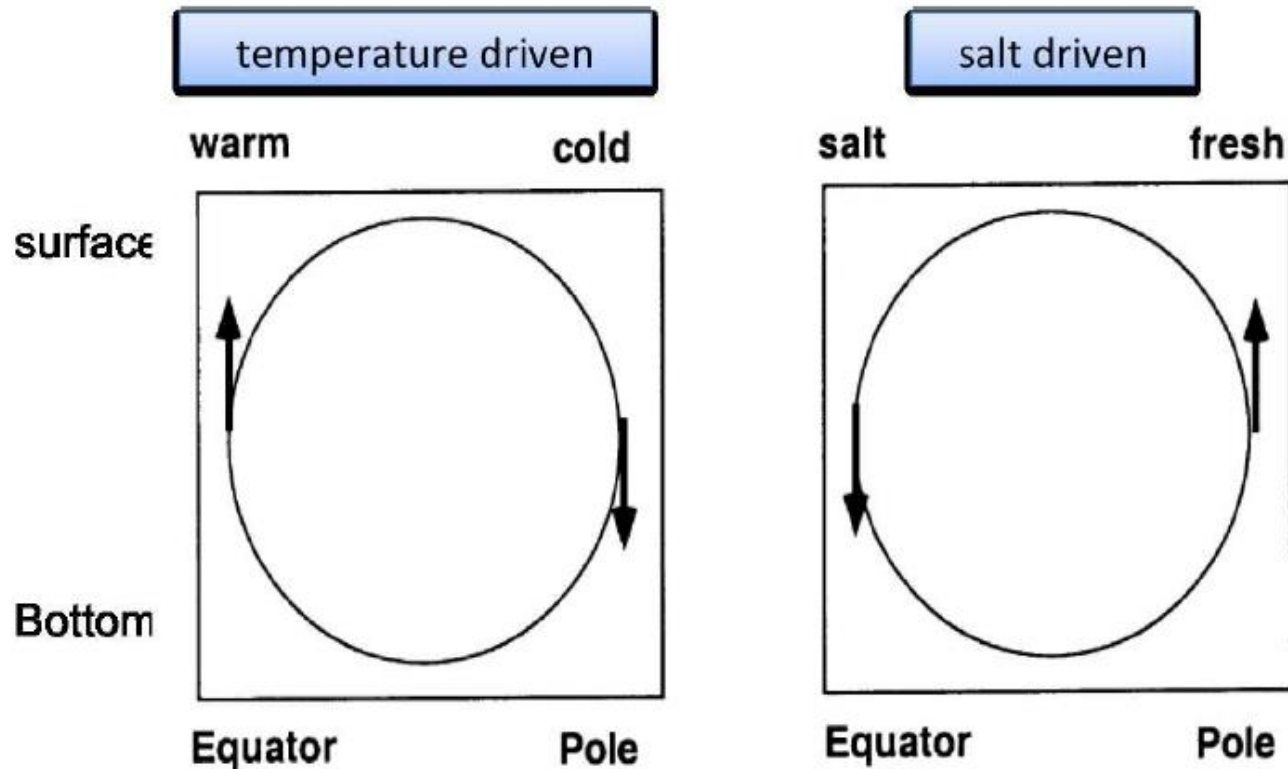


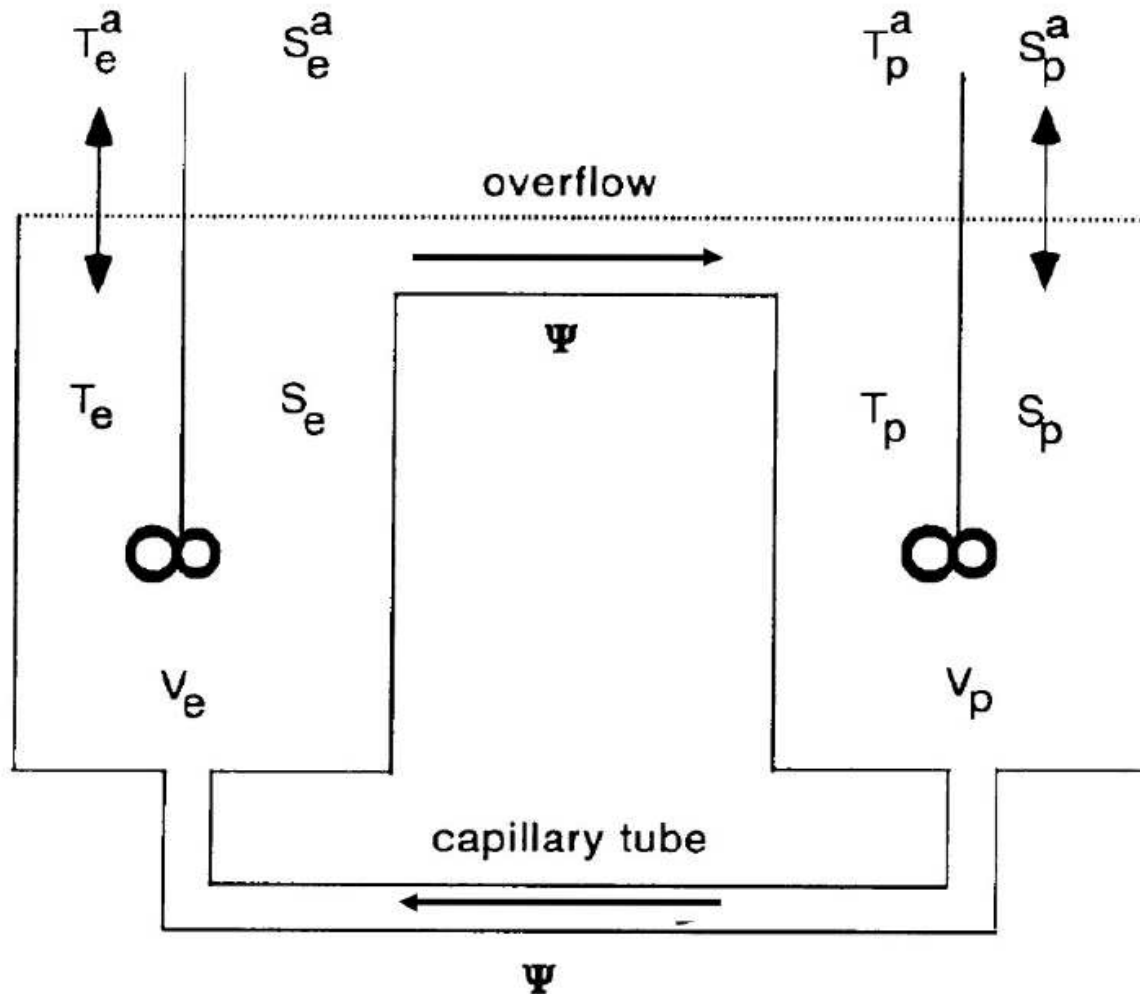
Buoyancy-driven ocean circulation

- continued

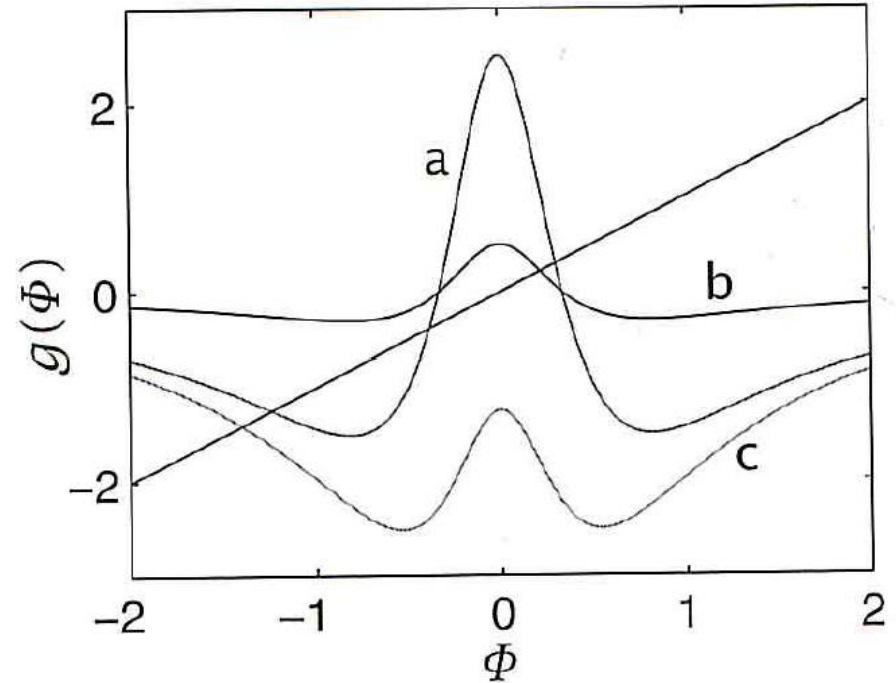
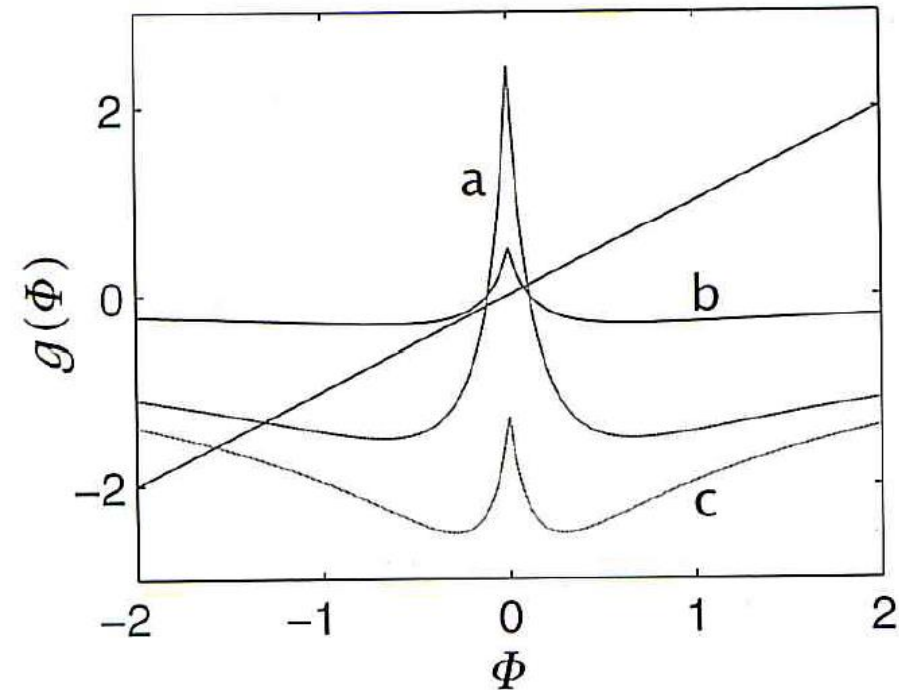
