Seasonal Variability of Salt in The Western Atlantic Tropical
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Introduction
The Western boundary regime of the tropical South Atlantic Ocean is the main pathway of an important meridional transfer of warm and cold water masses that balances the global temperature on Earth, known as Atlantic Meridional Overturning Circulation (AMOC). The AMOC is a system that depends on a delicate balance of heat and salt effects on density, and is considered one of the main elements of the terrestrial system (Stouffer et al, 2006; Caesar et al., 2018). The objective of this work was to study the interdecadal salt transport variability in the Western Atlantic Tropical Ocean, in order to identify anomalies associated with the main water masses involved in the Atlantic Meridional Overturning Circulation, which may be related to climate change.

Data and Methods
Three decades of hydrographic observations (1993 – 2019), available at the World Ocean Database – NOAA, of two important sections crossing the western Brazilian margins at 5°S and 11°S, were analyzed. The time series gaps were filled with Copernicus dataset-armor-3d-rep-monthly. The neutral density surfaces, absolute salinity, geostrophic transport and salt transport were calculated to distinguish the salt transport variability in different water masses horizons. The salt transport was calculated as function of absolute salinity, velocity and density. The neutral density ($\rho'$) surfaces were calculated to distinguish the salt transport in different water masses, following the reference values proposed by Hummels et al. (2015) in the Table 1.

<table>
<thead>
<tr>
<th>Water Mass</th>
<th>Neutral Density ($\rho'$)</th>
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</thead>
<tbody>
<tr>
<td>Surface water - SACW</td>
<td>24.5 kg m$^{-3}$</td>
</tr>
<tr>
<td>SACW - AAIW</td>
<td>26.8 kg m$^{-3}$</td>
</tr>
<tr>
<td>AAIW – NADW</td>
<td>27.7 kg m$^{-3}$</td>
</tr>
<tr>
<td>NADW – AABW</td>
<td>28.135 kg m$^{-3}$</td>
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</tbody>
</table>

Figure 1: Map of surface absolute salinity at $\pm$4.5 with the location of the Sections 5°S and 11°S and the variability of absolute salinity standardized by water mass at the Sections.

Results and discussion
Using the algorithm of Grinsted et al. (2004) we were able to assess the periodic behavior of the salt transport at 5°S and 11°S considering the three water masses horizons (SACW, AAIW and NADW). The results (figure 4) showed a markedly seasonal signal at the SACW, due to its interaction with ventilated waters, as well as a marked 1 year period at AAIW horizon, suggesting the seasonal influence on its formation and spreading. It is interesting to note the presence of a (less) significant sign in the 4 years period band, marked on the horizons of AAIW at 11°S and at NADW. The 4 years period band usually represents the main oscillation band for events in El Niño / La Niña. It is not yet clear how such a sign can appear so noticeable at the core of NADW’s salt transport, but clearly this is a point of further investigation.

Conclusions
The geostrophic and salt transports suggest a multidecadal variability and the changes in upper limit salinity are consistent with an increased Agulhas Leakage, as described in literature (i.e. Biastoch, et al - 2009). In the deep ocean, water mass changes seem to be likely related to changes in weather patterns in the North Atlantic as well as in tropical circulation changes.

References

Acknowledgment