We sincerely thank Referee #1 for his/her careful review and constructive comments. We truly believe that the changes suggested by Referee #1 would enhance the quality of the manuscript. A point-by-point response is presented in Supplements.

1. please give more clarification on motivation of writing this paper, i.e. significant importance in Shanghai.

Thanks for your comments. Shanghai is the largest and most developed coastal megacity in China. Shanghai is surrounded by water on three sides, and the Huangpu River passes through the city. Rainstorm and storm surge caused by typhoon from June to October often cause substantial losses. For example, Typhoon Winnie killed seven people and flooded more than 5,000 households in 1997. Although the construction of flood control measures in the past 50 years has effectively reduced the risk of storm floods, Typhoon Matsa in 2005, Typhoon Fitow in 2013, and Typhoon Lekima in 2019 brought significant damage to Shanghai. However, owing to the unavailability of water level records during typhoon events, there is no research that has been able to calculate the joint probability of peak water level and rainfall during historical tropical cyclones (TCs) and to calculate the marginal contribution of each driver as we have done in this research. Our modeling framework couples a state-of-the-art hydrodynamic model and statistic model. This model coupling enables us to quantify the joint distribution of peak water level and rainfall during typhoon season, and also to consider the comparative cases with and without RSLR for Shanghai. This framework could be applied to other coastal cities which face the similar constraint of unavailable water level records. This is the major motivation and contribution of our research.

We rewrite paragraph 2 in the Introduction to emphasize the significant importance of compound flood risk in Shanghai.

"Coastal regions are usually the most densely populated and economically developed areas of a country, and they are also the most vulnerable regions to the risk of compound flooding from heavy rainfall and extreme storm surge due to this large population and property density (Neumann et al., 2015). Shanghai is the largest and most developed coastal megacity in China. Rainstorm and storm surge caused by typhoon from June to October often cause substantial losses (Li et al., 2018; Yin et al., 2021). For example, extreme storm flooding caused nearly 30 thousand casualties in 1905 (Li et al., 2019). In 1962, storm flooding inundated half of the downtown region for nearly 10 days due to 46 failures along the floodwalls of the Huangpu River and its branches and led to huge losses of 1/6 of the local Gross Domestic Product (GDP) in Shanghai (Ke, 2014). In 1997, Typhoon Winnie killed seven people and flooded more than 5,000 households due to the extreme storm surge and rainfall (Ke et al., 2021). Although the construction of flood control measures in the past 50 years (especially after typhoon Winnie in 1997) has effectively reduced the risk of storm surge and rainstorm floods, Typhoon Matsa in 2005 (US $2.23 billion damage), Typhoon Fitow in 2013 (US $10.4 billion damage), and Typhoon Lekima in 2019 (US $2.55 billion damage) also brought significant damage to Shanghai (Du et al., 2020). Given the substantial damage caused by compound flooding, comparing the encounters of rainfall and storm surge during typhoon season is urgent in order to understand the driving mechanisms and frequency of compound flooding in Shanghai. However, owing to the unavailability of water level records, there is little research that has been able to estimate the dependency between peak water level and accumulated rainfall during historical TCs."

2. Please add the discussion in the context to support your findings with references.

Thank you for your suggestion. We have added a new discussion section to support our findings with additional references. In this new section, we discussed the dependency between the water level and rainfall, the effect of RSLR on peak water level and the multiple contributors to peak water level. These discussions further convince the feasibility of the probabilistic modelling framework we developed in incorporating the interdependence of multiple drivers. We highlighted our key finding that the peak water level is the most dangerous hazard to Shanghai. The combination of astronomical tide, storm surge and RSLR drives the peak water level. In the future research, it is essential to take into account the contribution of tide during the typhoon events. We expect the findings from our research to be useful for the decision-making on the adaption via coastal flood defense measures for Shanghai and other coastal cities or regions in East and Southeast Asia. The new discussion section is as follows.4 Discussion

Coastal areas are the most densely populated and economically developed areas of many countries, and they are also the most vulnerable regions to the risk of compound floods from heavy precipitation and storm surge because of high population and property density as well as storm surge risk (Shen et al., 2019). In this study, we provide a framework that could be applied in general to coastal cities which face the constraint of unavailable water level records.

4.1 The dependency between the water level and rainfall

The dependence among different drivers of compound floods has been widely studied. For example, Zheng et al. (2013) identified significant dependence between precipitation and storm surge along the coastlines of Australia; Wahl et al. (2015) examined the enhanced dependence between precipitation and storm surge, and reported an increasing trend in compound flood risk in past decades along the coast of the US. These findings are critical to better understand the changing compound flood risk and provide important references for the evaluation of simulation-based studies.

