

# AMOC Definitions

- Tipping point
  - “A tipping point is a threshold in a (forcing) “control parameter” at which a small additional perturbation (within natural variability of  $\sim 0.2^{\circ}\text{C}$ ) causes a qualitative change [significantly larger than the standard deviation of natural variability in (1)] in the future state of a system [see (1) and SM for the full definition].” Armstrong McKay et al., “Exceeding  $1.5^{\circ}\text{C}$  global warming could trigger multiple climate tipping points,” Science, 2022
  - “Critical transitions between different equilibrium states of natural systems are preceded by characteristic properties of the fluctuations in the systems’ dynamical behaviour that are referred to as critical slowing down.” Boers, “Observation-based early-warning signals for a collapse of the AMOC,” Nature Climate Change, 2021
  - “Crossing a tipping point in the climate system can trigger self-reinforcing feedbacks that commit parts of the system to a qualitatively different state.” Armstrong McKay et al., “Exceeding  $1.5^{\circ}\text{C}$  global warming could trigger multiple climate tipping points,” Science, 2022
  - “Tipping points are defined as “a critical threshold at which a tiny perturbation can qualitatively alter the state or development of a system” (1).” Armstrong McKay et al., “Exceeding  $1.5^{\circ}\text{C}$  global warming could trigger multiple climate tipping points,” Science, 2022
- AMOC Collapse
  - “A collapse from the currently attained strong to the weak mode would have severe impacts on the global climate system and further multi-stable Earth system components.” Boers, 2021, Nature Climate Change
- Bistability
  - “Early studies based on box models indicated that the AMOC has two different stable states of operation, corresponding to a strong and a weak circulation mode. The AMOC’s bistability and corresponding hysteresis were thereafter confirmed in a hierarchy of models.” Boers, 2021, Nature Climate Change
  - “The AMOC is the archetypical example of a potentially multi-stable Earth system component.” Boers, 2021, Nature Climate Change
- Critical Slowing Down
  - “Critical slowing down is typically measured in terms of increasing variance and autocorrelation in time series... These increases provide early-warning signals for an abrupt transition to an alternative stable state.” Boers, 2021, Nature Climate Change
- Early warning signal (EWS)
  - “Significant early-warning signals are found in eight independent AMOC indices... revealing spatially consistent empirical evidence that the AMOC may have evolved from relatively stable conditions to a point close to a critical transition.” Boers, 2021, Nature Climate Change

- Salt-advection feedback
  -
- Freshwater forcing
  - “A shift from the strong to the weak AMOC mode can be triggered by adding large amounts of freshwater to the North Atlantic, effectively reducing salinity there.” Boers, 2021, Nature Climate Change
- Threshold
  - “The point where the restoring rate  $\lambda$  reaches zero from below marks the bifurcation point, that is, the critical value of the control parameter where the abrupt transition will occur.” Boers, 2021, Nature Climate Change