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Impact of large-scale future floods on the railway system

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Increasing flood risk was caused by expanding climate change. The floods directly or indirectly disrupt the railway system and arise a significant negative impact on our social-economic system. This study developed an integrated approach to explore the impact of large-scale future floods on railway system. Firstly, A three layered traffic flow simulation model was constructed to study propagation and amplification effects of component failure after the event of flooding in the system. Secondly, future runoff scenarios were produced by using five global climate models and three different representative concentration pathways. The future floods was simulated by using CaMa-Flood model after inputting future runoff scenarios. Furthermore, we imposing simulated future floods into traffic simulation system and develop two measurements to evaluate the impact of floods on the railway system as the perspective of the entire system. Here we explore the impact of floods on the real-world highway network of China. The results illustrate that: (i) **Unprecedented uncertainty**. The damage of the flood to the railway system is not linearly and positively correlated with representative concentration pathway and the year within different global climate models; Floods in different years have different impacts in connections among regions; (ii) **Unacceptable damage**. 59.76 % of railway segments inundated and 98.61461% of large cities could not be reached by extreme floods. These results have critical policy implications for the transport sector in reference to railway location and design, railway network optimization and protection and can be also easily adapted to analyze other spatial damages for valuable protection suggestions.