

Interactive comment on “Reconstruction of track and simulation of storm surge associated with the calamitous typhoon affecting the Pearl River Estuary in September 1874” by Hing Yim Mok et al.

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Received and published: 18 July 2019

Thanks for the comments of Anonymous Referee #2. We provide below a point-by-point response to the comments.

1. Anonymous Referee #2 [Comment]: I understand that the reconstructions of natural phenomena in historical time are very difficult because the information is very limited. However, I concern that reconstructed storm surge in this paper are derived from estimated typhoon track. So I would like to strongly recommend that the authors give more explanations about “reliability” of reduplication of reconstructions.

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Authors [Response]: Noted. The following paragraph will be added to ‘Results and Discussion’ after line 430 to elaborate more on how likely the reconstructed track is:

‘It has to be noted that the parts of the reconstructed track over the western North Pacific and southwestern part of China (plotted in green in Figure 7(a)) were arbitrarily extended to meet the requirement of input of thirteen 6-hourly positions for running the storm surge model for estimation of storm surges in Hong Kong and Macao. The limited weather observations in the Luzon Strait area, though not sufficient enough to enable a detailed estimation of the positions of Typhoon 1874 moving over the Luzon Strait (plotted in blue in Figure 7(a)), had indicated that the typhoon had very likely moved across the Luzon Strait between Vigan and Batan with typhoon intensity on the early morning of 22 September. For the reconstructed track over the northeastern part of the South China Sea, the Pearl River Estuary and western Guangdong (plotted in red in Figure 7(a) and the whole track in Figure 7(b)), a quantitative and reliable estimation of the hourly positions, hourly minimum mean sea level pressures near the centre and the radii of maximum wind became possible by using the Jelesnianski tropical cyclone model based on the more comprehensive weather observations taken in Hong Kong and Macao. Besides reproducing well the trends of change of atmospheric pressure with time at Hong Kong and Macao, including the rapid fall of atmospheric pressure at Macao from 2 a.m. to 4 a.m. on 23 September while the atmospheric pressure at Hong Kong was rising (Figure 5), the atmospheric pressure readings taken at Hong Kong and Macao could also be reproduced quantitatively with reasonably small difference. Comparing the hourly atmospheric pressures at Hong Kong and Macao during the period estimated by the Jelesnianski tropical cyclone model based on the hourly positions, hourly minimum mean sea level pressures near the centre and the hourly radii of maximum wind from 8 a.m. on 22 September to 11 a.m. on 23 September in Table 4 with the corresponding available hourly atmospheric pressure observations taken by the Hong Kong Harbour Master Office and Vessel HMS Princess Charlotte in Hong Kong (where the pressure readings were taken near mean sea level and closest to the Hong Kong Observatory) and Gunboat Tejo in Macao (where the pressure read-

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ings were taken near mean sea level and at the Porto Interior), the root-mean-square of the differences were 4.0 hPa, 4.6 hPa and 2.7 hPa respectively. The differences were even smaller for the period from 8 p.m. on 22 September (when the storm surge at North Point started to rise and before the typhoon picked up a northwesterly track) to 4 a.m. on 23 September (when the storm surges at North Point, Tai Po Kau and Porto Interior were almost at the highest and the typhoon had made landfall) with root-mean-squares of 2.7 hPa, 3.1 hPa and 1.7 hPa respectively. Furthermore, the reconstructed track also matched well with the observed wind direction changes at Hong Kong during the approach and departure of the typhoon. Combining Figure 6 and Figure 7 could reveal that the wind direction at Hong Kong would veer gradually from northwesterly to northeasterly during the day on 22 September, and continue to veer to easterly and then southeasterly during the evening on 22 September and early morning of 23 September. This matched well with the observed wind direction changes reported by the Harbour Master and HMS Princess Charlotte as shown in Table 3. Such sequence of wind direction change would not occur if the typhoon approached Hong Kong from the southeast or south during the day on 22 September.'

2. Anonymous Referee #2 [Minor Comment]: Page 2, line 30-44: Please state criteria of typhoon, Super Typhoon and Severe Typhoon, because typhoon criteria may differ in several countries.

Authors [Response]: A link to the Hong Kong Observatory website showing classification of tropical cyclones (<https://www.weather.gov.hk/informtc/class.htm>) will be added as a footnote in Page 2.

3. Anonymous Referee #2: Figure 5: This figure will be better to be understood especially for readers outside of the region if topographical information in Macau is added.

Authors [Response]: I guess it is Figure 3, not Figure 5. We will try our best to replace Figure 3 with a map showing topographical information in Macao but copyright issue

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would have to be resolved. If such a map with no copyright issue could not be found, we would like to keep Figure 3 as is as the main purpose of the map is to show the coastline (in particular, in the vicinity of Porto Interior) which is one of the major factors affecting storm surge.

4. Anonymous Referee #2: Figure 5, 8, 9: In Figure captions, please provide detail explanations what colors of the lines mean.

Authors [Response]: This will be done in the revised manuscript.

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2019-36>, 2019.

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