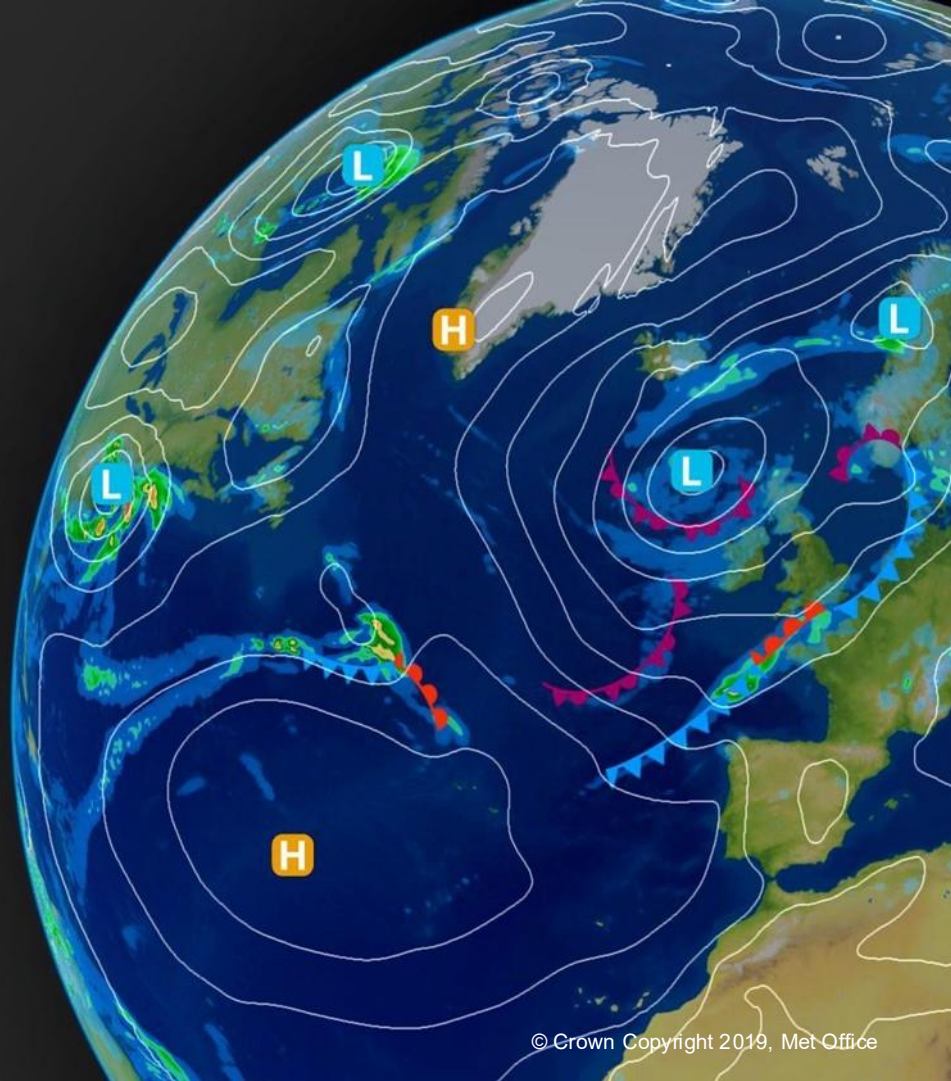
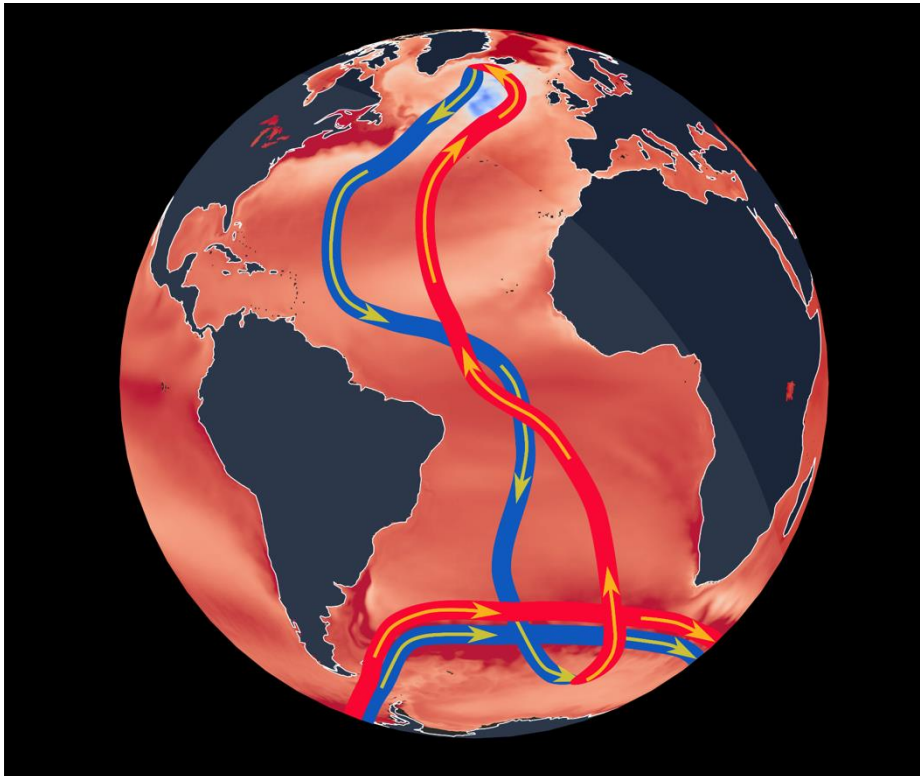
AMOC and Climate Derailment Risk