Two competing regimes in Stommel's two-box model



Stommel's two-box model



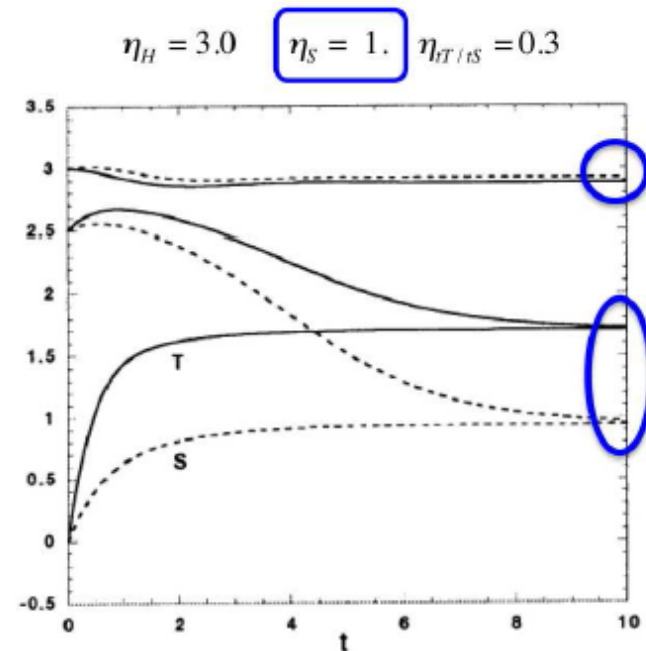
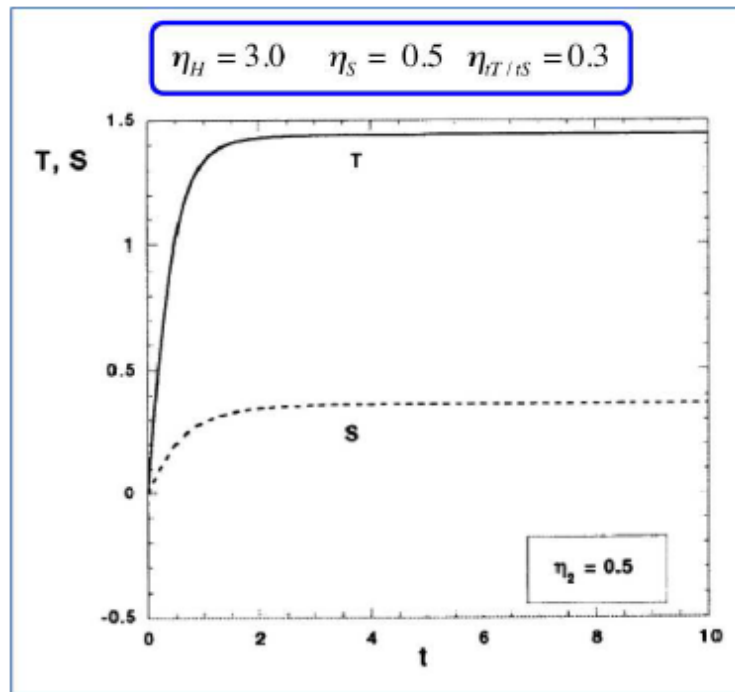
Stommel's two-box model



