#1227
Observations of Water Mass Properties in the Caribbean Through-Flow and their Implications for the Atlantic Meridional Overturning Circulation

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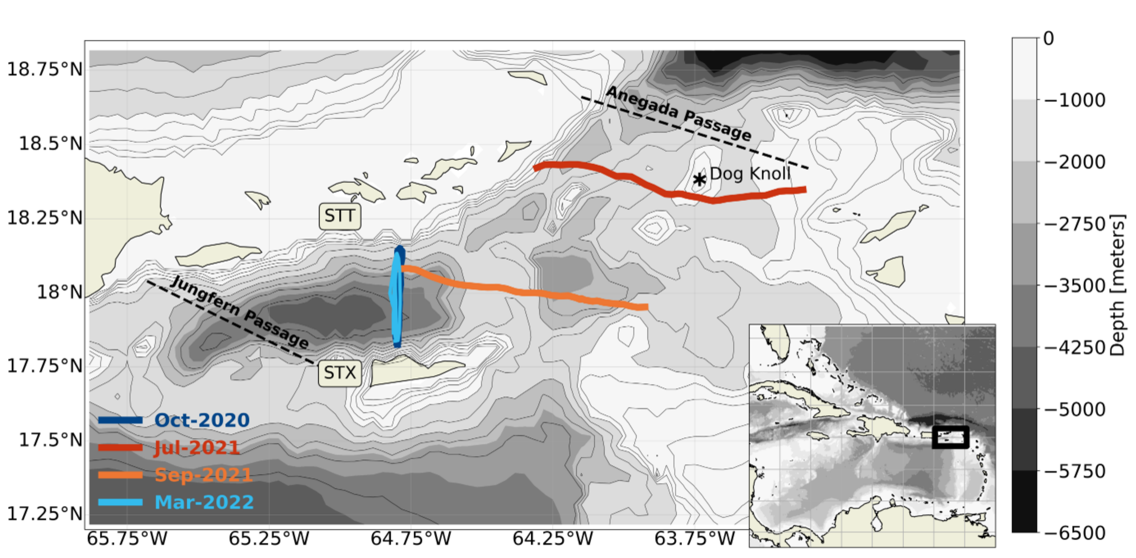
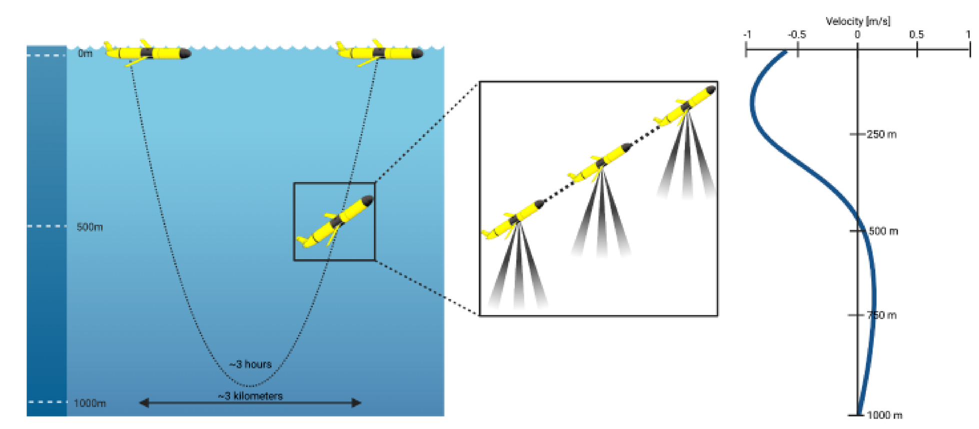
BACKGROUND

