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The mechanism of 60-year and 15-year Arctic climate oscillations in climate model INM-CM5-0

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Natural variability of Arctic climate is studied on the basis of preindustrial run with climate model INM-CM5-0. The length of run is 1200 years. Temperature in Arctic shows significant peaks at periods of 60 and 15 years. Model climate oscillations are studied using technique of calculation of energy generation and impact to phase change.

60-year oscillation is generated mainly by advection of Atlantic water to Arctic ocean. Anomaly of oceanic currents associated with the oscillation are generated by gradients of density. Before warm phase there is negative anomaly of density near coasts and continental slope. This leads to enhancing of Atlantic water inflow to Arctic ocean, warming, increasing of density near slope and turning to negative phase of oscillation. Cyclonic vorticity over warm Barents and Kara seas leads to wind currents that enhance inflow of Atlantic water to Arctic.

15-year oscillation is also generated by advection of Atlantic water to Arctic ocean, but anomalies of currents are generated mainly by wind stress. Before warm Arctic we have cold and fresh North Atlantic, that leads to positive NAO, it induces wind currents that transport more Atlantic water to Arctic ocean. This leads to Arctic warming, decrease of NAO and turn to opposite phase of oscillation. Warming of North Atlantic happens 3-4 years after maximum of Arctic warming. The response of Atlantic meridional streamfunction to the oscillation is studied.

"Ideal model" potential predictability experiments started from synthetic state preceding warm Arctic (cold and fresh North Atlantic) show that this oscillation can be predicted for time interval up to 10 years.

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