Graphical solution of the two-box model.

a: ($\gamma=5$, $\delta=1/6$, $\mu=1.5$), b: ($\gamma=1$, $\delta=1/6$, $\mu=1.5$), c: ($\gamma=5$, $\delta=1/6$, $\mu=0.75$)

Stommel's two-box model



Two Equilibrium states

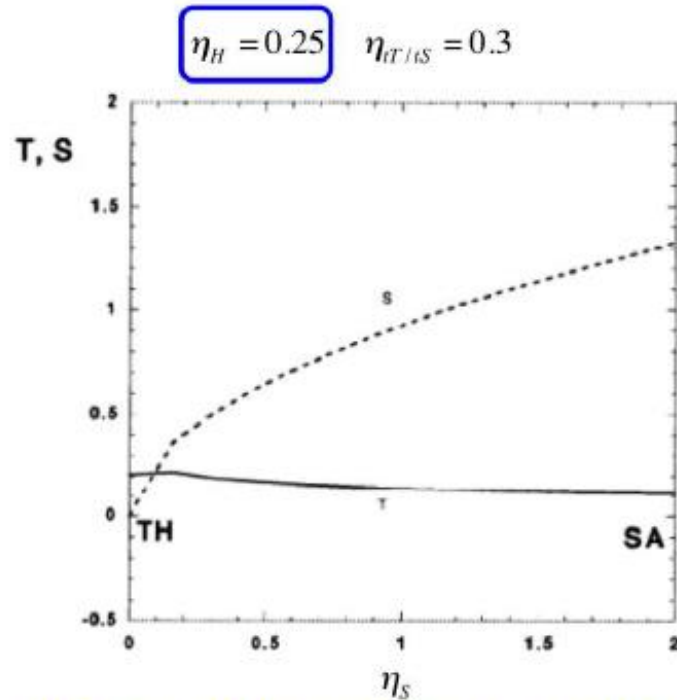
η_H heat forcing parameter

η_S salt forcing parameter

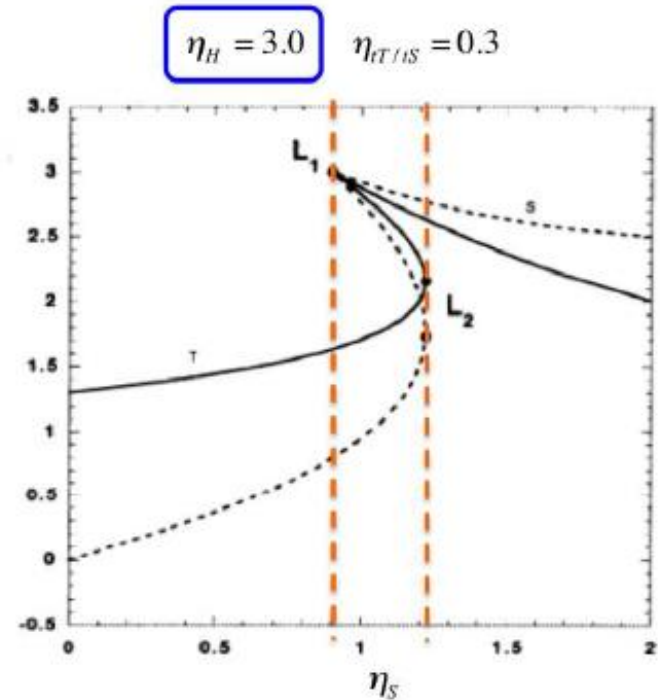
$\eta_{tT/tS}$ time scale ratio T/S

Source: Dommenges (2014)

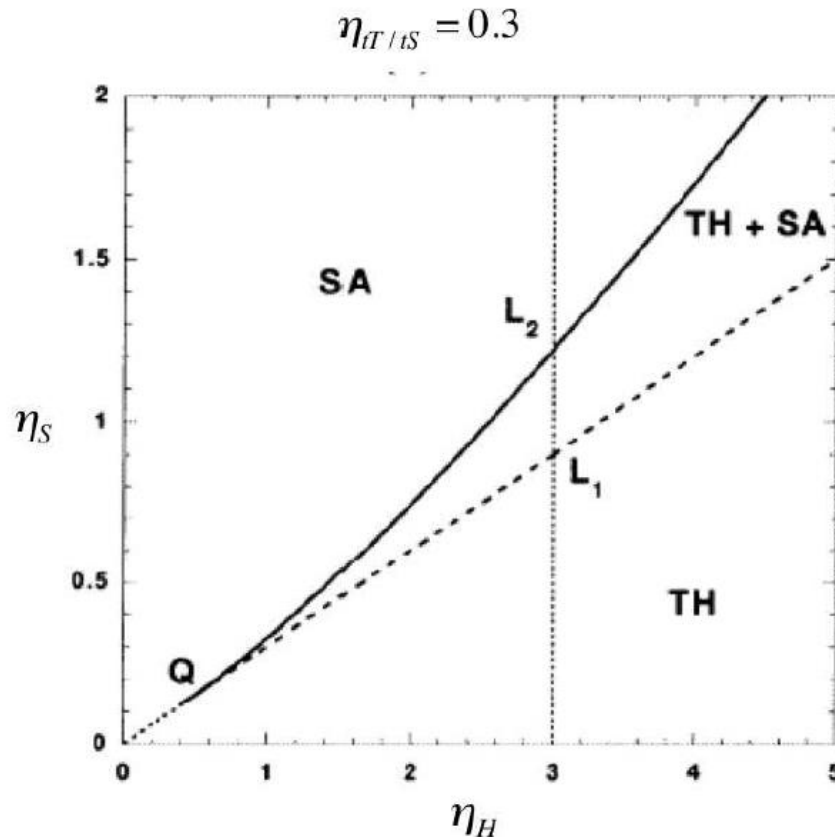
Stommel's two-box model



TH: Thermal driven; sinking in polar box
SA: Salt driven; sinking in equatorial box



