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CATASTROPHIC REDUCTION OF SEA ICE: FUNDAMENTAL MECHANISMS ASSOCIATED WITH ICE-OCEAN COUPLED DYNAMICS

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Here we introduce fundamental mechanism affecting the recent catastrophic reduction of sea ice associated ice-ocean coupled dynamics. The first is the strengthening of upper ocean circulation caused by the effective momentum penetration from atmosphere into the ocean via sea ice. The less sea ice condition reduced the momentum dissipation inside the sea ice as an internal stresses. Then the surface stress at the top of the ocean is increased and the upper ocean circulation is strengthened even under the same wind stresses. The activated upper ocean circulation delivered huge amount of heat within the Pacific Water layer into the Arctic Basin. The warming of the upper ocean resulted in less sea ice formation there. An imbalance between sea ice growth in winter and melt in summer caused total sea ice reduction. In the meeting, we introduce the actual changes in the upper ocean circulation and their detail features and influences on sea ice cover. The second is the upward heat flux from the Pacific Water layer. We introduce a critical condition of the anomalous heat flux associated with the sea ice motions. The third is the local ridding and rafting of sea ice near the coast. This local process is quite important for the distribution and lifetime of sea ice near the coast. The on-going sea ice deduction should be examined by integrations of fundamental processes that were observed in real Arctic Ocean.