Jonathan Baker
Met Office



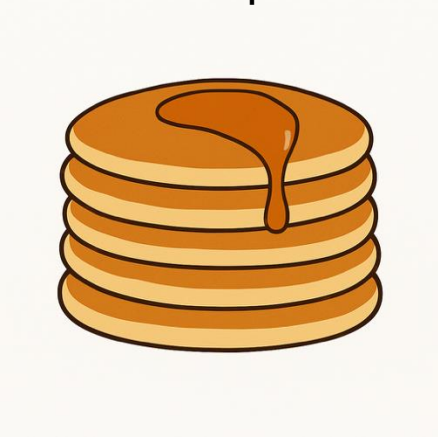
What is the AMOC?

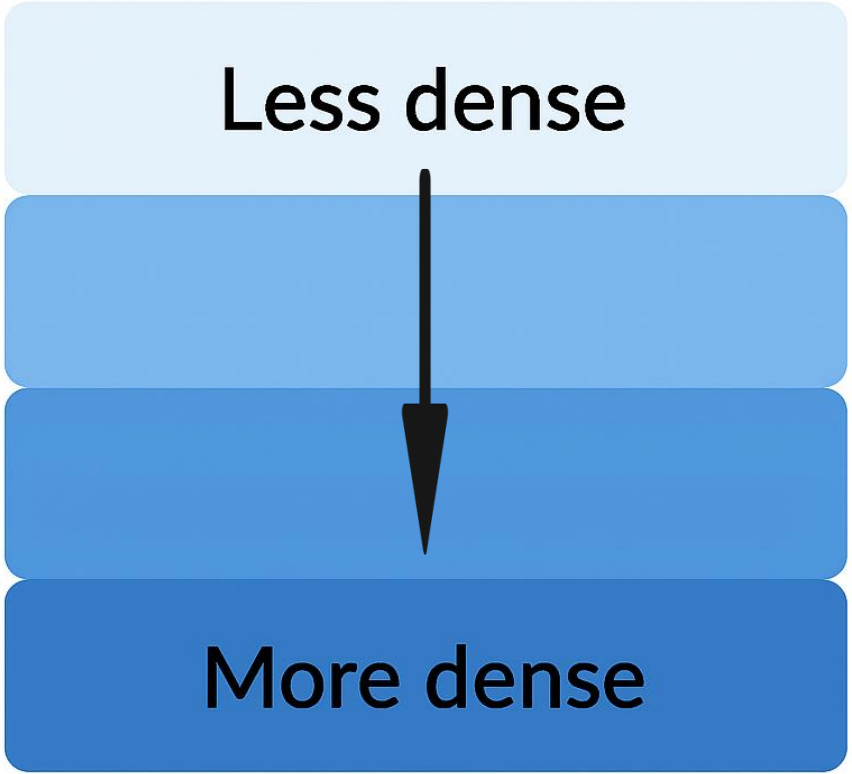
- Large Atlantic ocean circulation system
- Transports heat northwards
- Influences European climate, storms and sea level



Why will the AMOC weaken?