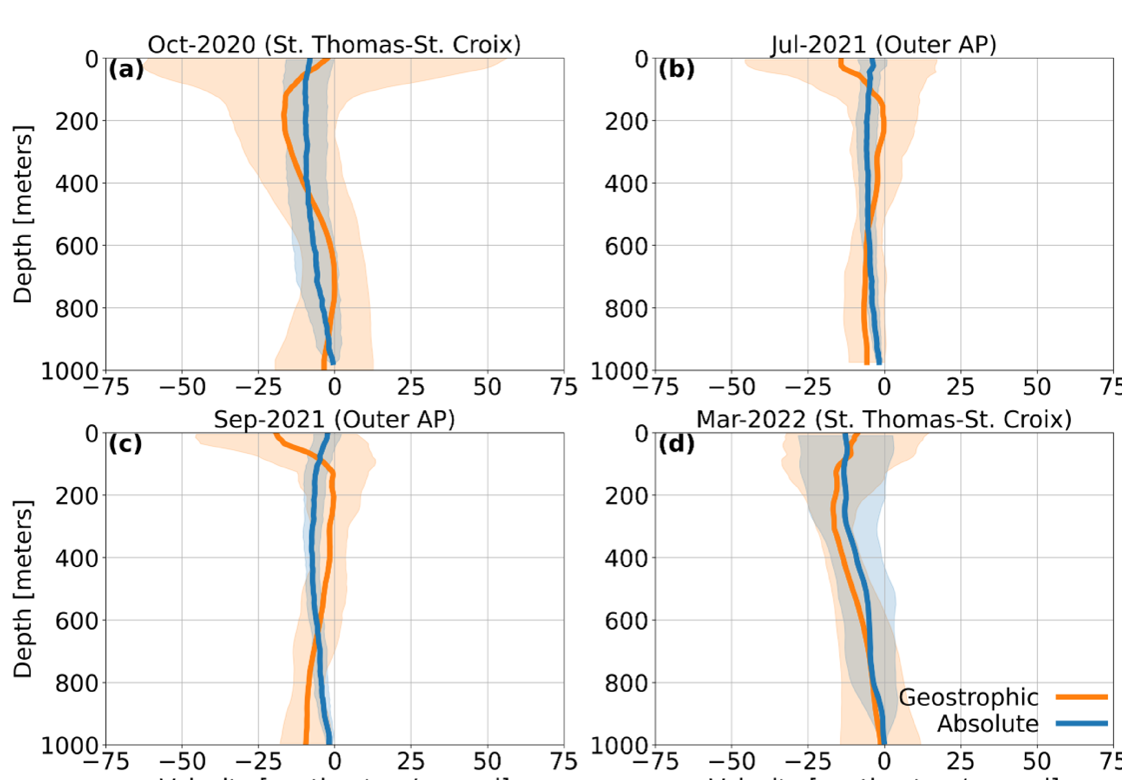
The Caribbean Sea is a semi-enclosed basin with chokepoints that lead it to serve as a critical through-flow region for North and South Atlantic water to form the North Atlantic western boundary current system and the upper ocean limb of the Atlantic Meridional Overturning Circulation (AMOC). The combined Caribbean through-flow into the Gulf of Mexico via the Yucatan Straits represents up to 90% of the source flow through the Florida Straits and consequently represents the primary conduit of northward mass, heat, and salt fluxes in the upper-ocean limb of the AMOC. As the water mass properties exported through the Yucatan Straits are established through mixing of North and South Atlantic water, which inflow primarily through the Eastern Caribbean Island passages, there is considerable interest in determining water mass hemisphere of origin. This is further important as it was recently determined that Florida Current water mass structure determines the northward transport of salt more than the transport of the FC itself. Here, we present the first co-located observations of temperature, salinity, and subsurface velocity in the Caribbean through-flow in nearly 20 years, first focusing on the Anegada Passage. We also compare glider-based observations of water mass properties from several eastern Caribbean island passages with data from the Windward Island Passage monitoring Program (WIPP) from the 1990's to show potential changes in vertical temperature and salinity structure of the Caribbean through-flow.

