Characteristics of the Atlantic Subtropical Cells inferred from ARGO data

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Warming trend in the Tropical Atlantic

- SST warming in the equatorial Atlantic and coastal eastern tropical Atlantic over the last decades (here: 1976-2012)
- Simultaneous increase of trade winds → intensified upwelling would decrease SST

Hypothesis:
- Upwelled subsurface water has warmed at a higher rate than the surface water
- Role and contribution of the Atlantic STCs?
Atlantic Subtropical Cells

Schott et al. (2004) - with transport values from Zhang et al. (2003)
Argo data (Roemmich-Gilson)

- Climatological monthly means on (1°)² grid
- Monthly anomalies (2004-2016)
- Temperature and salinity at 58 pressure levels (0-2000 dbar)
- RT and DM profiles with additional quality control criteria
Methods

• Thermocline transport (geostrophic):

  Temperature and salinity profiles
  \[ \downarrow \]
  Dynamic height
  \[ \downarrow \]
  Meridional geostrophic velocities through zonal sections
  \[ -fv = -\frac{1}{\rho_0} p_x \]

• Surface transport (Ekman):

  Surface mean wind stress (ASCAT)
  \[ \downarrow \]
  Meridional Ekman transport through zonal sections
  \[ M_E = -\frac{1}{\rho_0} \frac{\tau_x}{f} \]
Geostrophic velocity sections

Meridional absolute geostrophic velocity (10°N) - Roemmich-Gilson (ARGO)

Meridional absolute geostrophic velocity (06°S) - Roemmich-Gilson (ARGO)

pycnocline layer
Mean transport

**10°N**

**6°S**

Meridional Volume Transport [Sv]

Zhang et al. (2003)
Mean transport
Zonally accumulated transport

Cumulative meridional volume transport (24 - 26 kg m\(^{-3}\)) along 10°N

Cumulative meridional volume transport (24 - 26 kg m\(^{-3}\)) along 6°S

Zhang et al. (2003)
Zonally accumulated transport

Cumulative meridional volume transport (24 - 26 kg m\(^{-3}\)) along 10°N

Cumulative meridional volume transport (24 - 26 kg m\(^{-3}\)) along 6°S

Zhang et al. (2003)
Ekman transport at the surface

Mean wind stress from ASCAT (2007-2018)

~9 Sv

~13 Sv

Atlantic STCs from ARGO | PIRATA '18 | Franz Philip Tuchen
STC schematic

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Conclusions

- Calculation of pycnocline transports associated with the Atlantic Subtropical Cells based on ARGO data.

- Equatorward transports largely depend on representation and coverage of the western boundary in the data set.

- Inclusion of mooring data at the western boundary (5°S / 11°S).

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Outlook: time series analysis

![Graph showing time series analysis of ATL3-SST anomaly and Thermocline Convergence anomaly](image)
References (in order of appearance)

