



Fig. 4. Results from a very simple, conceptual model of the Atlantic thermohaline circulation (THC), building on Stommel (2, 26). The blue and red curves show steady-state THC strength as a function of the freshwater loss to the atmosphere in the subtropics (equal to freshwater gain at high latitudes). The red (blue) curve shows the case for weak (strong) mixing, which here represents either true oceanic mixing or processes such as the wind-driven circulation that are not modeled explicitly. Orange (green) curves and arrows show the responses of the models with weak (strong) mixing to a slow increase and subsequent decrease in freshwater forcing, starting from 0.2 in arbitrary units. Only in the case of weak diffusion (orange) does the model respond with an abrupt change, once a threshold in freshwater forcing is crossed. This model does not return to its original state after the anomalous forcing has gone back to zero (hysteresis behavior). In the case of strong diffusion (green), at any time, there is a unique equilibrium. It is not currently possible to establish whether the real Atlantic THC is better represented qualitatively by the red/orange or by the blue/green curves. This analysis also suggests that during the early stages of freshwater-forcing increase, THC observations cannot distinguish between the two possible cases.