- Surface warming
- Freshwater input
- Increased stratification
- Reduced deep water formation





Contrasting Headlines

Met Office
Hadley Centre

The Guardian

Collapse of critical Atlantic current is no longer low-likelihood, study finds

FINANCIAL TIMES

The utterly plausible case that climate change makes London much colder

Bloomberg UK

Europe's Warming Ocean Current 'Unlikely' to Collapse This Century

CNN

A critical system of Atlantic Ocean currents could collapse as early as the 2030s, new research suggests

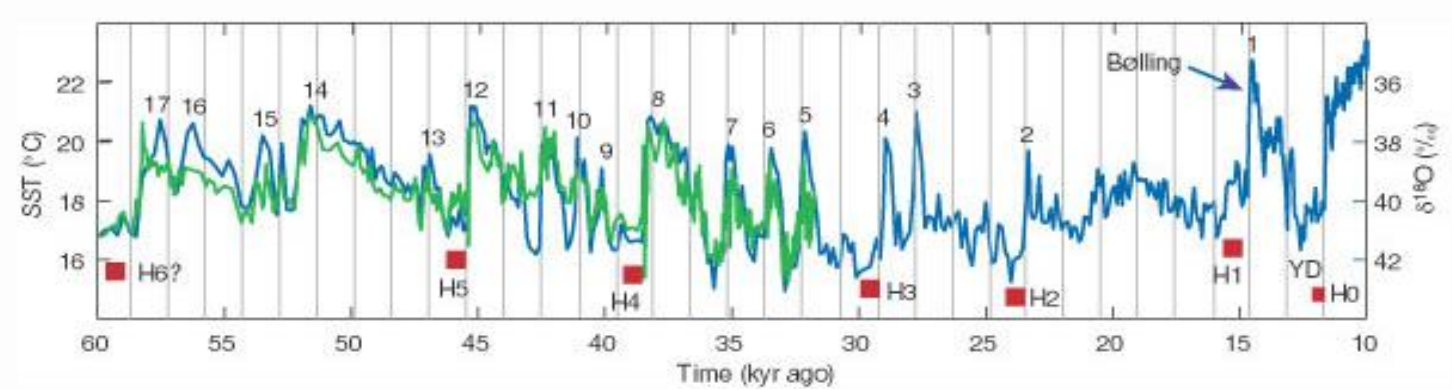
BBC

Will the Gulf Stream really collapse by 2025?

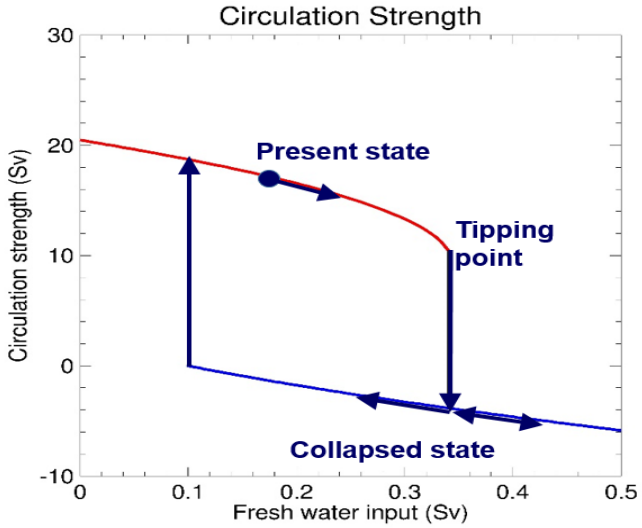
The Guardian

Total collapse of vital Atlantic currents unlikely this century, study finds

AMOC tipping points are physically plausible

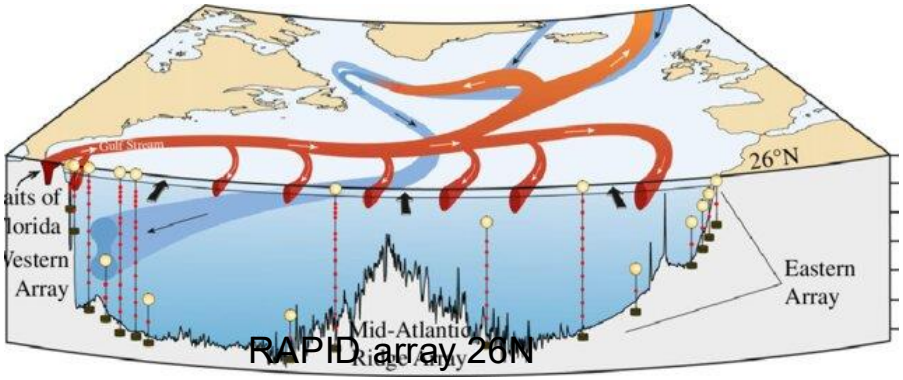


- Seen in past climates
- Simulated in climate models
- But uncertain under modern conditions