METHODS

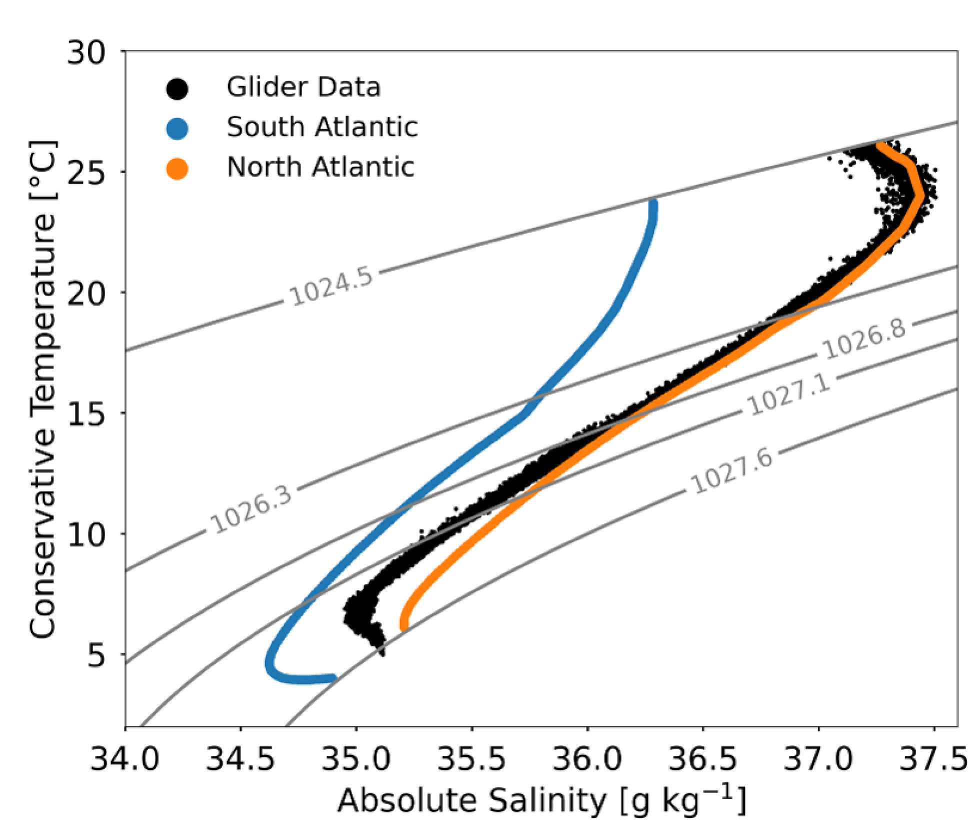




Glider ADP sampling scheme: Subsurface velocity collected and processed using a least squares linear inversion for all four glider deployments.

