

# The role of **salinity** in ocean circulation and climate response to greenhouse gas forcing

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# Background:

## Ocean salinity:

- less constrained than temperature
- strong impact on circulation via density
- ocean signature of global water cycle

## Impacts of salinity on climate variability:

- Thermo*Haline* Circulation (**abrupt change**)
- fresh water flux (**climate change**)



## Issues:

What maintains the **mean salinity** structure ?

- sources, sinks
- time scales

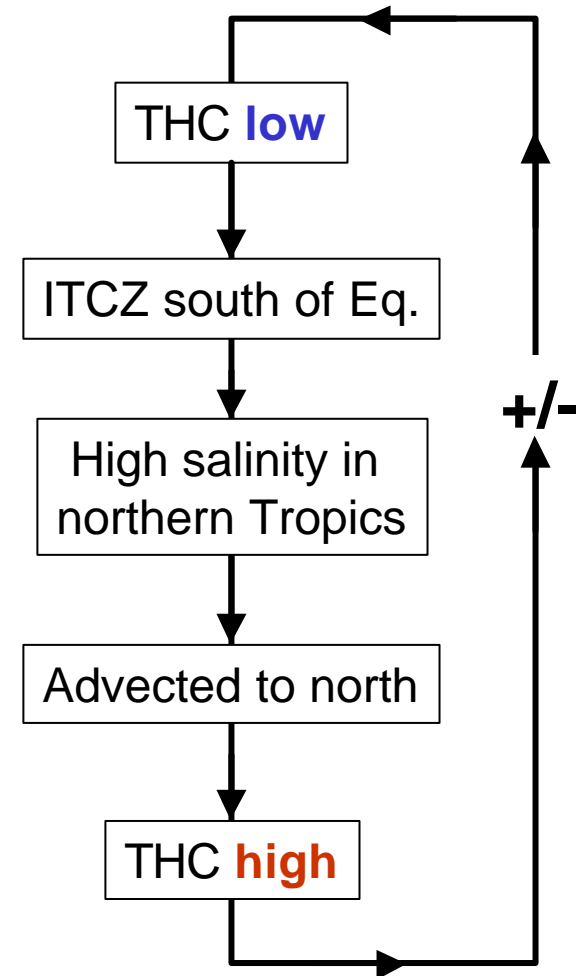
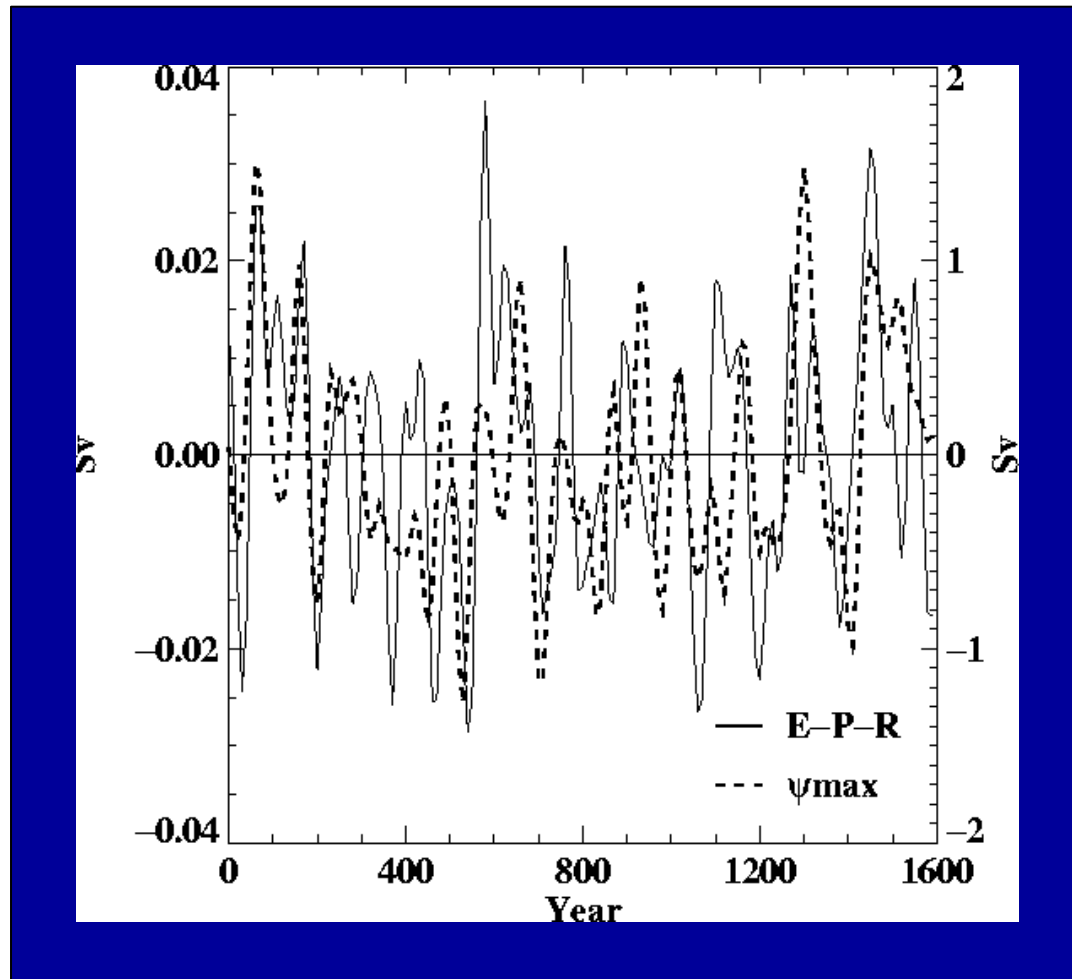
How does salinity **amplify/damp climate variability** ?

