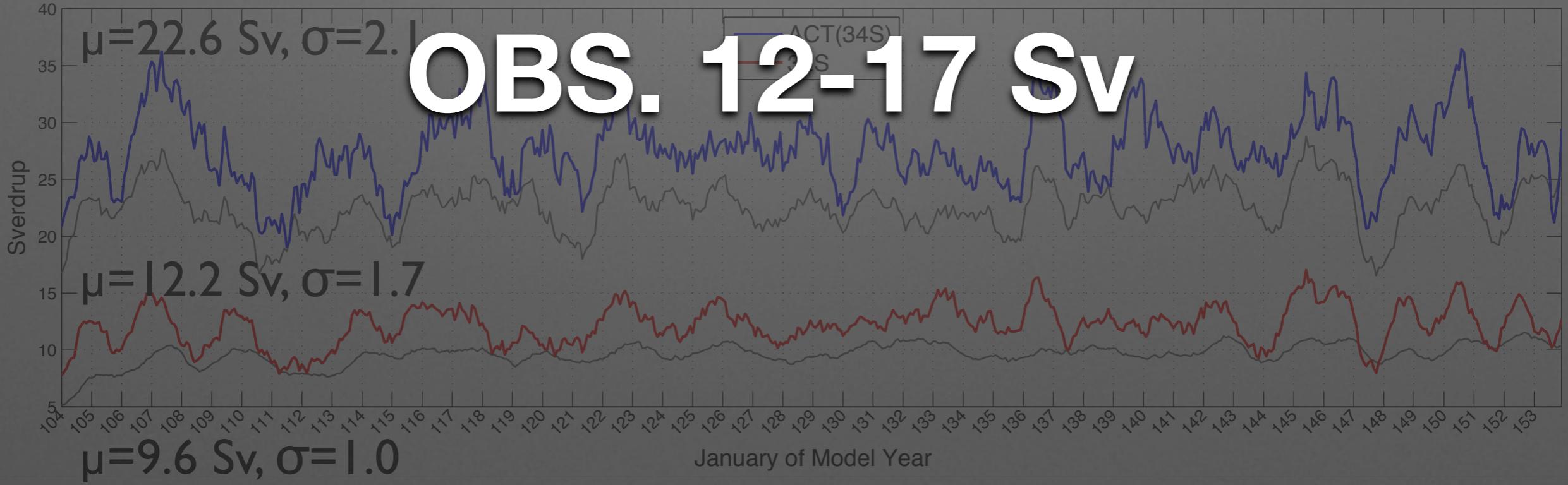


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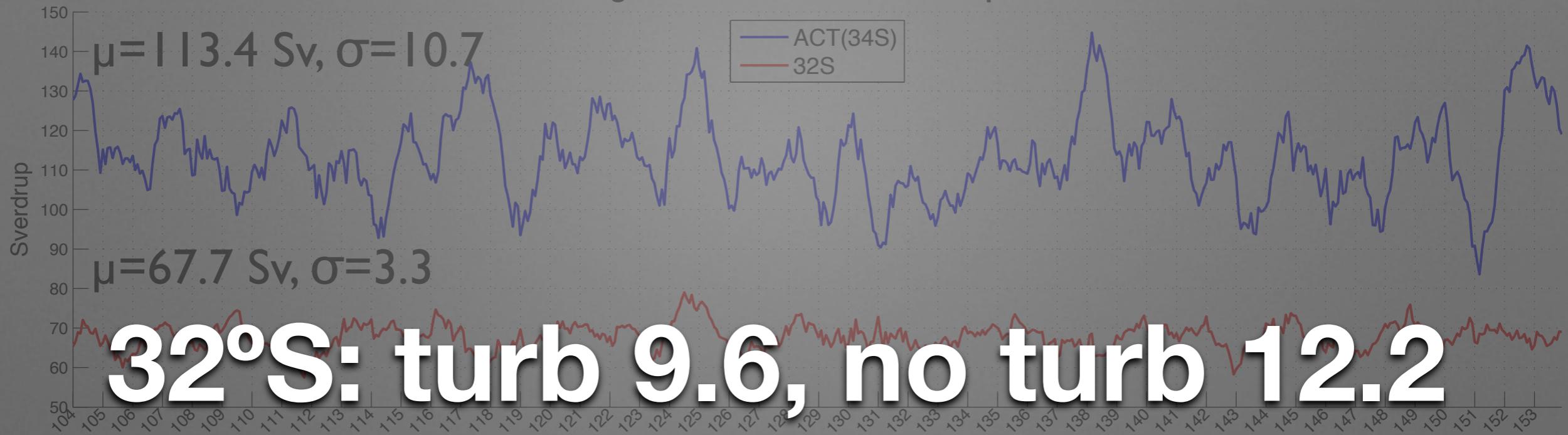


