INSTITUTIONEN FÖR GEOVETENSKAPER

Tropical Cyclone Induced Extreme Wind, Rainfall, and Floods in the Mekong River Basin

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Akademisk avhandling för filosofie doktorsexamen i Naturgeografi, som med tillstånd från Naturvetenskapliga fakulteten kommer att offentligt försvaras fredagen den 12 juni 2020, kl. 10.00 i Stora Hörsalen, institutionen för geovetenskaper, Guldhedsgatan 5C, Göteborg.

ISBN: 978-91-7833-860-3 (tryckt)
ISBN: 978-91-7833-861-0 (pdf)
Tillgänglig via http://handle.net/2077/64068

ABSTRACT

Increasing magnitude and frequency of climate extremes under global warming are threatening the socioeconomic development in many parts of the world. The Mekong River Basin (MRB) is a good example for how climate extremes can affect society, as the transboundary MRB has experienced hydroclimate changes and fast socioeconomic development during the past decades. The MRB is a flood-prone area with high flood induced mortality, where heavy monsoon rainfall and tropical cyclones (TCs) landfall are the two main determinants of floods. This thesis focuses on the change in TCs and their associated impacts of extreme wind, rainfall, and floods on the MRB. Findings from this thesis provide an improved understanding of TCs and their impacts, which is useful to mitigate potential consequences of global warming in the MRB and other areas facing similar challenges.

Employing reliable precipitation data, this thesis finds that TC induced rainfall plays a minor role in the annual mean precipitation in the MRB. But TCs are crucial to the occurrence of extreme rainfall events, particularly at the eastern lower basin. TC induced floods amount to about 24.6% of all flood occurrence in the lower riparian countries. TC induced floods cause higher impacts on human mortality and displacement rates than the average of floods induced by all possible causes do. Moreover, future projection shows increases in the future TC intensity under the Representative Concentration Pathway (RCP) 8.5 scenario.

Overall, this thesis reveals that climate extremes, such as TC associated rainfall and floods, can substantially affect society, in terms of the high TC induced extreme rainfall and great human mortality and displacement rates caused by TC induced floods. The projected future intensified TCs indicate increasing TC risks.

Keywords: Mekong River Basin, Climate extremes, Tropical cyclones, Precipitation, Floods, Satellite data, Reanalysis data