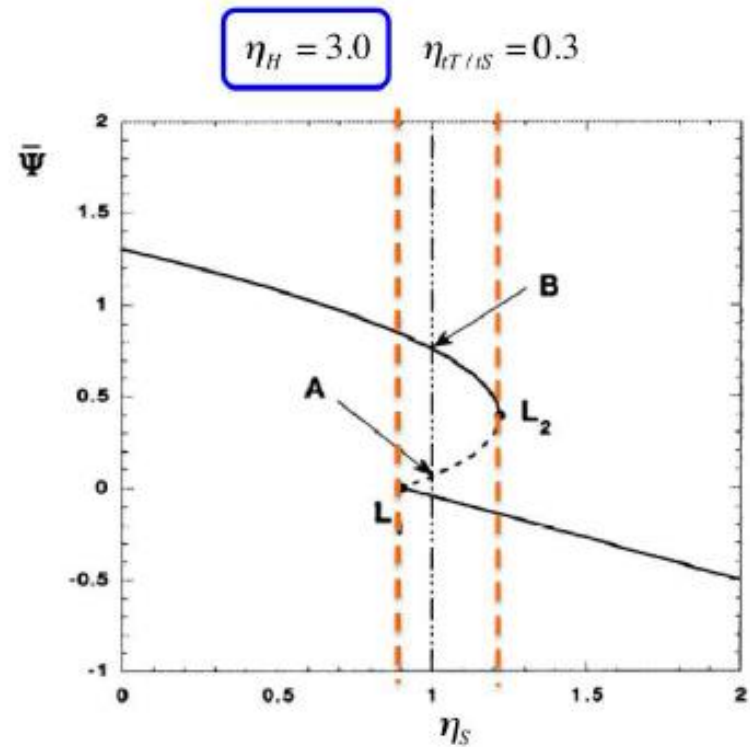
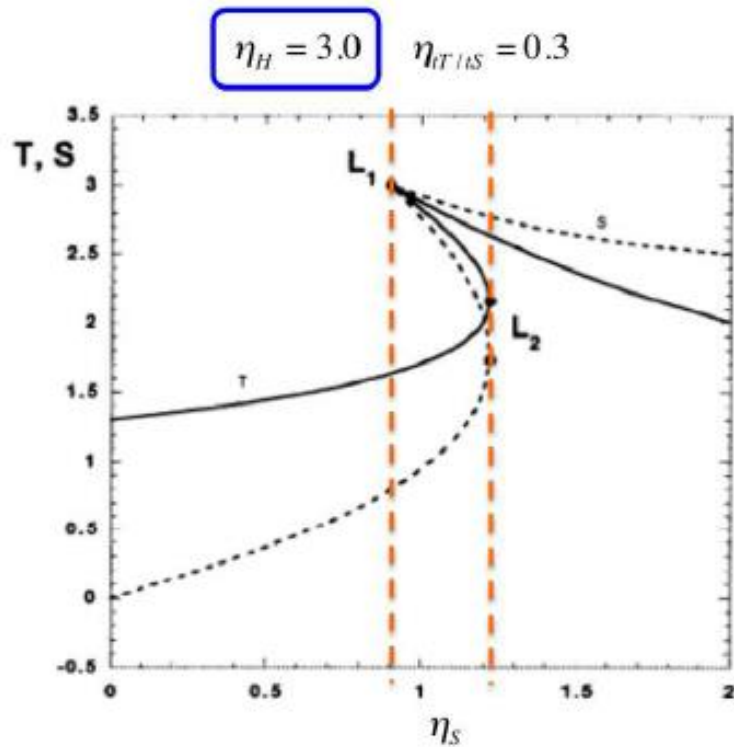
Stommel's two-box model



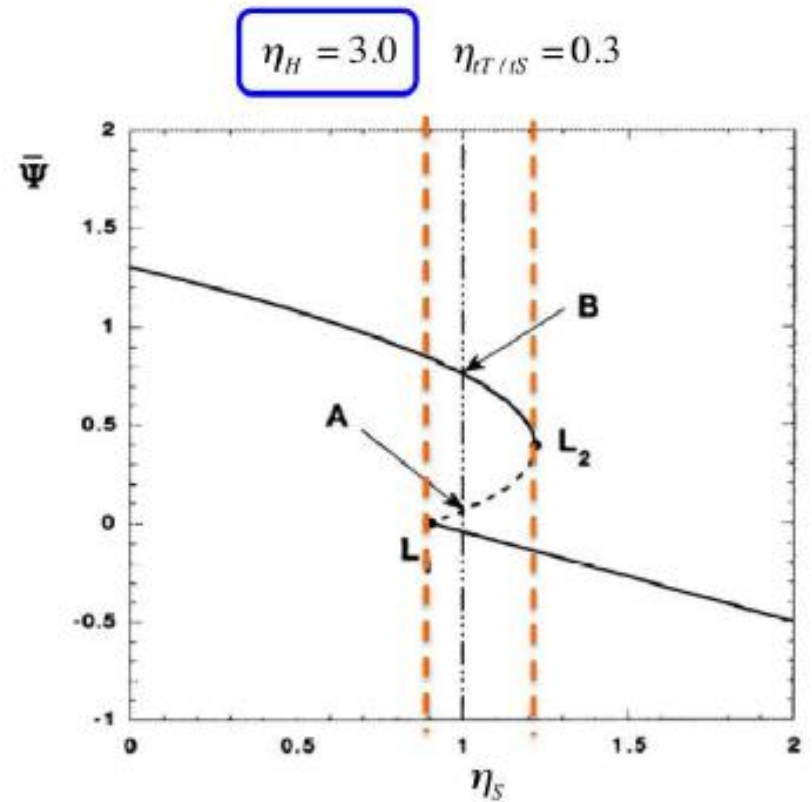
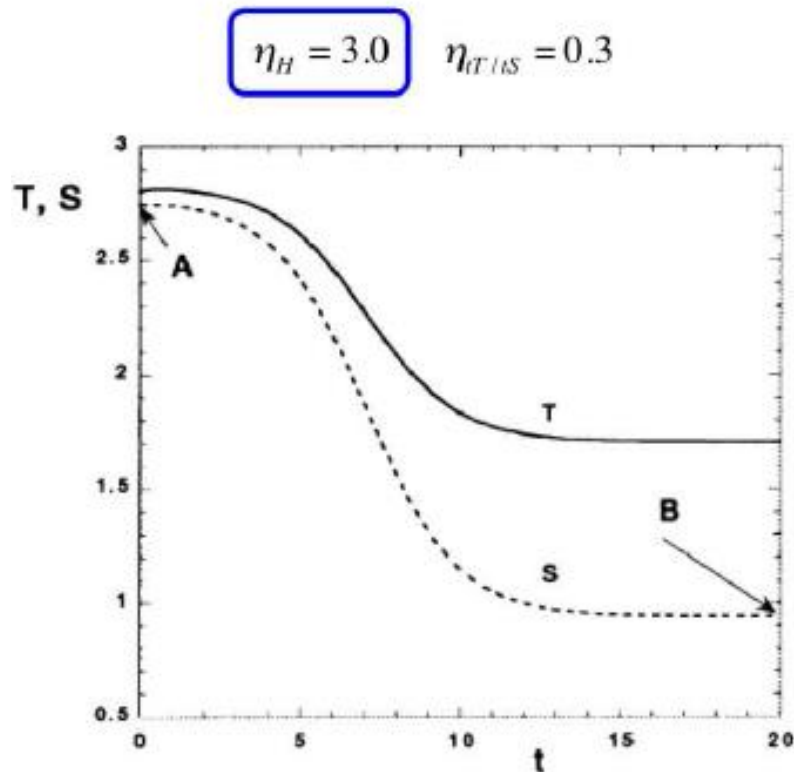
TH: Thermal driven; sinking in polar box

