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INTERIOR FLOOD DAMAGE IN JAPAN: PRESENT AND FUTURE

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The assessment of flood risk and its future prediction under anthropogenic climate change are important to policy makers for future preparedness and adaptation planning. Almost all countries in the world including major cities suffer from flood damage every year due to large exposed population and property. The intensity of damage amount varies as per the level of their preparedness. The case of Japan is also similar, having about 100 billion yen annual damage due to interior flood. Flood losses are increasing more rapidly during late 20c and is expected to increase in future too. Another major factor contributes to future climate events like floods and its losses will be anthropogenic climate change. But due to lack of robust analytical framework to estimate future losses and lack of long term damage data; future projections of flood loss still have many uncertainties.

Most studies regarding flood damage assessment have been done for river flood which always excludes interior flood damage usually caused by rainfall inside city area due to poor or insufficient drainage facilities. Also some extreme events corresponding to large return period is usually taken for damage assessment, which always exclude the damages caused by high frequency events, but reported as equal as an extreme event. In this study, we present a robust methodology for interior flood damage assessment exclusively; taking all daily rainfall events into account and its application to future climate.

We use recorded historical daily damage data in Japan that was archived in Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Government of Japan to produce functions namely damage occurrence probability function and damage cost function. Our statistical approach gives the probability of damage following every daily rainfall event and thereby the annual damage as a function of rainfall, population density, topographical slope, and gross domestic product. Our results for Japan show reasonable agreement with area-averaged annual national damage for period 1993?2002 in calibration and 2003-2009 in validation. The flexibility of this method leads to future projection of interior flood damage in Japan.

Multiple climate models in different resolution with different convective schemes, sea surface temperature (SSTs) and future climate scenarios to predict the future interior flood damage amount in monetary term are being used. For Japan, we use high resolution Meteorological Research Institute (MRI) atmospheric general circulation models (MRI-AGCM) for present and future precipitation. The precipitation parameters are calculated from 1979-2009 in present and 2075-2099 in future using MRI-AGCM with two mesh sizes (20 km and 60 km) and three different convective schemes (Yoshimura Scheme, Arakawa-Schubert scheme & Kain-Fritsch scheme) which give multi-physics ensemble. The future sea surface temperature (SST) is as per the multi-model ensemble mean change of CMIP3 and CMIP5 with A1B and RCP8.5 scenario respectively. Moreover to consider uncertainty of future SST due to geographical SST distribution, three different clusters SST are also taken for future damage assessment.

Initial results for annual average interior flood damage in Japan shows 13.25% increase in average for future [2083- 2099] from the base period [1993-2009] for A1B scenario and 10.08 % increase for RCP8.5 scenario. The range of future estimate of average annual interior flood damage for A1B scenario is 68.17 billion yen to 117.81 billion yen and for RCP8.5 scenario, it is 78.93 billion yen to 119.06 billion yen in 2005 price. Another important notice in the result is future largest annual damage in A1B scenario seems quite same as present largest annual damage, but for RCP8.5, some year shows the largest damage will double than the present.

We will add different models and CMIP5 results and will describe more features of future interior flood damage in our presentation.

Keywords: interior flood damage, damage occurrence probability, damage cost function, preparedness, economic losses, climate change