Impact of linear infrastructure on floodplains on inundation characteristics

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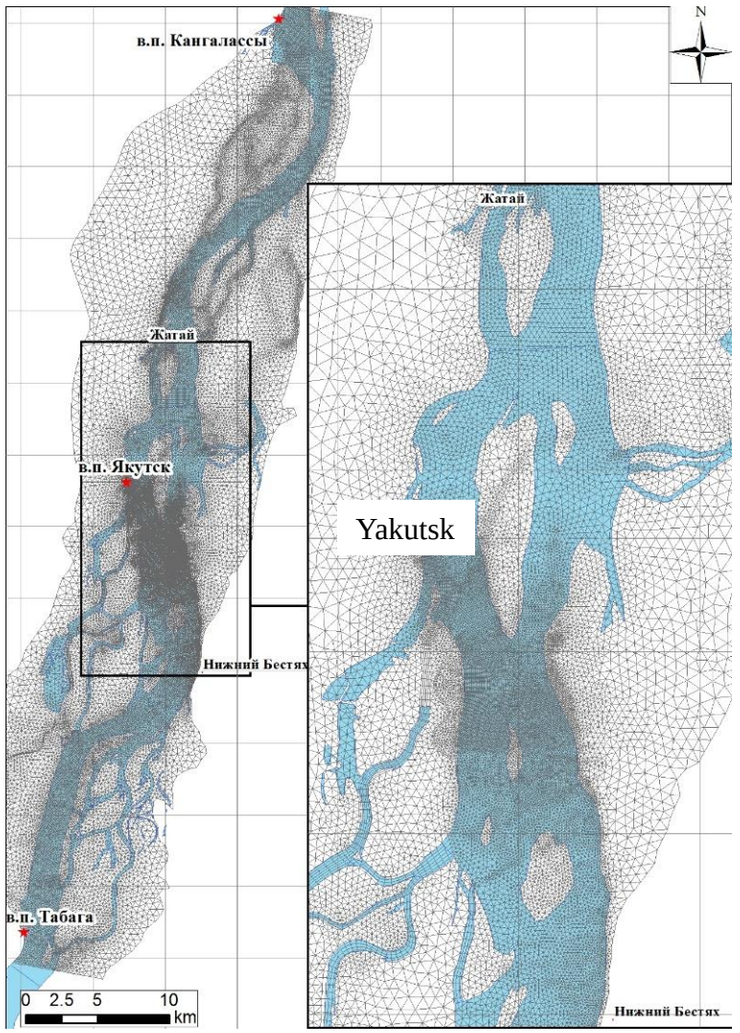
Inundation modeling

STREAM_2D and STREAM_2D CUDA two-dimensional model with ice-module (Aleksyuk, Belikov et. al., IWP RAS)

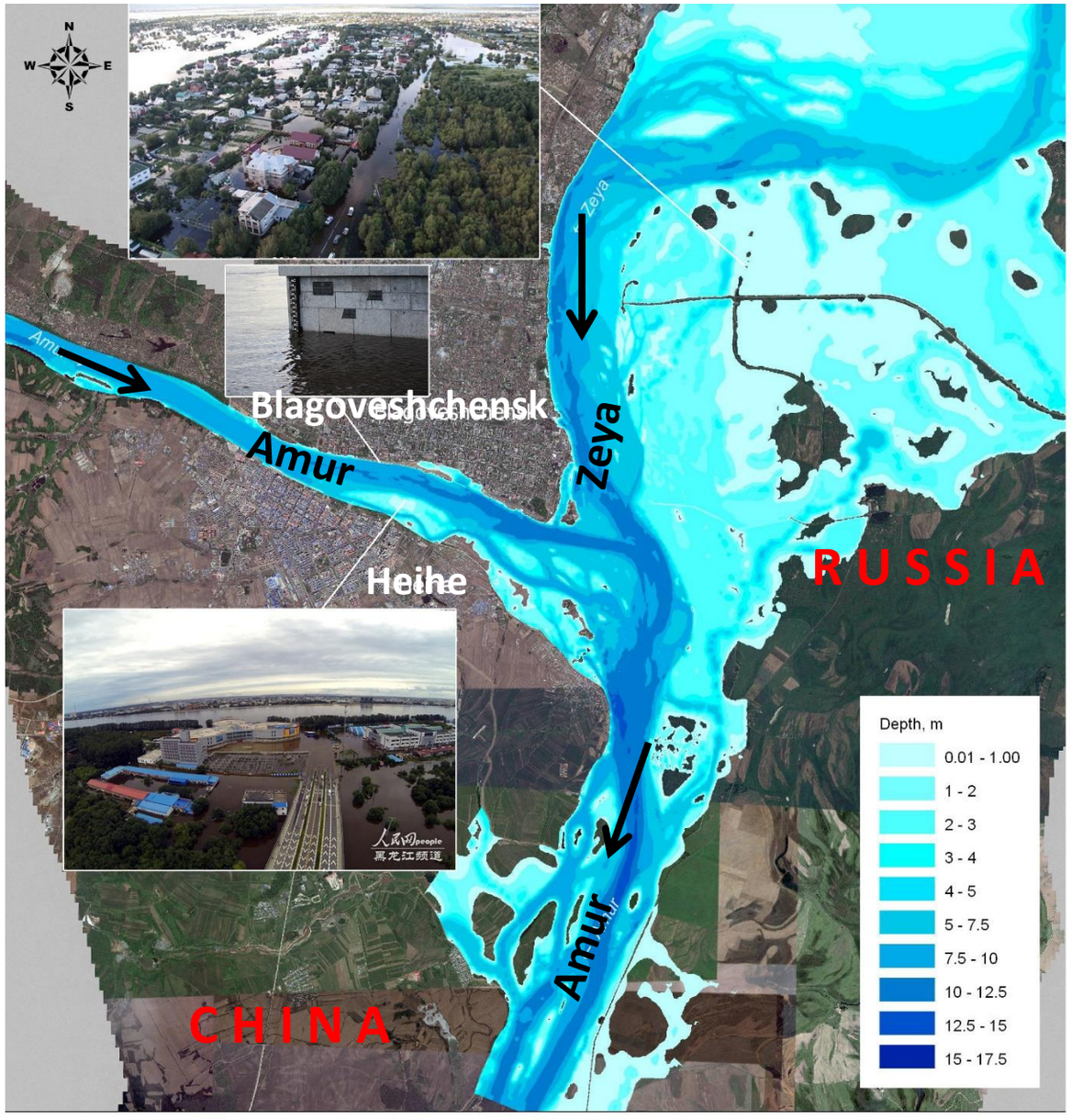
$$\begin{cases} \dfrac{\partial h}{\partial t} + \dfrac{\partial (hu)}{\partial x} + \dfrac{\partial (hv)}{\partial