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Snap, buckle, break and melt; some violent consequences of frozen flows

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It is well known that the large-scale heat and mass balance of the sea-ice cover in the polar oceans has been extensively studied because of its importance in climate. The principal balances that control the distribution of sea-ice thickness are those between (i) thermal processes that lead to growth and melting and thus the buoyancy forcing in the oceans, and (ii) mechanical processes, induced by wind, oceanic and internal stresses, that drive deformation. In this talk I describe connections between the small-scale mechanisms of sea-ice formation and the basin-scale stability of the thermohaline structure, the mechanical fate of colliding ice floes, that are driven by wind and water stresses, and the sensitivity of the climatological equilibrium of sea ice thickness to radiation fields produced by global climate models. What is found is a critical condition for the ventilation of the Arctic halocline, the mechanical regimes of ice deformation and the underlying reasons that Global Climate Models are incapable of rigorously predicting the fate of northern hemisphere ice cover.