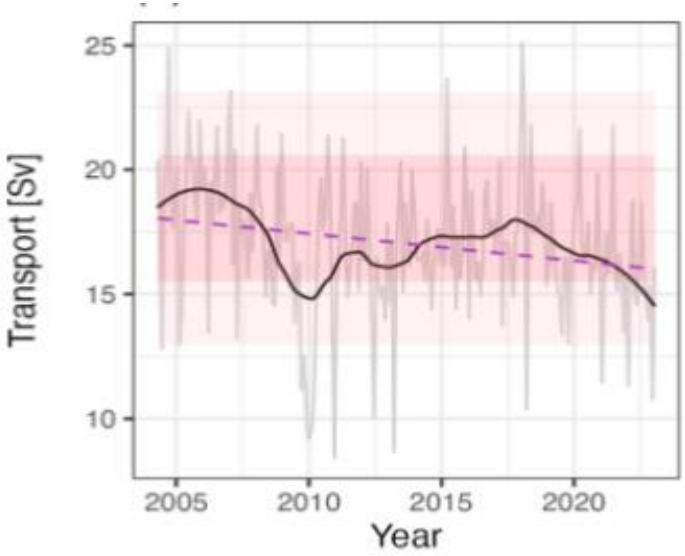


How has the AMOC changed?

- ~20 years of direct measurements
- Large natural variability
- Long-term trend difficult to detect

