



Tracking the seasonal cycle of coastal sea ice: Community-based observations and satellite remote sensing in service of societal needs

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Break-up and freeze-up of coastal sea ice determine the timing and extent of a number of human activities, ranging from ice use by Indigenous hunters to coastal shipping. Yet, while major reductions in the extent of Arctic summer sea ice have been well studied, changes in its seasonal cycle have received less attention. Here, we discuss decadal scale changes and interannual variability in the timing of spring break-up and fall freeze-up, with a focus on coastal communities in Arctic Alaska. Observations of ice conditions by Indigenous sea-ice experts since 2006 indicate significant interannual variability in both the character and timing of freeze-up and break-up in the region. To aid in the archival and sharing of such observations, we have developed a database for community ice observations (eloka-arctic.org/sizonet). Development of this database addressed key questions ranging from community guidance on different levels of data sharing and access to the development of protocols that may lend themselves for implementation in the context of operational programs such as Global Cryosphere Watch. The lessons learned and tools developed through this effort may help foster the emergence of common observation protocols and sharing practices across the Arctic, as explored jointly with the Greenlandic PISUNA initiative and the European INTAROS project. For the Arctic Alaska region, we developed an algorithm to extract the timing of break-up and freeze-up from passive microwave satellite data, drawing on community-based observations. Data from 1979 to 2013 show break-up start arriving earlier by 5–9 days per decade and freeze-up start arriving later by 7–14 days per decade in the Chukchi and Beaufort Seas. The trends towards a shorter ice season observed over the past several decades point towards a substantial change in the winter ice regime by mid-century with incipient overlap of the end of the freeze-up and start of the break-up season as defined by coastal ice users.