



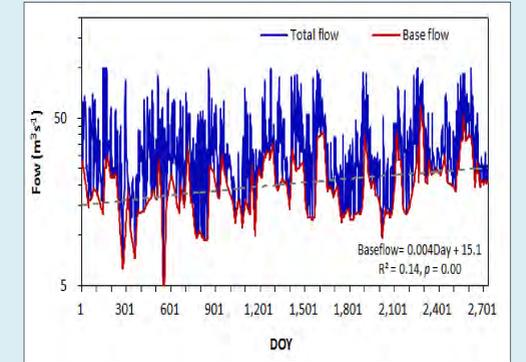
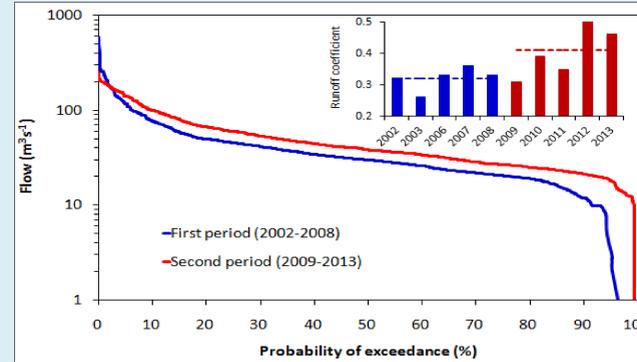
Hydrological Responses to Urbanization in the Urban–rural Interface in Nanjing, China