y} = 0, \\ \dfrac{\partial (hu)}{\partial t} + \dfrac{\partial \left(hu^2 + \frac{1}{2}gh^2\right)}{\partial x} + \dfrac{\partial (huv)}{\partial y} = -gh\dfrac{\partial b'}{\partial x} + \dfrac{\tau_1^b + \tau_1^i}{\rho}, \\ \dfrac{\partial (hv)}{\partial t} + \dfrac{\partial (huv)}{\partial x} + \dfrac{\partial \left(hv^2 + \frac{1}{2}gh^2\right)}{\partial x} = -gh\dfrac{\partial b'}{\partial y} + \dfrac{\tau_2^b + \tau_2^i}{\rho}. \end{cases}$$

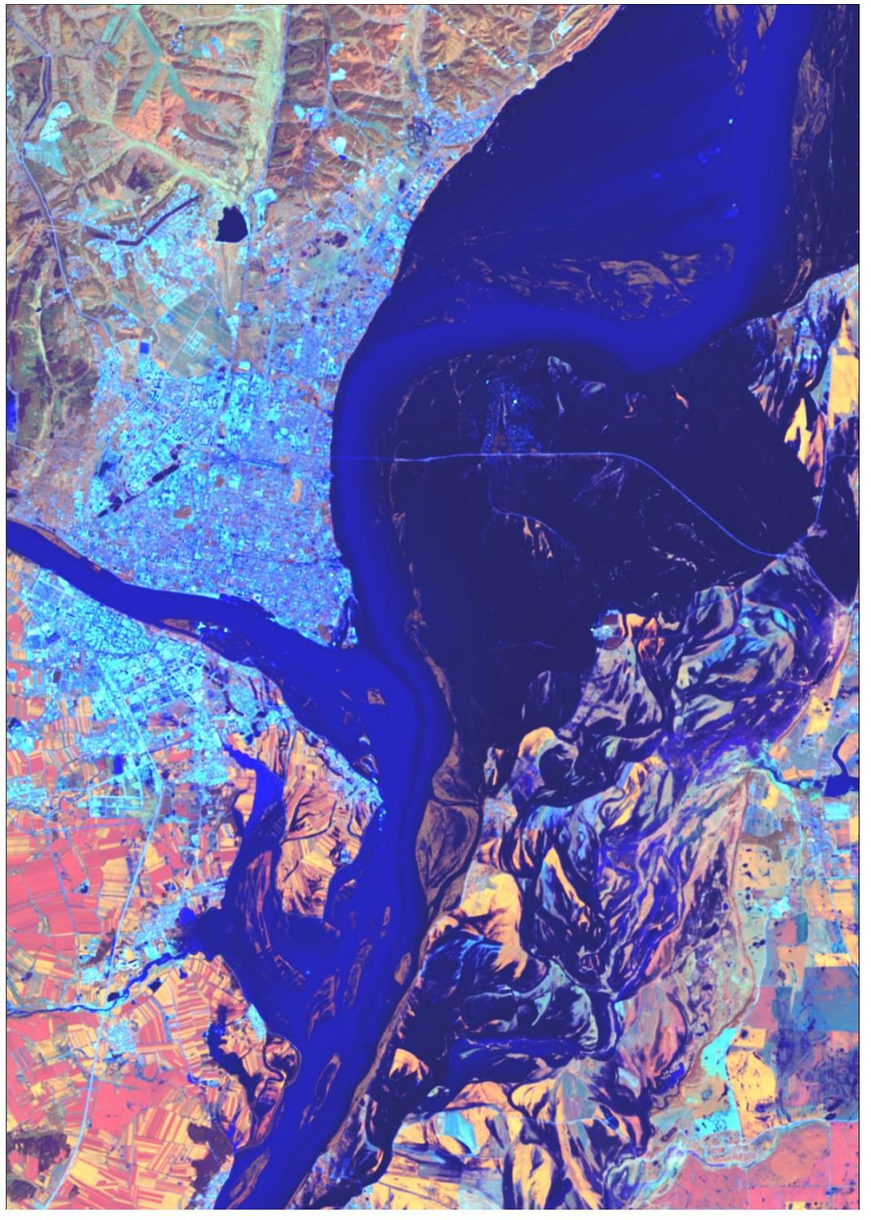
where (x, y) and t are the Cartesian coordinates and time;
$u(x, y, t)$, $v(x, y, t)$ depth-averaged fluid velocity components
$h(x, y, t)$ - the flow depth;
$b' = b + \rho_i H/\rho$, where b denotes the bed level;
ρ and ρ_i represent water and ice density,
H - ice thickness;
vectors (τ_1^b, τ_2^b) and (τ_1^i, τ_2^i) - the bed and ice surface shear stresses,
g - is the gravitational acceleration.