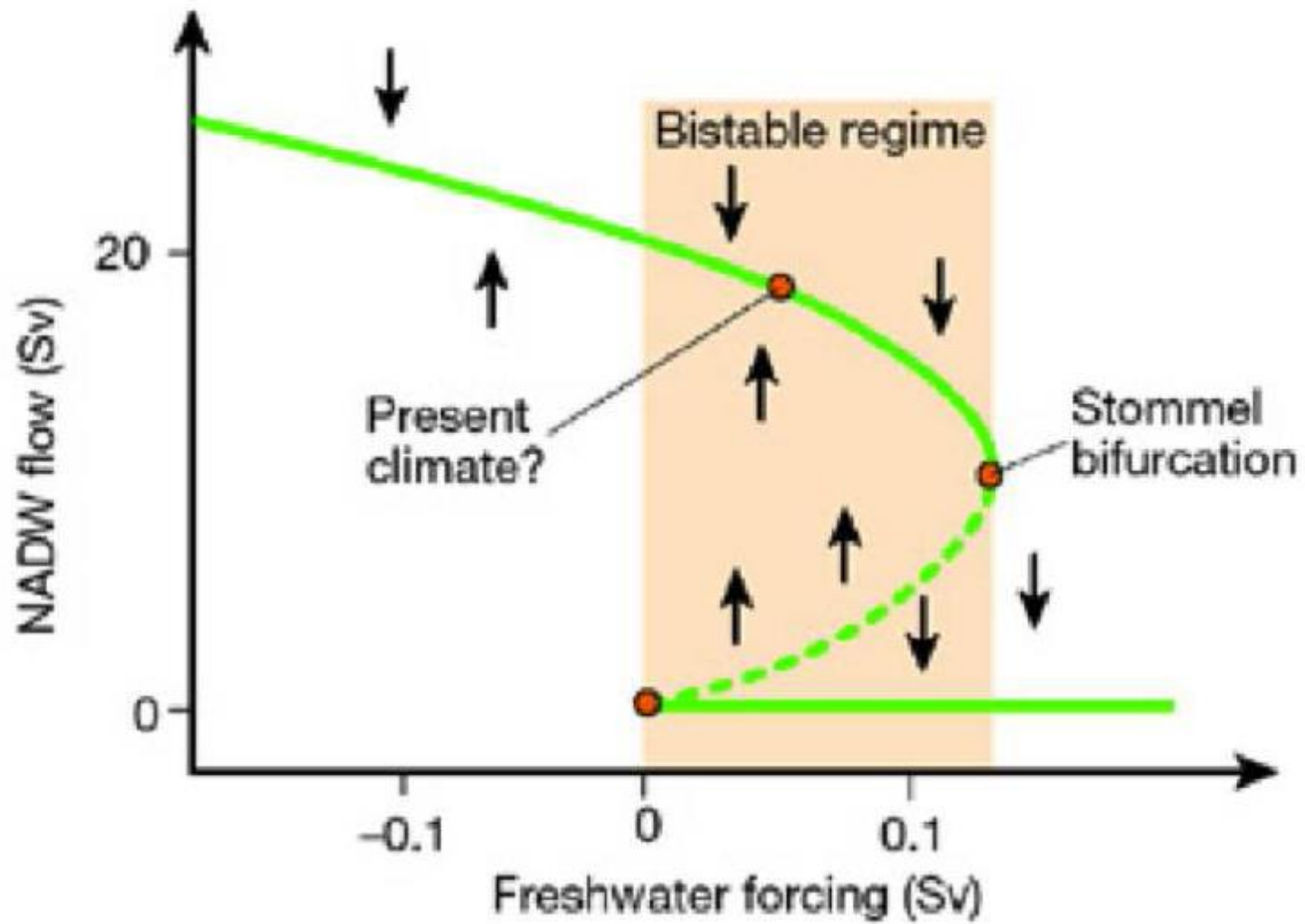
SA: Salt driven; sinking equatorial box

Stommel's two-box model

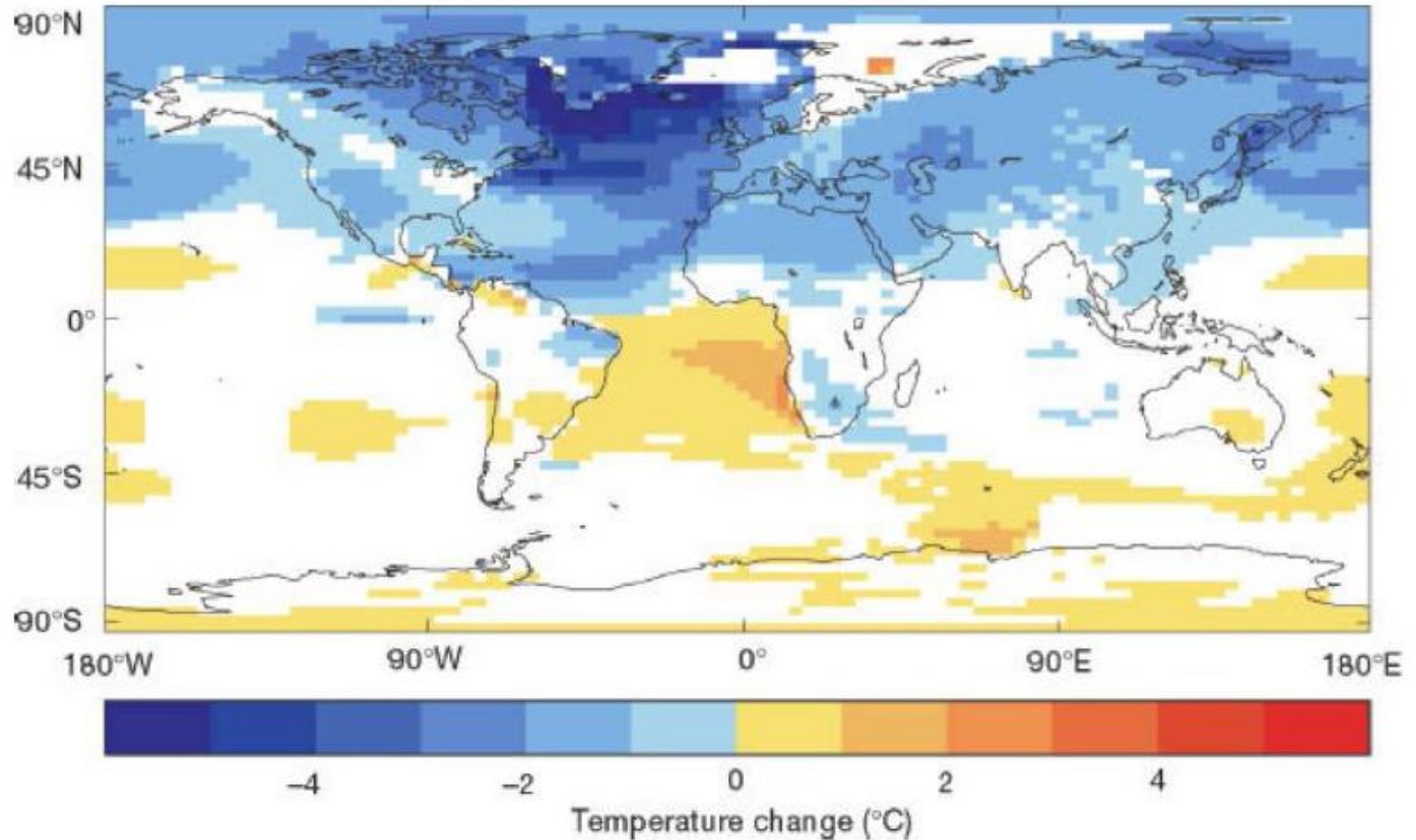


Stommel's two-box model





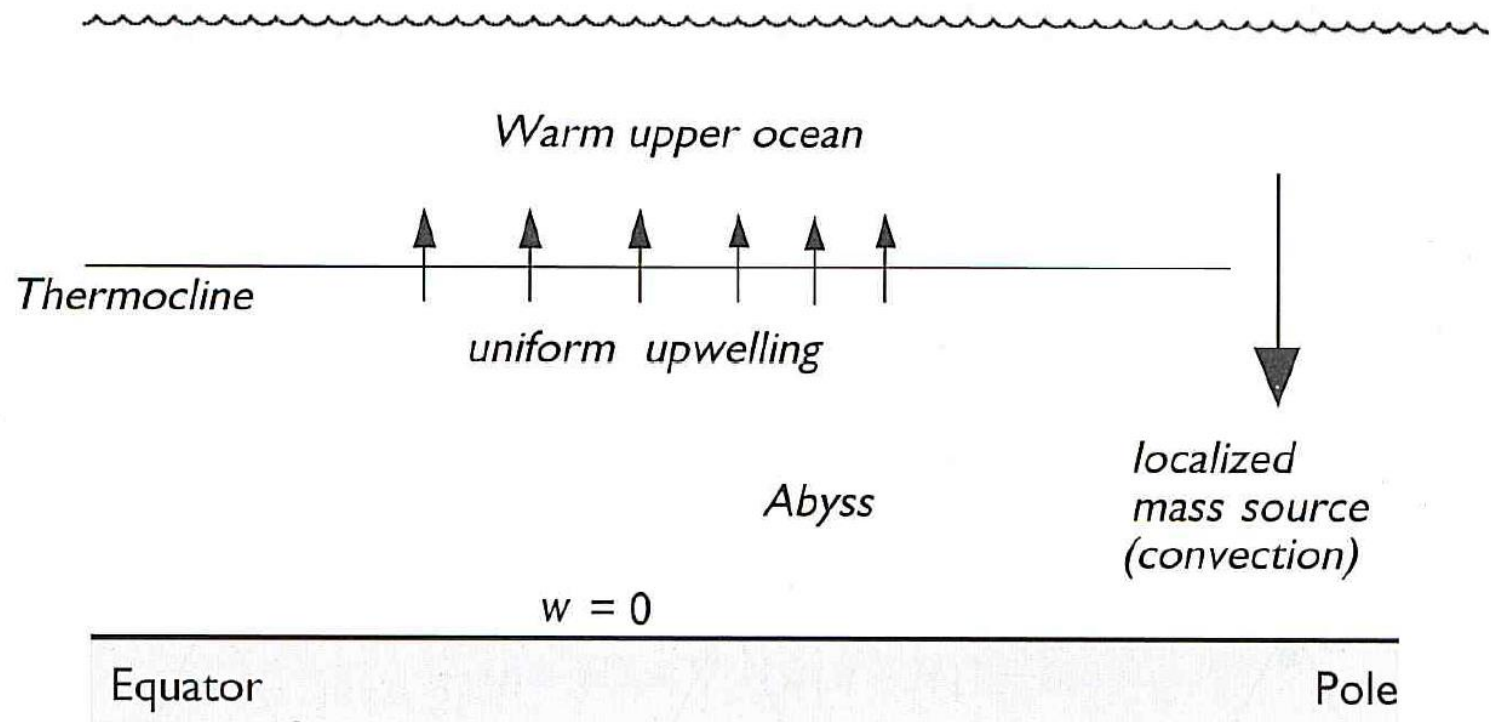
Response to MOC shutdown



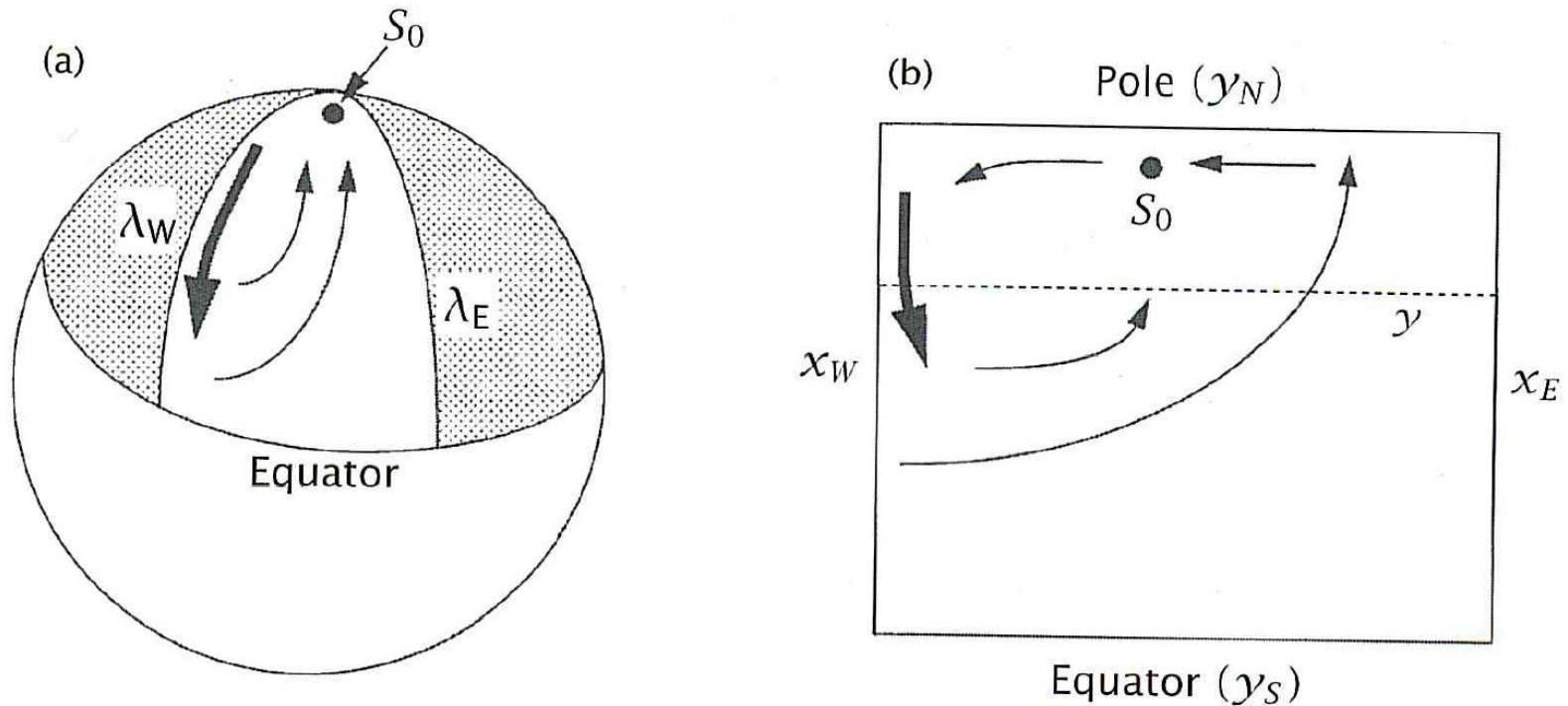
Source: Dommenges (2014)

- During climate change two things can happen:
- *First the polar regions warm more* than the equatorial regions. This reduces the heat temperature gradient and therefore the heat forcing for the ocean circulation. The circulation should get weaker.
- *Second Greenland and other glaciers may melt*, leading to increased fresh water into the North Atlantic. This increases the salinity forcing of the circulation, causing the TH circulation to be reduced.
- The second effect may also be further supported by increased rainfall and decreased sea ice formation.
- Overall it should lead to a reduction of the MOC as simulated by most climate change GCM simulations.

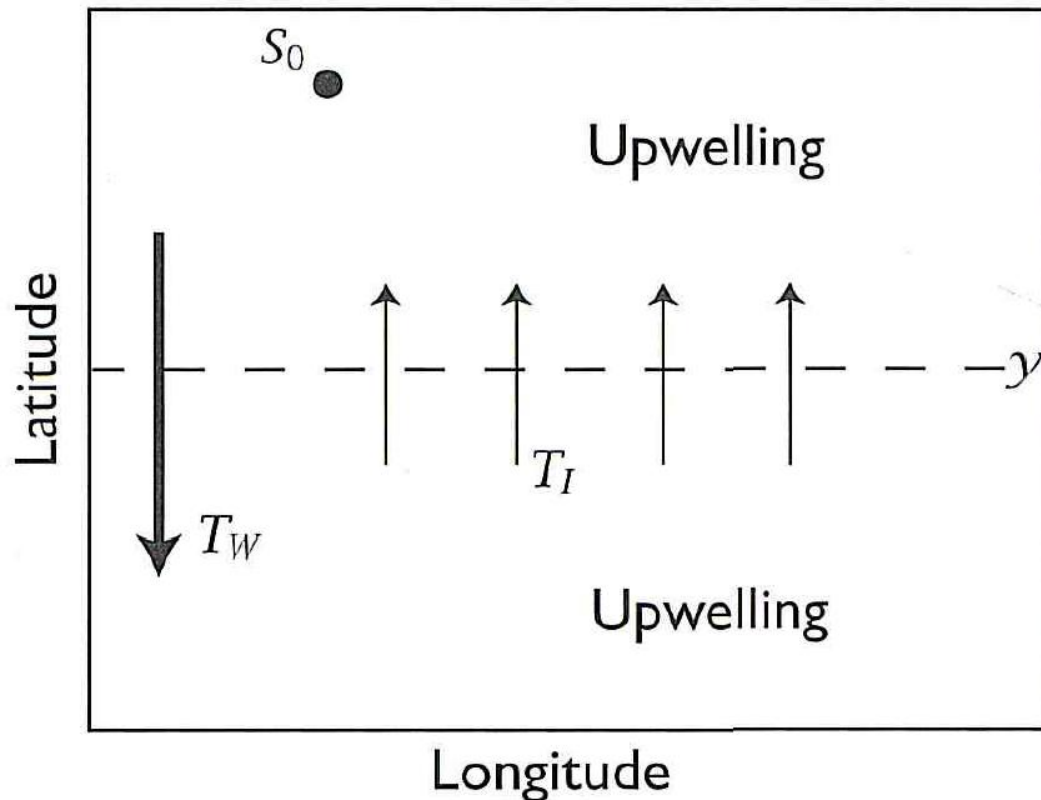
A model for the oceanic abyssal flow (Stommel-Arons model)



A model for the oceanic abyssal flow (Stommel-Arons model)

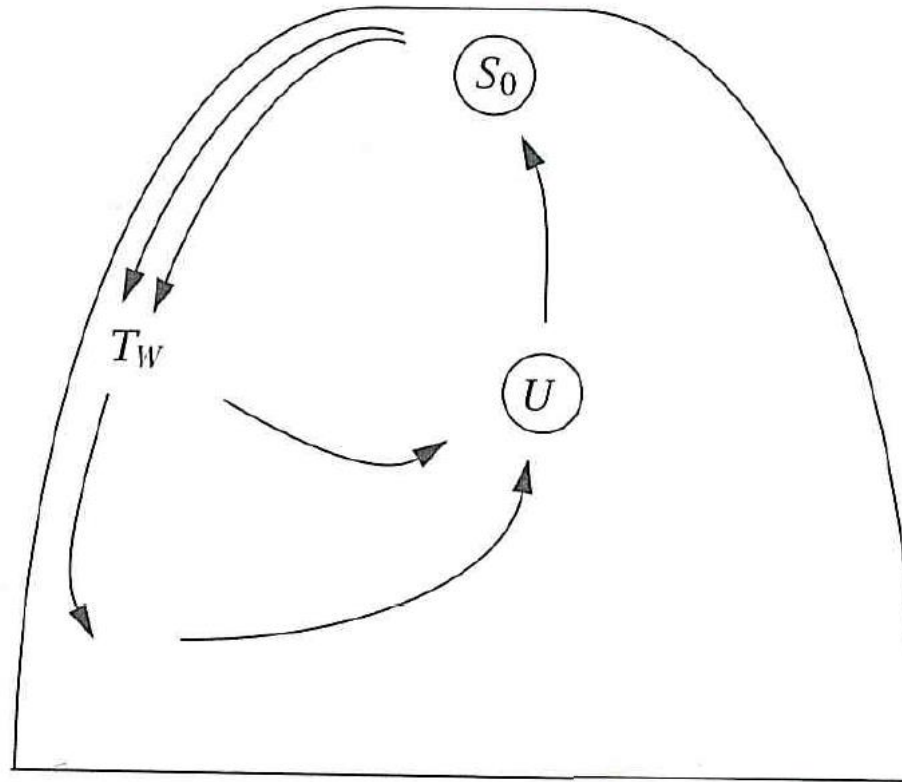


A model for the oceanic abyssal flow (Stommel-Arons model)