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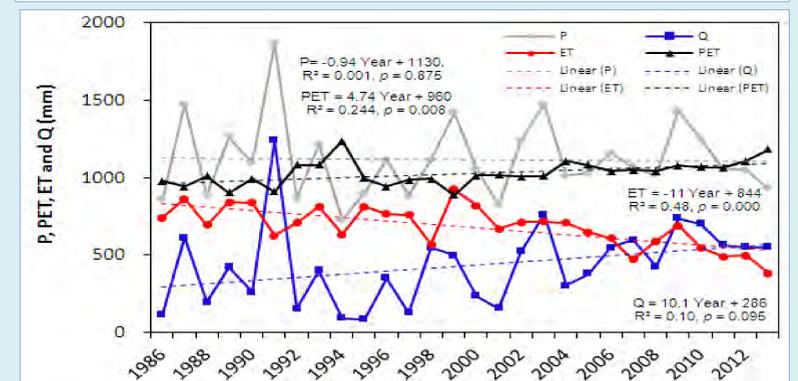
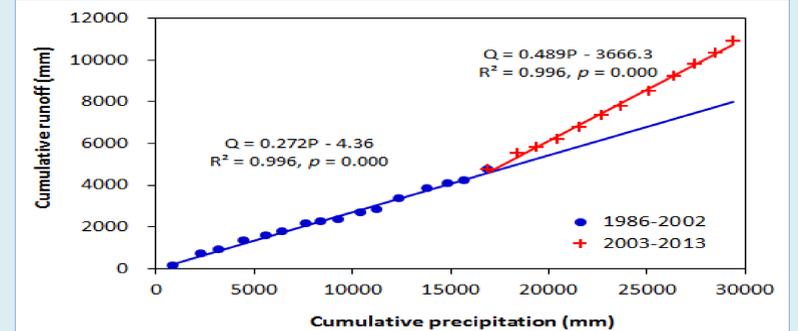
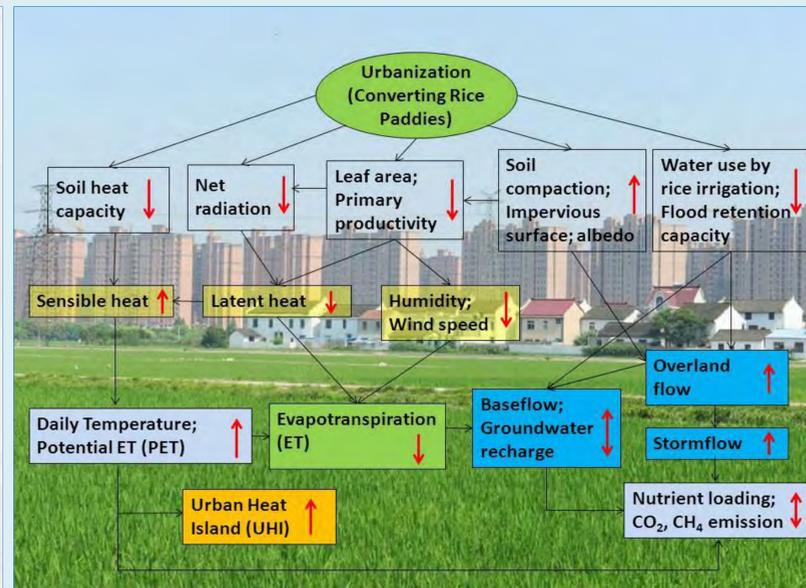
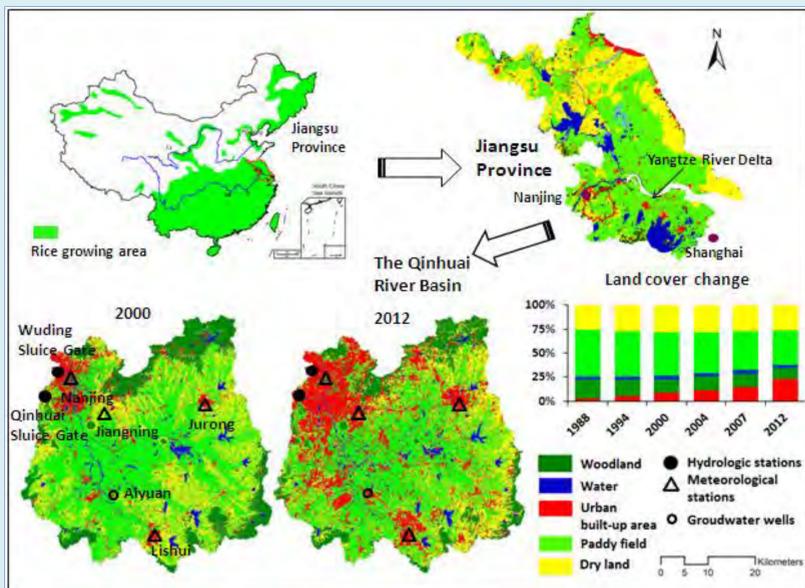
Motivations

- Contemporary urbanization-associated land conversions profoundly affect the hydrologic conditions at the urban–rural interface (URI) in many parts of the world.
- Understanding the regional ecohydrological responses to the anthropogenic forcing from land use/land cover change (LUCC) and human activities (such as urbanization, population rise, land conversions) in the context of climate change is critical for future URI planning, water resource management, and the sustainable development.
- The Qinhuai River is one of the tributaries of the Yangtze River that runs through Nanjing, one of the mega cities in southern China. Qinhuai River basin (QRB) provides important functions to more than 8 million residents including drought/flood prevention, crop irrigation, recreation, tourism, and emergency drinking water supply.
- Issues to address:
 - Examine how urbanization in the past decade (2000-13) has affected the water balances and hydrologic characteristics of the QRB
 - Test the hypothesis that urbanization in a paddy field dominated watershed dramatically reduced ET, thus altered water balances
 - Explore the implications of urbanization for regional environmental change in southern China