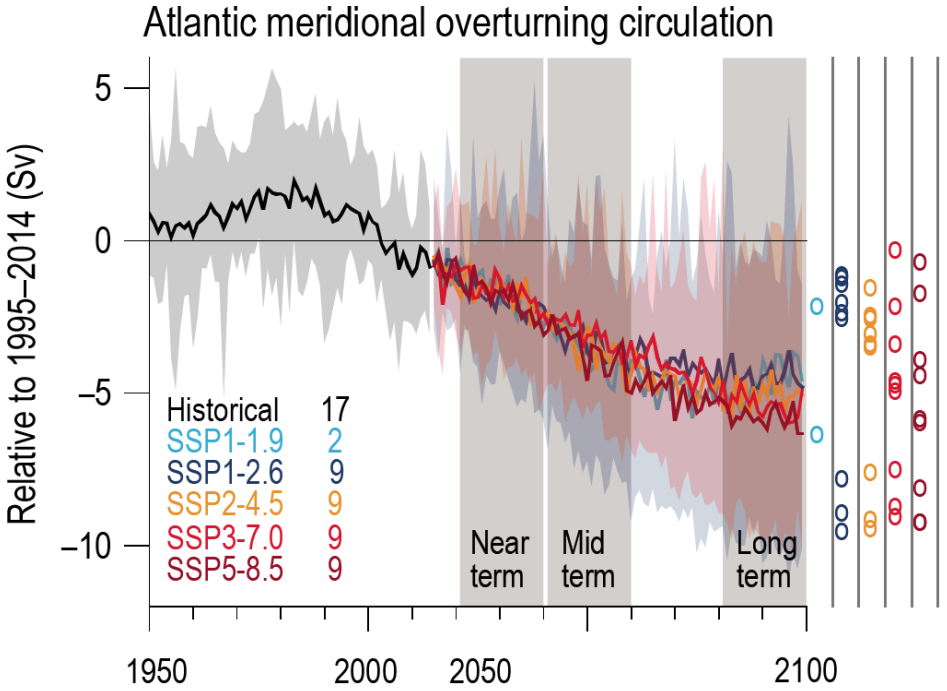


RAPID array 26N



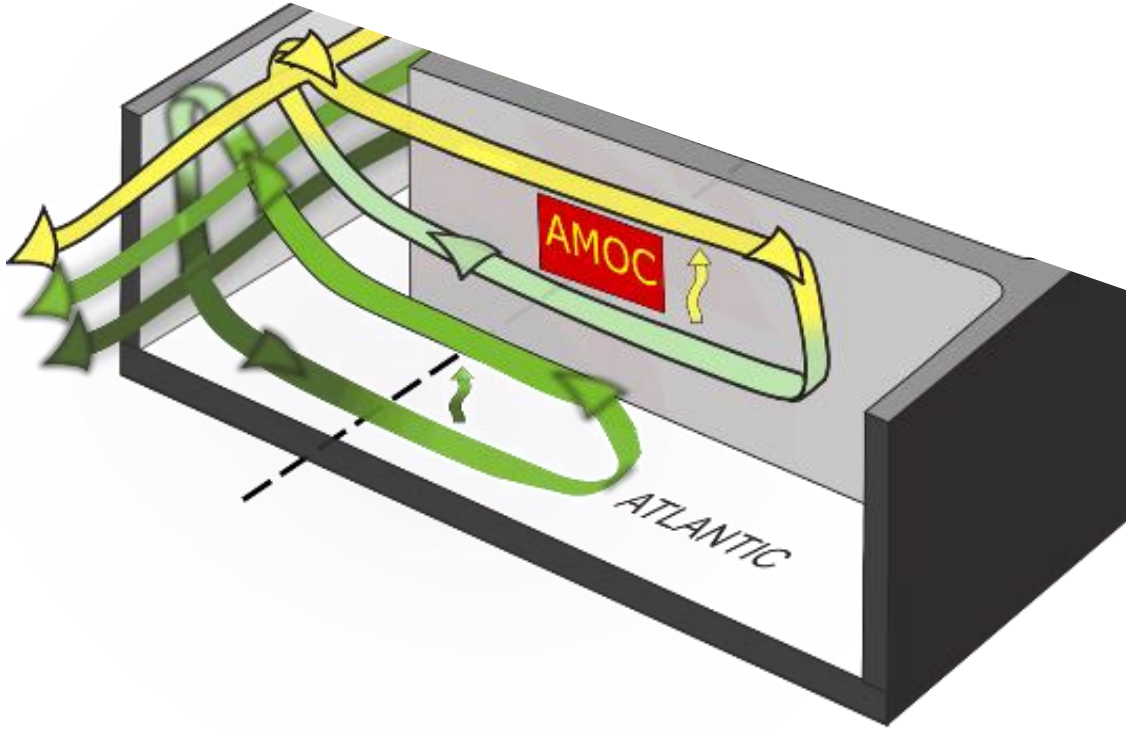
What do climate models say?

- Consistent weakening under warming
- Large spread across models
- Collapse this century unlikely



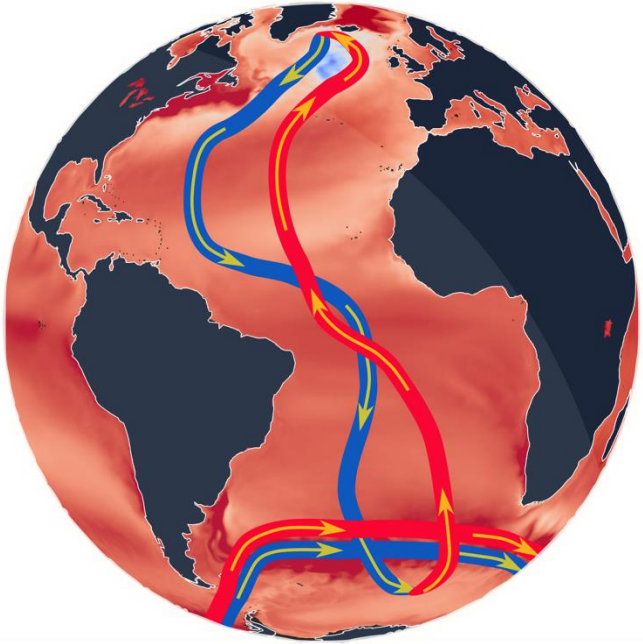
Why do studies disagree?

