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Interactive comment on "The role of turbulence and internal waves in the structure and evolution of a near-field river plume" *by* Rebecca A. McPherson et al.

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Review of "The role of turbulence and internal waves in the structure and evolution of a near-field river plume" by Rebecca McPherson et al. Submitted to: Ocean Science Manuscript number: 2019-120

Summary: In this paper the authors focus on structure and dynamics of a near-field part of the buoyant plume formed by the jet-like freshwater inflow with high velocity (> 2 m/s) and relatively small discharge rate (500-550 m3/s) into a deep and isolated fjord. The authors describe elaborate in situ measurements within the near-field plume and provide comprehensive analysis of the momentum budget of this complex dynamical

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Discussion paper

system based on the obtained data. They report several important features registered by in situ data at the river plume including anomalously high stratification, turbulence dissipation rate, and internal stress. They describe an internal hydraulic jump formed within the near-filed plume that generates energetic internal waves. The presented study evaluates the components of the momentum and energy budgets of this dynamical system and demonstrates the important role of internal waves in these budgets. The topic addressed in this manuscript and the obtained results are of great scientific and practical interest because similar processes are observed by satellite imagery in many world coastal areas where mountainous rivers inflow to sea and generate internal waves. Due to high quality and importance of the manuscript, I recommend this article to be published in Ocean Science after minor revision. Below I provide general comments and corrections that should be addressed by the authors.

1. One of the main drawbacks of this work is lack of in situ velocity measurements in the surface layer (top 2.5 m), which were linearly interpolated between the 0 m and 2.5 m measurements. However, the largest turbulence stress divergence was estimated to occur in this surface layer (Fig. 7), and these predicted values dominated the along-term momentum balance for the plume and the shear-stratified interfacial layer along the first 1 km of the transect (Fig. 9). Thus, usage of the linear interpolation for velocity in the top 2.5 m should be more thoroughly discussed and confirmed. This would provide a firm basis for the main results of the manuscipt. 2. No well-developed hydraulic jump was registered by in situ thermohaline or velocity measurements (e.g., Page 10, line 178-179). The hydraulic jump is predicted to form at a distance of 1 km from the freshwater inflow point (Fig. 6g), however, variability of the plume depth h at this part of the transect (between 3.5-4 and 5 m) was relatively low and did not exceed variability of h at the other part of the transect (Fig. 6b). Other characteristics of the plume also did not show any anomalous values near the predicted point of the hydraulic jump. Why the hydraulic jump was not detected by high-resolution in situ measurements? This issue should be addressed in the manuscript. 3. Internal waves generated by inflow of rivers at high speed to coastal sea are commonly visible at

satellite and aerial images. Is it the case of the internal waves generated in the Deep Cove? Did you analyze this kind of data? The paper might be strengthened by the related analysis. 4. Page 14, line 254. Why the depth of the plume was fixed equal to 2 m, while the depth of the shear-stratified interfacial layer was variable? It seems to be more appropriate to fix the depth of the shear-stratified interfacial layer and have variable plume depth. This point should be clarified. 5. Page 3, line 88 – page 4, line 89. Tidal amplitudes are relatively large, 1.5-2.5 m. What are values of tidal velocities? Do they influence mixing of the near-field part of the plume? 6. Page 9, line 173. Fig 5e -> Fig. 5d

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