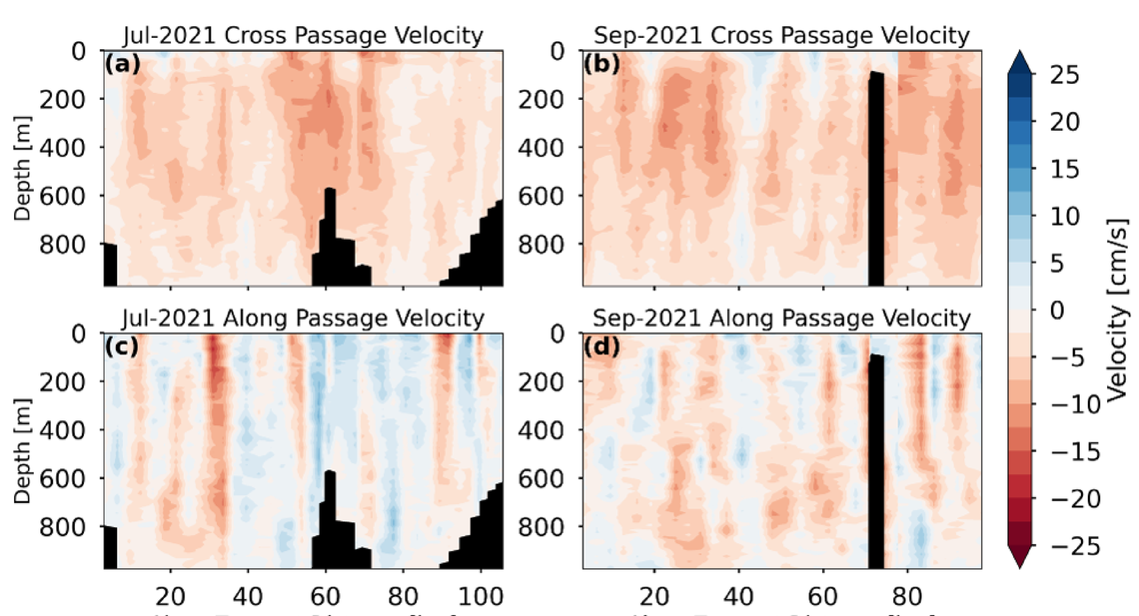


Mean velocity profiles: Mean thermal wind derived geostrophic velocity and ADP derived absolute velocity shaded by one standard deviation for all four deployments.

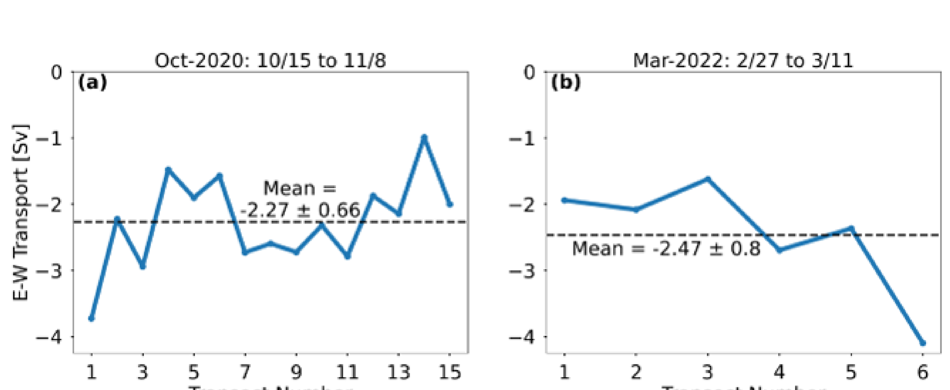


Isopycnal Water Mass Analysis: Representative source water mass profiles obtained using mean T/S profiles from World Ocean Atlas 2018 following Rhein et al. (2005) for the South and North Atlantic. T/S data from all four glider deployments shown in black.

