Deep-sea vertical mixing from a turbidity current induced by the super typhoon Hagibis

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General comments:

This manuscript presents some unique observations of a series of turbidity currents that were most likely triggered by super typhoon Hagibis. Although observations of turbidity currents are becoming more common, still very little is known about these powerful oceanfloor flows. The potential link between the observations and the occurrence of the super typhoon make the presented data even more interesting. For these reasons I would strongly support the publication of these observations.

In the current format there is a very strong focus on vertical mixing. And although I agree with the authors that vertical mixing is an important aspect of turbidity current, there is no attempt to quantify the amount of shallow water that is transported to the deep-sea. If the authors would like to keep this strong mixing focus, then it might be worthwhile to attempt some mixing calculations as those presented in Kao et al GRL 2010. Alternatively, I think there could be a very interesting discussion on the trigger of the events, as the link to the super typhoon make these observation even more unique. Previous work like Pope et al 2017 have linked delayed typhoon triggers to sediment failures, but here I think there is some good evidence to link the turbidity currents indirectly to the typhoon via river floods, more like the typhoon triggered event presented by Liu et al., 2012. Focussing more on the triggers and less on the mixing might further enhance the impact of the manuscript.

On the technical side my only concern is related to the salinity measurements. If salinity is measured through conductivity, then it will be very hard to distinguish changes in salinity from changes in suspended sediment (see comments below). I think this uncertainty should be discussed in the manuscript.

Otherwise, I think this manuscript presents some very interesting and unique observations. And I look forward to read more about this new autonomous mooring system. I do apologise for writng this review in a bit of a rush. Please contact me if anything is not clear, or if the authors struggle to find any of these reference (I ran out of time to add a reference list at the end).

Detailed comments:

L37: I would suggest “vertical mixing of seawater” instead of “seawater vertical mixing”

L38: I would have agreed with “rarely observed”, but in the last 5-10 years there are more and more of these observations, so I don’t think it is that rare.

L45: I would suggest “sharp” or “strong” peaks, as the peaks are not violent.

L63: I would suggest “dating of the repeated turbidite sequences provide…”

L66: I would agree with Talling et al 2013 that observatinos are rare, but in the recent years there have been quite few observations, for example Xu et al., 2004,2010; Liu et al., 2012; Khripounoff et al., 2012, Hughes Clarke, 2016; Paull et al., 2019, Wang et al 2020, Heerema et al., 2020, Hage et al., 2017,2019; Normandeau et al., 2020, Lintern et al., 2016, Simmons et al., 2020 etc

L71: Yes, that is a good point seawater temperature and/or salinity observations are rare yet important. I think there are some more good references for that like the work of Khripounoff in the Var Canyon and the recent work of Wang et al Deep Sea research, 2020.

Fig 2: I like the photo, but a line drawing of the layout of the mooring with it different instruments would be even better.

L114: What was the height above the seafloor of these instruments?

L139: What was the reason behind collecting the colour images on the descent?

L153: Did the instrument record salinity or conductivity? During the turbidity currents the sediment concentration can be high enough to cause a reduction in the conductivity, which in most CTD would be reported as a drop in salinity (see for example the work of Warrick et al Continenal shelf resreach, 2008 and Wang et al. deep sea research 2020).

L159: It seems form figure 3 that the turbidity peaks started in both cases around low water. Previous work has shown that tides can strongly effect the timing of river-triggered turbidity currents, for example Lintern et al 2016, Clare et al., 2015, Hage et al., 2019. Is there any data from the river at the head of the canyon? Were the suspended sediment concentrations in that river still high enough to trigger turbidity currents?

L161: Great to see that he highest turbidity did not occur neat the head of the flow, as is most common. Such gradual rise in sediment concentration and therefore velocity are often indicators of river flood triggered events, see khripounoff et al 2012 or Mulder et al 2003.

L162: Interesting to see how the salinity dropped consistently, while the temperature only increase during the AM3 event. This makes me wonder whether the salinity drop were indeed related to the presence of suspended sediment? If shallow water was indeed the trigger for the lower salinity, then I would expect that to occur twice. Maybe the AM3 event includes indeed warm shallow water while the AM11 event does not? Alternatively, it could also have something to do with height of the instruments above the seafloor versus the height of the turbidity currents. Again, good to know how high above the seafloor the observations were made.

L214-227: I fully agree that the vertical mixing due to turbidity current could be important for vertical mixing in the ocean. I was wondering if the volume of shallow water could be estimated, as I think they do in Kao et al? Especially if you have the density estimate form the NTU, it should be possible to estimate a velocity and hence a flux or volume of water. I did, however, wonder how you converted the NTU to kg/m3, as I think this is often not straightforward.

L229-238: The trigger is always a very interesting question, especially with the link to the super typhoon. Recent work by Hage et al GRL 2020 has shown how low tides can help to trigger turbidity currents at river mouths. The potential drop in salinity, the onset of both events at low water, and the peak turbidity occur not at the head of the flow are all strong indication for a flood trigger. I would suggest to discuss such alternative flood trigger in this paragraph as an alternative to the sediment failure trigger.

L240-256: I am not too sure if there is a lot of added value in this earthquake paragraph, as there was no earthquake. Maybe a typhoon centred discussion paragraph could be added here. I would certainly find it interesting to see how these new observation compare with the previous typhoon-triggered event described by Liu et al, Kao et al, Pope et al, Sequeiros et al etc.