Session: OS-7 Atmosphere-Ice-Ocean interactions in the Polar Regions
Polar program: None
Title: Frazil ice streaks on PIPERS: the role of sea ice-ocean interactions
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Text:
In polar regions, open water areas (e.g., polynyas) are regions of high production rates of new sea ice. If the wind is sufficiently strong, streaks of frazil ice tend to form on the sea surface. Observations show that the streaks have several remarkable features: their spacing is irregular; there are sharp boundaries between regions with high and low frazil concentration; neighboring streaks tend to merge into larger ones, but they never split. These features make the Langmuir circulation an unlikely explanation for the formation of frazil streaks. In this paper, we propose a model reproducing the overall behavior and evolution of frazil streaks, and we make an attempt to answer a question whether their formation is solely a result of upper-ocean turbulence, with ice crystals behaving as a passive tracer that accumulates in convergence zones, or, alternatively, whether the presence of ice itself affects the turbulence patterns in a way that further reinforces streak formation. Our results suggest that the second scenario is consistent with observations, and that growth rates of frazil clusters on the sea surface are enhanced by turbulence suppression within those clusters - which in turn is a consequence of enhanced viscosity in areas of high frazil concentration and lowered effective restitution coefficient between colliding crystals. This last property speeds up transition of frazil/grease ice into pancake ice, thus substantially influencing the evolution of the ice cover.
Preferred Presentation Type: Poster Presentation

And the abstract number: A-938-0060-00480