RESULTS



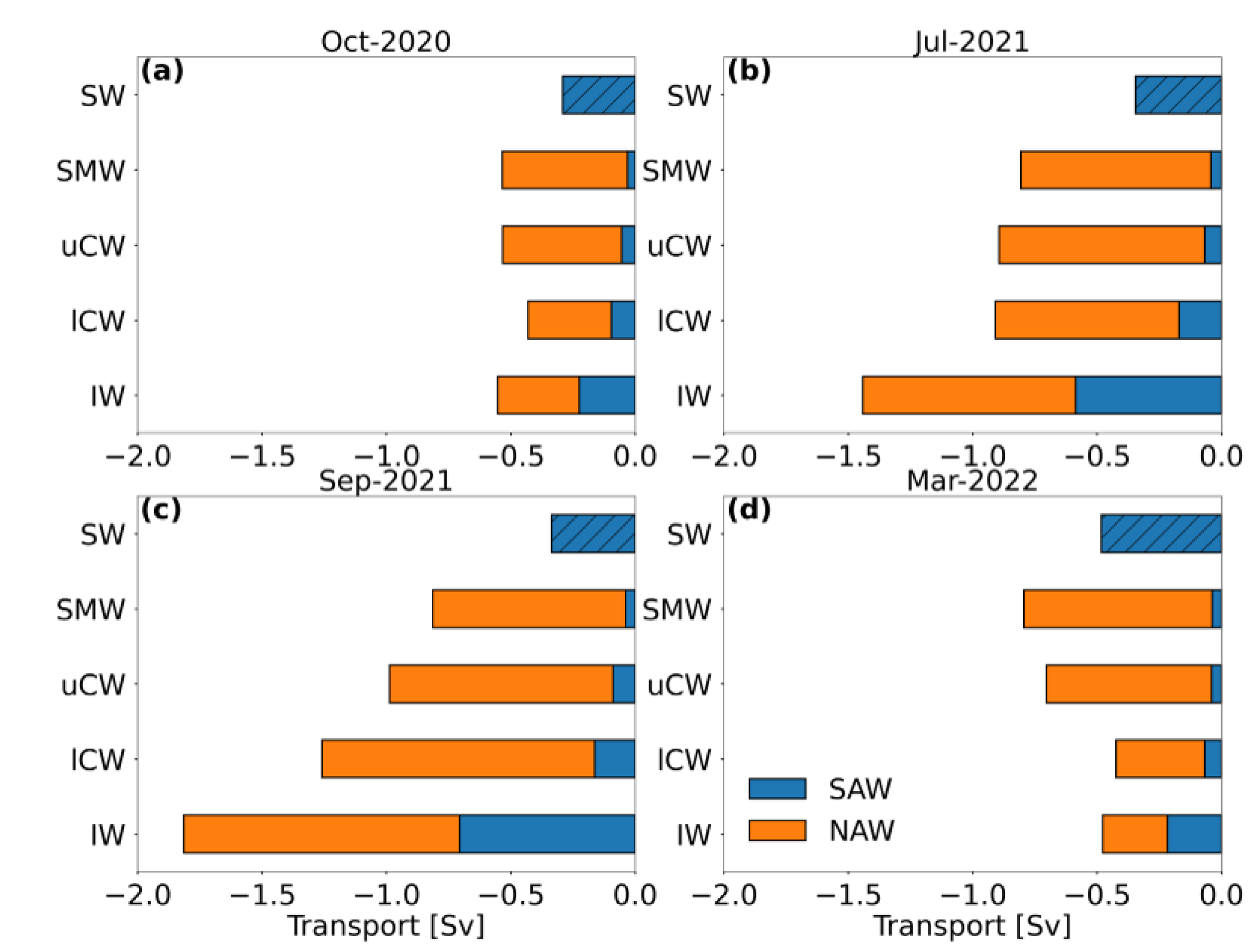
Anegada Passage velocity derived from glider mounted ADP: Both transects started on the E/NE side of the passage and traveled to the W/SW side of the passage. The duration of the Jul-2021 deployment was approximately 5.5 days and the duration of the Sep-2021 deployment was approximately 4.5 days.