**vs**

### Agulhas Leakage Volume Transports

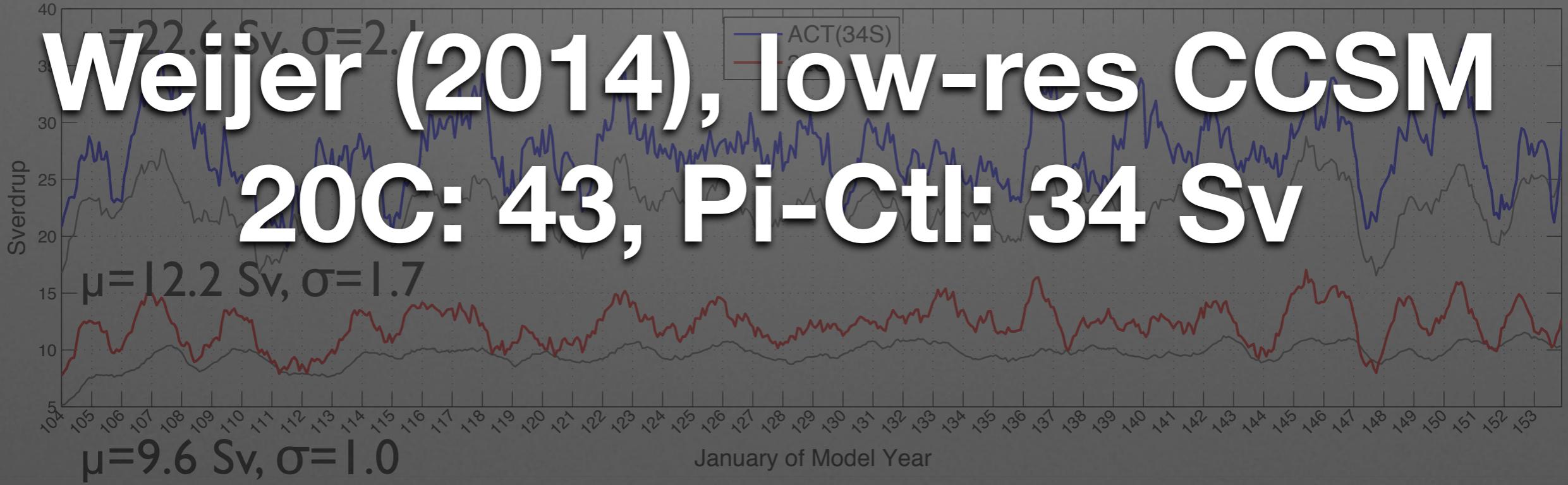


Agulhas Current Volume Transports



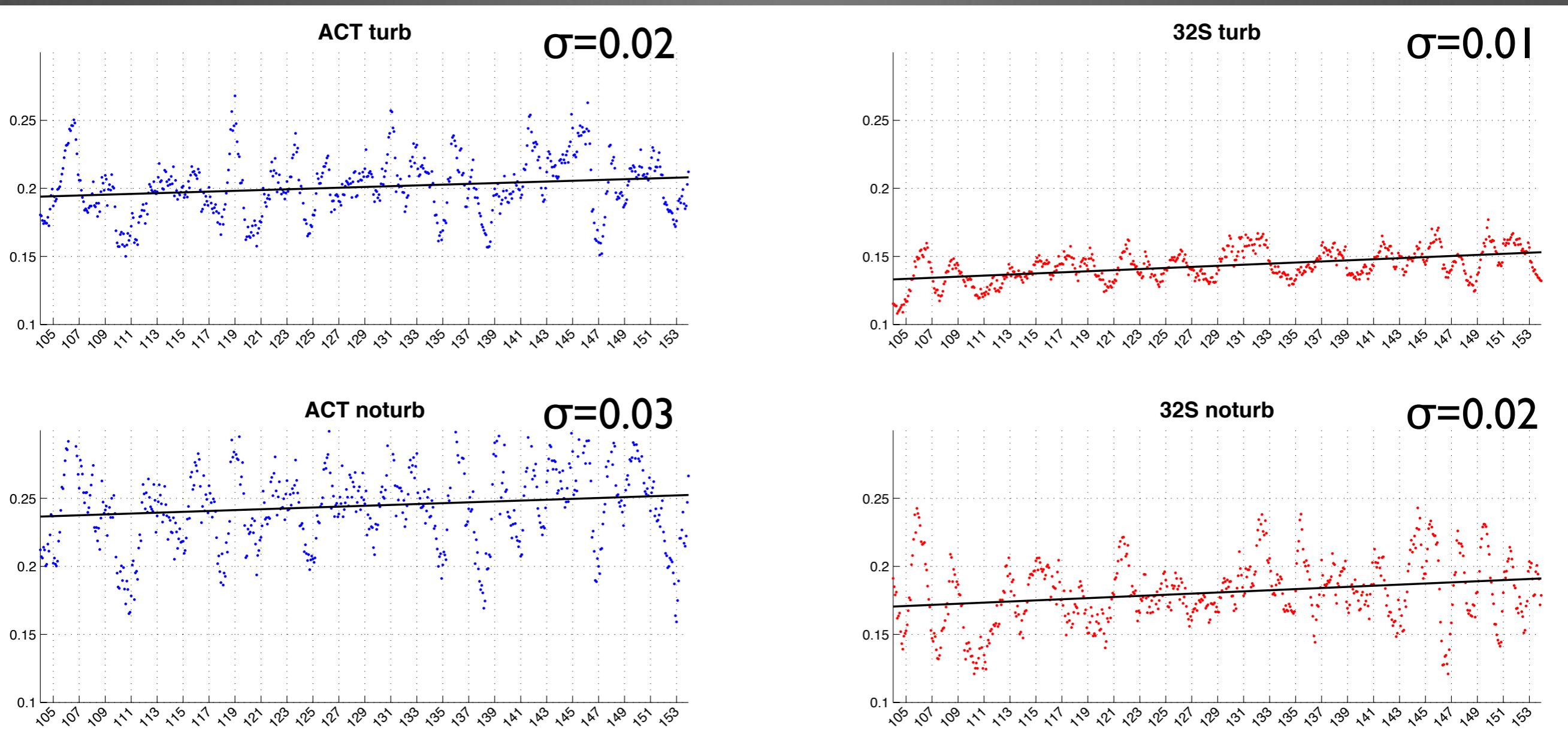
vs

Agulhas Leakage Volume Transports



# Leakage/Current

## ACT 0.22; 32°S 0.15



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- Our Agulhas leakage estimates are closer to observations than those of coarse resolution CCSM simulations.
- The ratio of leakage to mean current transport seems to be roughly constant: we may use the ACT mooring array observation to estimate Agulhas leakage.

# Future Work

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- Use daily CCSM output to analyze the impact of temporal resolution on CMS integration
- Analyze the interannual variability of Agulhas leakage transport, and possible trends in CCSM 20C run

A photograph of a sunset over the ocean, taken from the deck of a boat. The sun is low on the horizon, casting a warm, golden glow over the water. The ocean waves are visible in the foreground, and the sky is filled with soft, pastel colors. The overall atmosphere is peaceful and serene.

**Thank you!**

# References

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