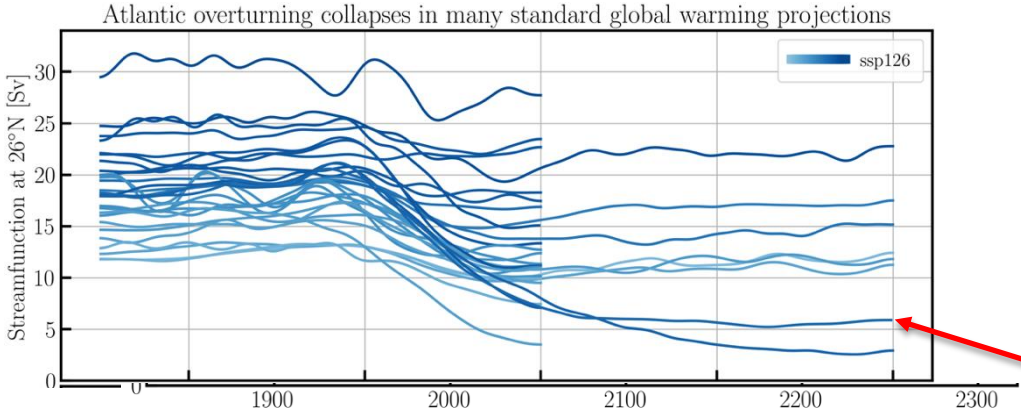
- Different methods → different conclusions
- Balance of competing processes
- AMOC is part of a global system



What is plausible this century?

- Significant weakening likely
- Collapse to very weak state unlikely
- Risks increase beyond 2100

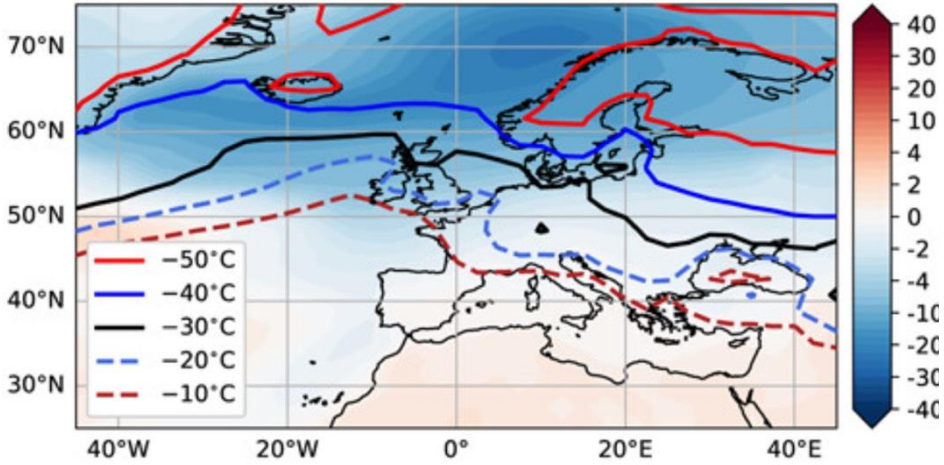




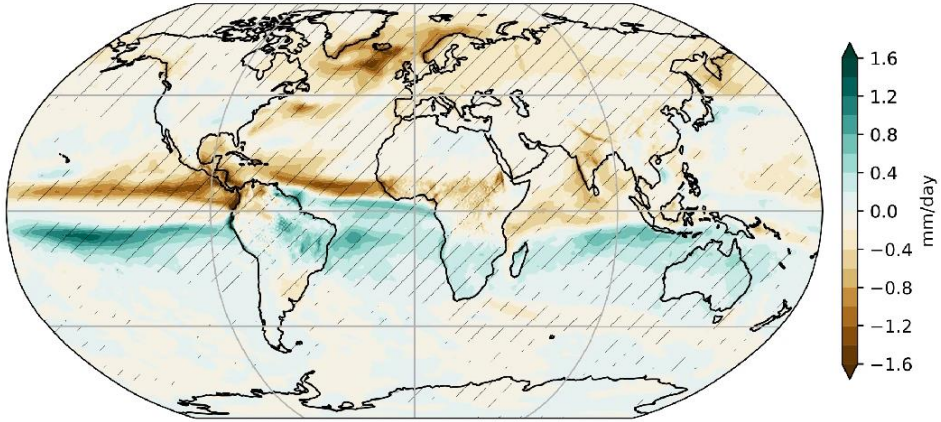
"Collapse"

What could happen if the AMOC weakened substantially?