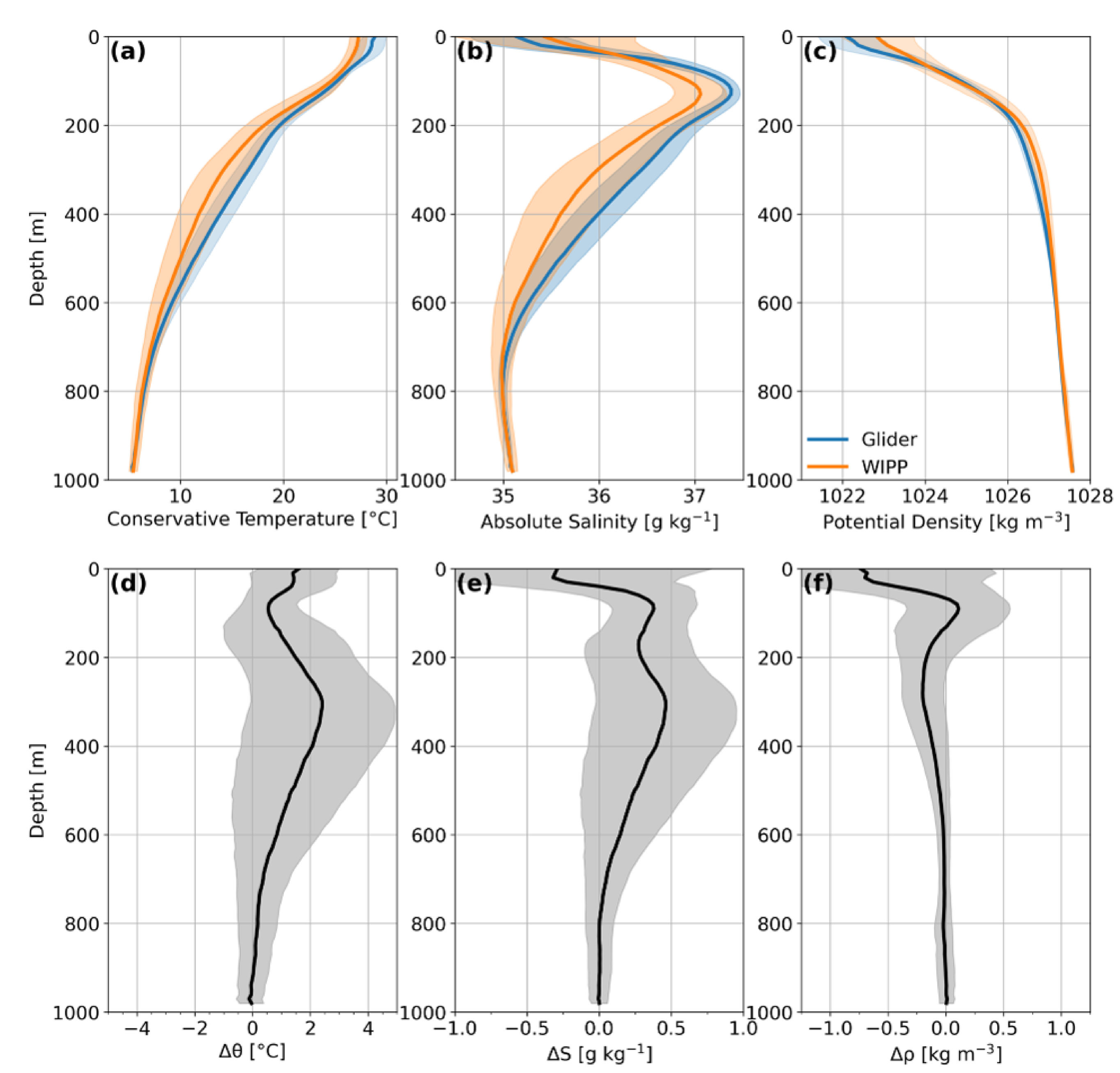
Passage Transport: E(+)/W(-) transport time-series calculated from repeat transects between St. Thomas and St. Croix. Black dashed line represents the deployment mean transport. A single transect took approx 36 hrs.

Gliders measuring **water mass properties** and island passage **transport** for **AMOC observing**

RESULTS



Water Mass Transport: Transport of SAW (blue) and NAW (orange) in the major water masses from the isopycnal water mass analysis. The surface water is hatched blue as it was not included in the water mass analysis.



Changes in Caribbean Through-Flow Properties: Mean profiles of water mass properties from the WIPP (orange) and glider (blue) datasets. Means profile changes in water mass properties over the approximately 25-year period between the WIPP and glider datasets.

CONCLUSION AND FUTURE WORK

- Total transport (4.8 Sv) and transport of South Atlantic Water (1.33 Sv) through the Anegada Passage may be larger than previously estimated.
- The Anegada Passage is a pathway for both Atlantic Meridional Overturning Circulation return flow and subtropical gyre recirculation.
- Comparisons of glider-based observations from the 2020's with ship-based observations from the 1990's suggest a significant warming and salinification trend for upper ocean water masses
- Gliders are an effective component of the global ocean observing system, needed for measuring subsurface water mass structure and transport.

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