Computational mesh

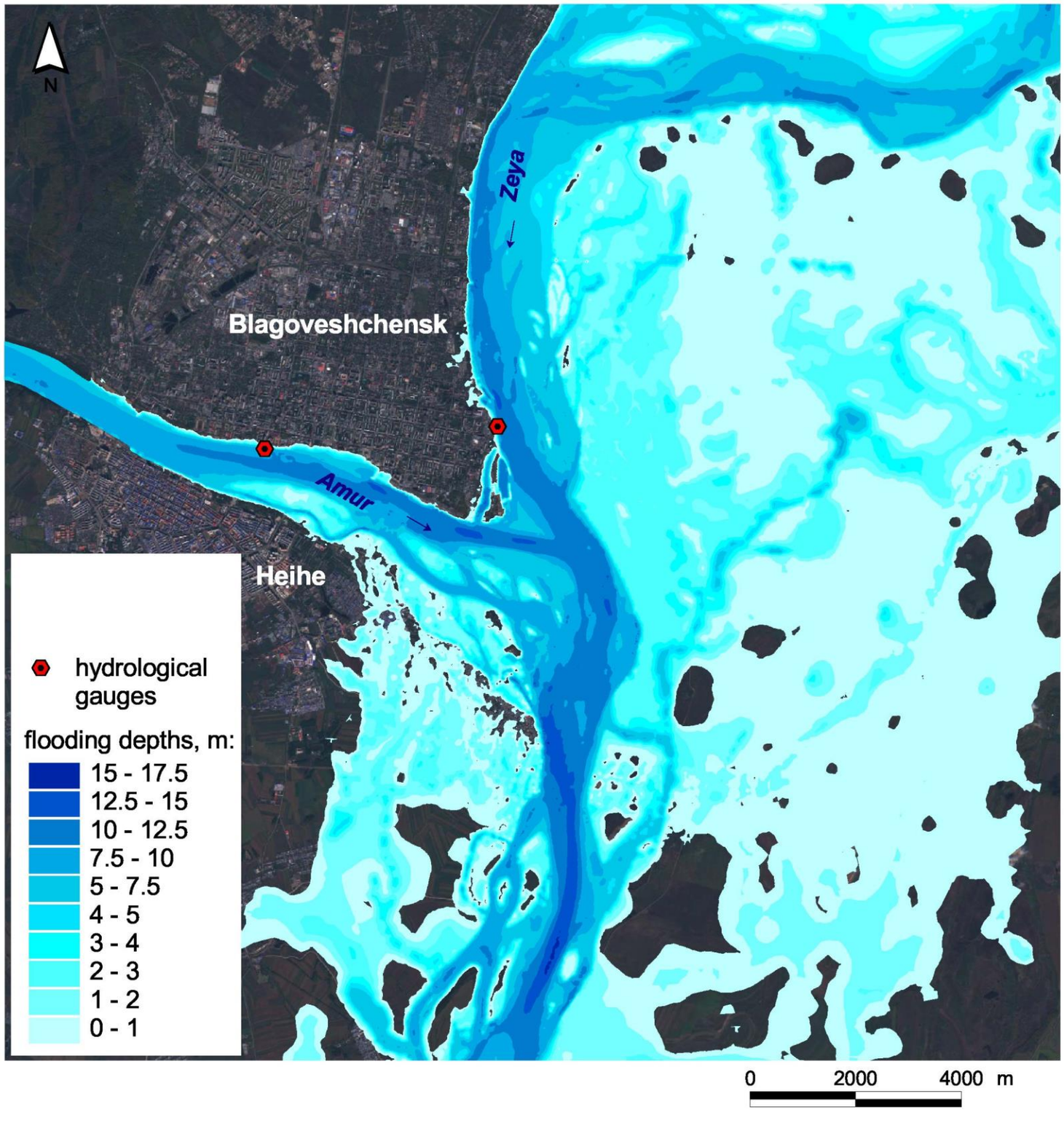


Flood of 