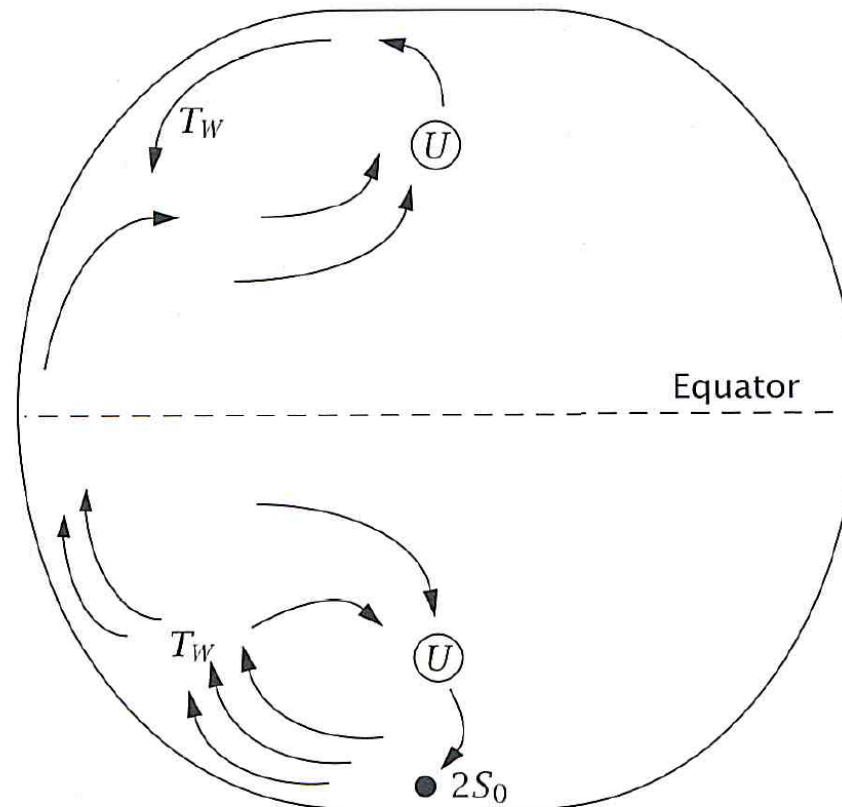
Source: Vallis (2006), Fig. 15.14

A model for the oceanic abyssal flow (Stommel-Arons model)



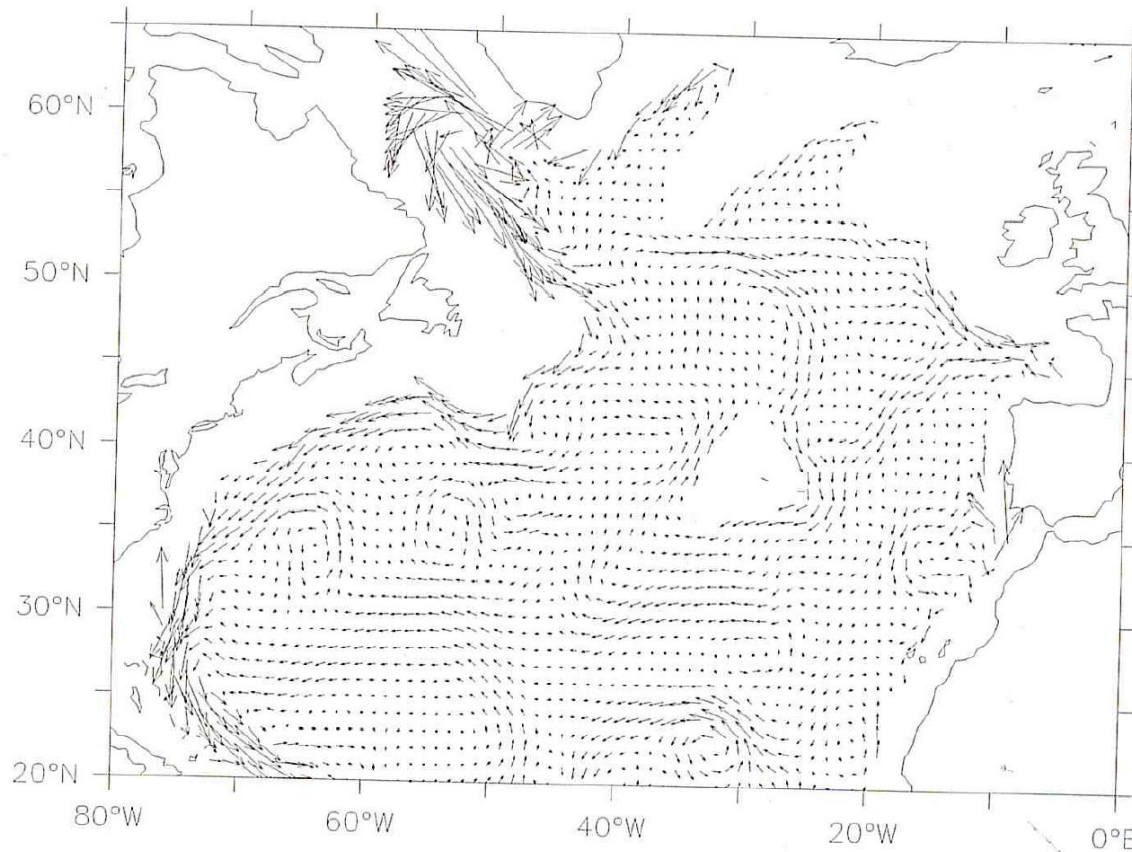
Source: Vallis (2006), Fig. 15.15

A model for the oceanic abyssal flow (Stommel-Arons model)



Source: Vallis (2006), Fig. 15.16

A model for the oceanic abyssal flow (Stommel-Arons model)



Source: Vallis (2006), Fig. 15.18