Could the associated mechanisms lead to **abrupt climate change** under “**global warming**”?



# A 60 year feedback loop in HadCM3:

THC (lagged by 60 years) vs. E-P in tropical atlantic

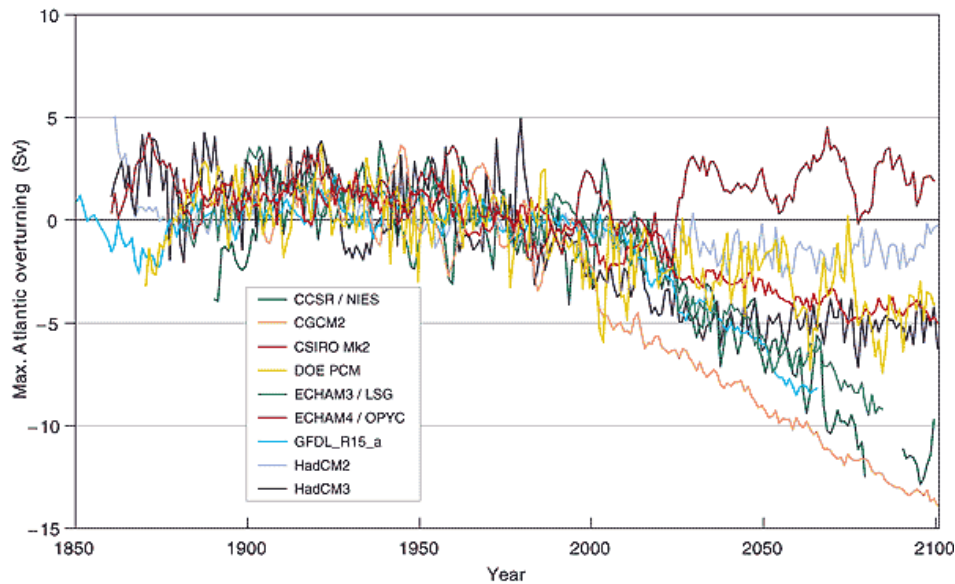


Courtesy Michael Vellinga (Met Office)

## Issues (cont'd):

Which are the **dominant feedback mechanisms** ?

Models differ significantly:



THC evolution  
in IPCC climate change  
scenario simulations



## Project objectives:

- 1) investigate **mechanisms** and **feedback loops** that:
  - **maintain the ocean mean salinity** structure
  - **drive its variability** on decadal to centennial time scales
- 2) investigate **role of salinity** in the climate response to **GHG forcing**



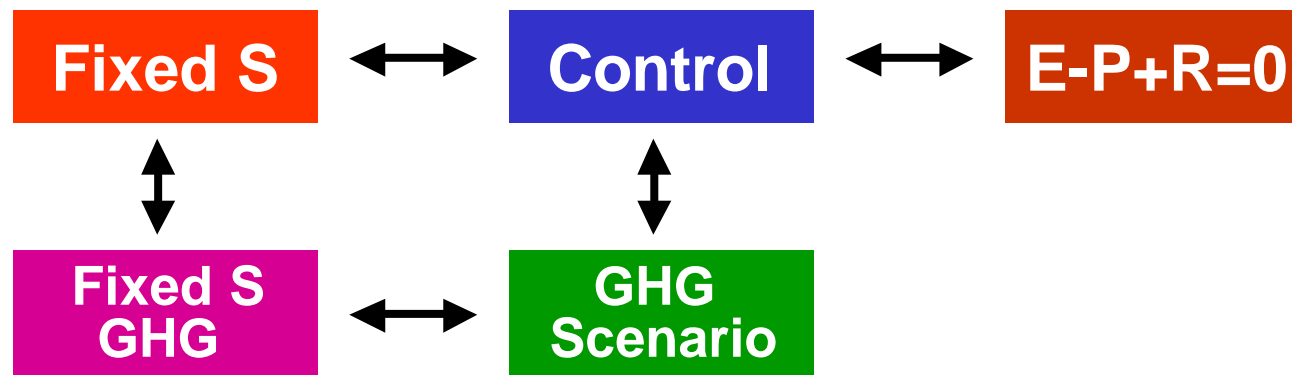
## How ?

- 1) Use a **coupled Earth System GCM** (HadGEM1)
- 2) Perform **sensitivity experiments** (control and GHG) by removing important feedbacks:
  - **fixed salinity**
  - **no fresh water flux input**



## How ? (cont'd)

### 3) Analyse **compared adjustment**



### 4) Assess **robustness of results** in other models

