Impacts of climate change and land-use change on flood inundation: a coupled modelling a pproach

D.YU [1] & Z.CHEN [2]

[1]Department of Geography, Loughborough University, Leicester, LE11 3TU, UK E-mail: d.yu2@lboro.ac.uk

[2]East China Normal University, State Key Estuarine Lab, Shanghai 200062, China. E-mail: z.chen@ecnu.Edu.cn

Recent major floods around the world have raised concern that climate change is causing increases in the frequency and magnitude of high discharge events. Furthermore, the sensitivity of the system to climate change appears to have increased significantly as a result of anthropogenic land-use change. This study investigated the impacts of climate change and land-use change upon flood inundation using a coupled modelling approach in an upland catchment with downstream urbanized floodplains through continuous scenario-based simulations in the City of York, Yorkshire UK. It also investigated how the potential impacts of climate change and land-use change at the catchment scale could be alleviated to reduce flood risks. Flood alleviation measures were designed and fed into the coupled model to investigate their impacts on flood inundation. In particular, this focused on flood alleviation measures in relation to construction of flood defences, provision of washlands and increase of channel capacity due to sedimentation. This study also evaluated land management options in mitigating the flood risks in the future, including how they scale through to downstream effects, e.g. sediment delivery and floodplain inundation. Coupled continuous simulations of catchment-scale rainfall-runoff and reach-scale flood inundation for the next 100 years was carried out to derive flood inundation extents under different climate change, land-use change and flood alleviation scenarios. This allows integrated analysis of flood risks at both catchment and reach scales. This study addressed a much understudied aspect in flood risk management which is the impact of catchment-scale rainfall-runoff on flood risk in terms of flood inundation extent. This represents a more holistic approach that involves whole catchment and risk-driven adaptation to climate change.

Water abstraction from the Changjiang River downstream Datong and its impacts on water discharge into the estuary under the extreme drought of drainage basin

Erfeng ZHANG

State key laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China
E-mail: efzhang@sklec.ecnu.edu.cn

Datong is a hydrometric station in lower reach of the Changjiang River, which is closest to the estuary. But the distance between Datong and the estuary is still about 500 km. The water level of the Changjiang River downstream Datong is affected by ebb and flow of tides, which produces the opportunities for areas along the Changjiang River to abstract water from it. And these are the most developed areas in the drainage basin. With the development of economy, the requirements for water resource of these areas increase quickly. And the water-abstracting projects increase continuously, including sluices and pump stations built at the estuary of branches, culverts along the bank, and other pump stations along the bank for life and corporations. At present, the total water-abstracting capacity reaches about 20000 m^3/s. Because the salt water intrusion in estuary became stronger and stronger in recent years, the problem about effects of water abstraction downstream Datong on water discharge into the estuary and salt water intrusion was paid attention to. In 2006, the extreme drought occurred in the upper and middle drainage basin of the Changjiang River. And the Three Gorge Dam stored water just in that period. As a result, the water discharge from the upper and middle basin decreased greatly. And the salt water intrusion in estuary was very strong, the occurring time was ahead of the usual about 2 months. But when salt water intrusion occurred first time in September the corresponding water discharge in Datong was still more than 17000 m^3/s. In this paper, the practical situation of water abstraction between September 2006 and April 2007 is estimated and analyzed, based on many observed day-by-day data and investigated data. And the effect of water abstraction on water discharge into the estuary is calculated and analyzed. The results show that, on the whole the rainfall was ordinary in areas downstream Datong and no severe drought occurred. The sluices and partial pump stations (especially the water-diversion projects between drainage basins) are the main water-abstracting projects, which greatly impacts the quantity of