The correlations between rainfall and storm surge are determined by various factors such as meteorological conditions and regional topography. For example, compound floods from heavy precipitation and storm surge can occur during TCs (Wahl et al., 2015; Bevacqua et al., 2019). TCs are one of the most important triggers of compound floods from heavy rainfall and storm surge in coastal regions. Even though compound floods are receiving attention, few studies have analyzed the dependency between water level and rainfall during historical TCs in China. Considering the relatively short record lengths of observational data in China and the large uncertainties of simulation-based studies, further studies are needed to examine the characteristics and mechanisms of compound flood events (Fang et al., 2021).

4.2 The effect of RSLR on peak water level

Deltas are especially vulnerable to RSLR because of their low elevation and commonly high rates of land subsidence (Wang et al., 2012; Higgins et al., 2014). Long-term tide gauge records show that global mean sea levels have risen by 1.7 ± 0.3 mm/yr over the last century (Holgate, 2007; Cipollini et al., 2017). Nearly 90% of the world's river deltas suffer the impact of RSLR, including Shanghai and Manila (He and Silliman, 2019). The accelerated rise of global sea level puts low-lying coastal regions at risk of increases in frequency and magnitude of flooding (Cazenave and Cozannet, 2014). For example, the sea rose on average by $\sim$10 cm over the 20th century along the Italian coast, and flood frequency increased by more than seven times (Kulp and strauss, 2019). Increased flooding because of RSLR, in regions that experience storm surges from TCs, further increases the vulnerability of coastal regions to inundation (Edmonds et al., 2020).

This paper presents an analysis of the impact of RSLR on peak water level, accounting for the effects of sea level rise and land subsidence on coastal flooding in Shanghai. Previous studies of Shanghai reported increased risk of coastal floods due to global and local changes (Wang et al., 2012; Yin et al., 2013; Yan et al., 2016). Including the increased RSLR we estimated over the past 58 years (0.55 m), a 4.3 m projected RSLR due to additional land subsidence along the Yangtze River delta by 2100 would result in half of Shanghai being flooded by extreme storm-water levels (Wang et al., 2012). There are serval potential carbon emission scenarios used to project sea-level rise. Regardless of the methods and emission scenarios used to estimate future sea levels, the consensus is that sea levels are rising and its rate is expected to accelerate (Wahl et al., 2017). While taking into account the wide variety of other estuarine and coastal processes, as well as other anthropogenic impacts, further studies and more refined methodologies are needed for more accurate, realistic and up-to-date vulnerability assessments of coastal compound flood risk. We expect the findings from our research to be useful for the decision-making about the adaption via coastal flood defense measures for Shanghai.

4.3 Multiple contributors to peak water level

Coastal flooding from peak water levels is one of the most devastating natural hazards to Shanghai. A storm with strong winds and low atmospheric pressure can produce a large storm surge and large waves. A storm surge is an increase in water level above normal sea level and is a function of storm intensity, duration, size, and location (Cooper et al. 2008). Tides are an astronomical phenomenon caused by the gravitational attraction of the moon and the sun on earth's oceans, while storm surge is a meteorological phenomenon (Karim and Mimura 2008). If storm surge coincides with the astronomical high tide, these water levels superpose, and an extreme water level may be generated. Southeast Asia is highly vulnerable to, and frequently impacted by, extreme sea-level events of different origins: TCs cause severe storm surges and rainfall with potentially devastating impacts to the economy and environment and in many cases loss of human life.

Astronomical tides are deterministic and can be predicted far in advance, whereas storm surges can only be accurately hindcast from tide gauge records. Prediction of storm surge is possible days in advance of TC landfall, simulated by taking into account predicted forcing variables, such as wind stress and sea level pressure over the sea surface. Tide gauge records have been used to study sea level extremes. However, 90% of the tide gauges located in Southeast Asia have record lengths of less than 30 years. One way to overcome the absence of long tide gauge records is to use numerical models to simulate the storm surge component (Park and Suh, 2012) using best track TC data or meteorological reanalysis results.

In this study, we argue that the astronomical tide plays a role in the total water level in Shanghai. Indeed, surges might occur at any tidal level, and are especially strong in shallow estuaries. A high tide at Wusongkou gauge would extend to downtown Shanghai causing a fluvial flood. The flood extent, depth, and duration can be exacerbated by storm surge, and consequently, the disruptive impact increases strongly (Ke et al., 2018). Astronomical tides contribute to peak water levels during TCs (Sweet et al., 2009). 75% of extreme storm surges coincided with astronomical high tide, where the astronomical tides contribute 94% of the water level (Bacopoulos, 2017). The critical components to consider in the analysis of peak water level during TCs are the astronomic tides, storm surge and RSLR . In future research, we will explore the applicability of the presented methodology to other regions where limited observational data availability has hampered a better understanding of peak water level, storm surge and potential changes related to climate variability and change.