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Interactive comment on "Influence of Estuarine Tidal Mixing on Structure and Spatial Scales of Large River Plumes" *by* Alexander Osadchiev et al.

Anonymous Referee #2

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The paper presents very interesting observations of two major river plumes in the Arctic basin. There is a paucity of such information in the oceanographic literature, so the paper certainly merits publication in the Ocean Science. However, some details of the data analysis and interpretation need improvements.

In my opinion, the authors pay too much attention to the fact that the outflows from the Yenisei Gulf and the Khatanga Gulf form plumes of roughly the same offshore extension, although the freshwater discharges of the two rivers differ by an order of magnitude (∼30,000 mˆ3/s for the Yenisei River vs ∼3,000 mˆ3/s for the Khatanga River). According to the authors, this happens due to the different intensity of tidal

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Discussion paper

mixing in the two gulfs. I think this observation is rather trivial and obvious. Besides, it's not entirely accurate. First, the Yenisei River plume indeed separates from the coast and extends offshore (northward) over ∼300 km from the estuarine mouth. The Khatanga River plume on the other hand remains attached to the Taymyr Peninsular coastline on its left flank (facing downstream) so its northward spreading cannot be characterized as the offshore extension (even more so in August 2000). Second, the wind forcing, while weak, is upwelling-favorable for the Khatanga River plume (in 2017) and is downwelling-favorable for the Yenisei River plume. The authors do not describe the wind forcing conditions prior to shipboard surveys, and the plumes of such spatial scales can keep a "memory" of the wind forcing on time scales of a week or even more if the wind is not strong. So the wind field snapshots at the time of measurements are not entirely convincing. I also somewhat disagree with the authors' interpretation of the plume structure formed by large rivers (lines 187-190, page 11): In fact, both "medium-size" and "large" (author's terminology) river plumes have the anticyclonic bulge region near the mouth and the semi-geostrophic, narrower coastal current farther downstream, as long as the Coriolis force is important. In this regard, the Amazon River and the Congo River plumes are not quite relevant since they are near the equator, while other major river plumes do have both a bulge region and a coastal current (far field), including the Mississippi plume, The Yangtze plume, the La Plata plume, the Columbia River, the Danube River, the Siberian rivers, etc.

Some minor issues with the manuscript:

Line 46 and later: I think it's better to use mˆ3 /s units for the freshwater discharge throughout the text.

Line 58: "...tidal amplitude and velocity..." Amplitude of what, perhaps the free surface? As for the velocity, is it also an amplitude or rms?

Line 86: "...performed at 100 m spatial resolution...". How can it be? I thought the water was pumped continuously under way. Do the authors imply the averaging interval

here?

Line 92: “. . .and 200 km far from the river mouths. . .”. “Far” is not needed here.

Line 107:” . . .Kara Sea shelf (stations 5336-5350).” The statement is misleading; it should read “stations 5333-5336 and 5349-5350”.

Lines 123-124: “As a result, the majority of river runoff propagated off the estuary. . .”. This is a somewhat strange proposition; the riverine discharge should “propagate off the estuary”, otherwise there will a freshwater flux convergence in the estuary and the estuary will be continuously getting fresher.

Line 126 and below: “. . .was located in two salinity layers. . .”. “Layer” is not a good choice in this context; it is one buoyant layer, just comprising different salinity classes or ranges or whatever word the authors would prefer.

Line 138: Is the salinity gradient in this context “stable” or constant?

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