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Ocean Surface Connectivity in the Arctic: Capabilities and Caveats of Community Detection in Lagrangian Flow Networks

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To identify barriers to transport in a fluid domain, community detection algorithms from network science have been used to divide the domain into clusters that are sparsely connected with each other. In a previous application to the closed domain of the Mediterranean Sea, communities detected by the *Infomap* algorithm have barriers that often coincide with well-known oceanographic features. We apply this clustering method to the surface of the Arctic and subarctic oceans and thereby show that it can also be applied to open domains. First, we construct a Lagrangian flow network by simulating the exchange of Lagrangian particles between different bins in an icosahedral-hexagonal grid. Then, *Infomap* is applied to identify groups of well-connected bins. The resolved transport barriers include naturally occurring structures, such as the major currents. As expected, clusters in the Arctic are affected by seasonal and annual variations in sea-ice concentration. An important caveat of community detection algorithms is that many different divisions into clusters may qualify as good solutions. Moreover, while certain cluster boundaries lie consistently at the same location between different good solutions, other boundary locations vary significantly, making it difficult to assess the physical meaning of a single solution. We therefore consider an ensemble of solutions to find persistent boundaries, trends and correlations with surface velocities and sea-ice cover.