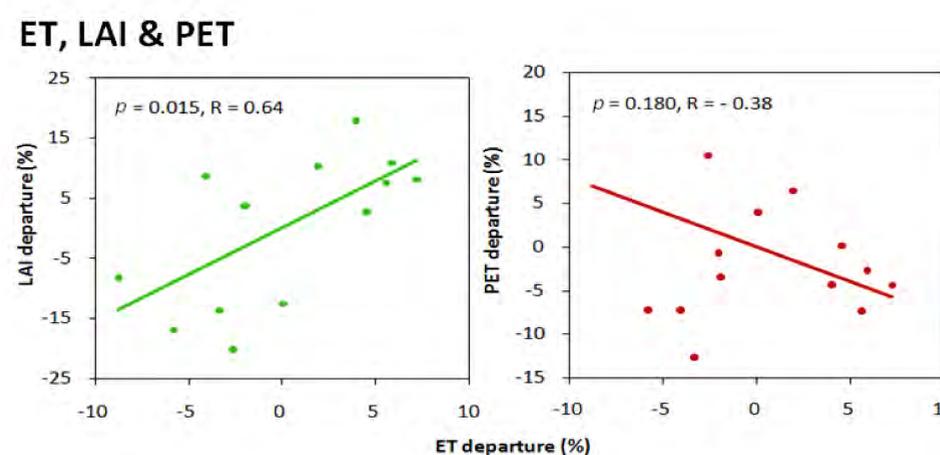
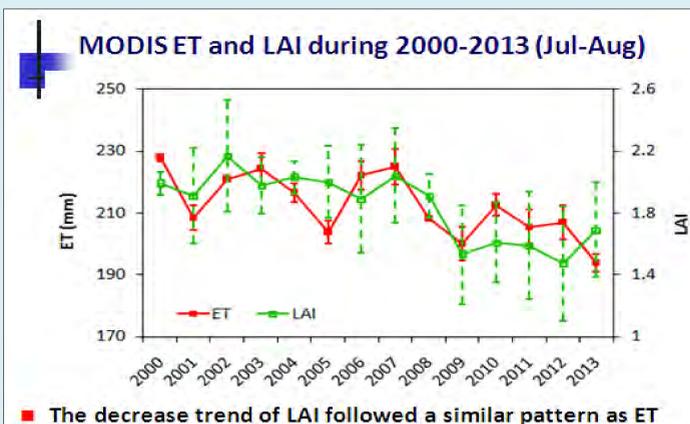


Period	\bar{P}	\overline{PET}	\bar{Q}	ΔQ_0	Climate Elasticity Model ($\alpha=2.93$; $\beta=0.$)		Rainfall Runoff Model ($a=-509$; $b=0.45$; $c=0.064$)	
					$\Delta \bar{Q}_{clim}$	$\Delta \bar{Q}_{tutc}$	$\Delta \bar{Q}_{clim}$	$\Delta \bar{Q}_{tutc}$
1986-2002 (reference)	1,105±291	998±82	353±287	--				
2003-2013	1,134±178	1,075±45	556±145	203	$27 \pm 166(13\%)$	$177 \pm 103(87\%)$	$36 \pm 169(18\%)$	$167 \pm 100(82\%)$

Methods and Conceptual Model



Results (Hao et al., HESS 2015)



Conclusions

- The streamflow increased by 58% and ET decreased by 23% during 1986-2013 as a result of an increase in urban areas of three folds and reduction of rice paddy field by 21%.
- Both highflows and lowflows increased significantly by about 28% from 2002 to 2013. The increases in streamflow were consistent with the decreases in ET and LAI monitored by independent MODIS data.
- The large effects of cropland conversion at the URI overwhelmed the effects of regional climate change and variability.
- Converting traditional rice paddy fields to urban use at the URI dramatically altered land surface conditions and thus was considered as one of the extreme types of contemporary hydrologic disturbances.
- The ongoing large-scale urbanization in the rice paddy-dominated regions in China and East Asia will likely elevate stormflow volume, aggravate flood risks, and intensify urban heat island effects. (More details Hao et al. 2015. Hydrology and Earth System Sciences Discussion. 12, 1941-1972. doi:10.5194/hessd-12-1941-2015.)