- Regional temperature changes
- Changes in rainfall & storm tracks
- Sea level rise along Atlantic coasts
- Reduced ocean carbon uptake



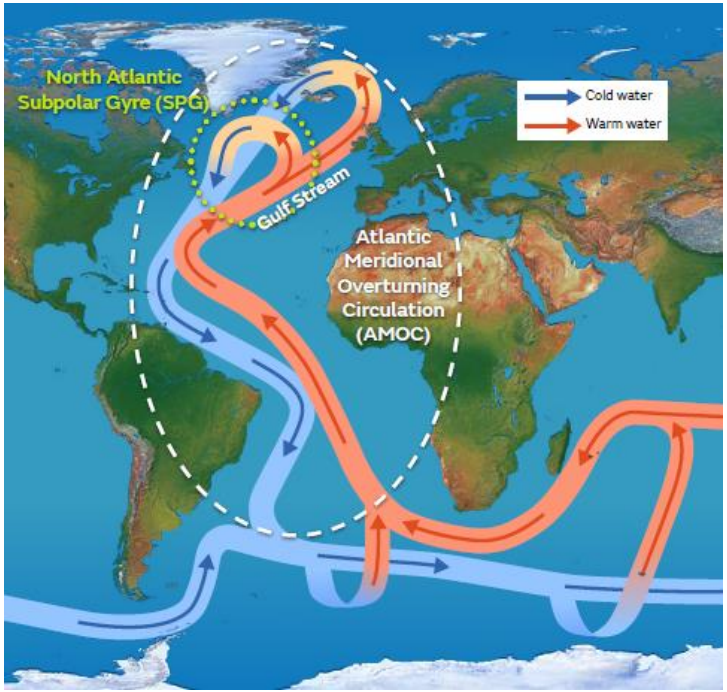
European cooling



Rainfall changes

Subpolar gyre risk

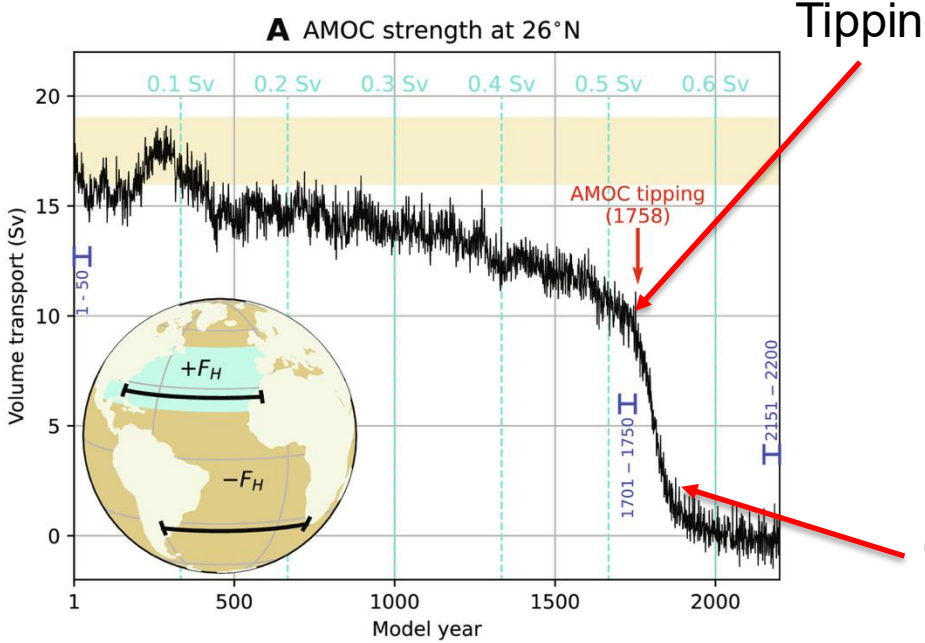
- Likely more sensitive than AMOC as a whole
- Potential regional North Atlantic impacts
- Could change more rapidly



Energy relevance

- Energy demand
- Infrastructure resilience
- Climate uncertainty

How should we interpret future claims?



Tipping point

- What method is used?
- What timescale?
- What definition of “collapse”?

“Collapse”

AMOC as a derailment risk

- Not a primary near-term derailment risk
- Collapse unlikely this century
- But uncertainty remains
- Weakening still matters

Take-away

- The AMOC will weaken, and that matters.
- The key challenge is managing risk under uncertainty, rather than reacting to any single headline.
- This means continuing to improve observations, models, and early warning capabilities while planning for a range of plausible outcomes.