2013, Amur and Zeya rivers confluence

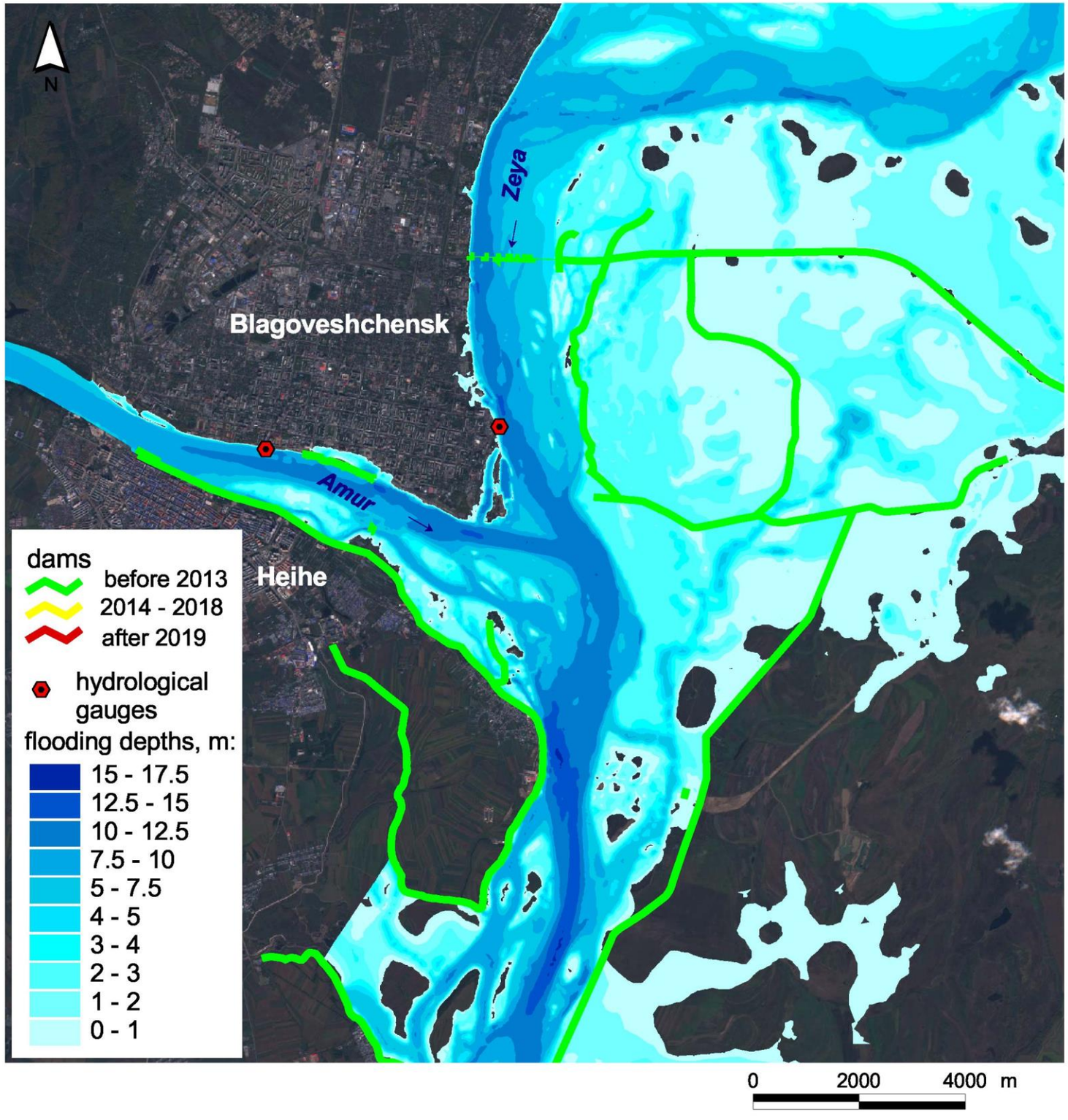




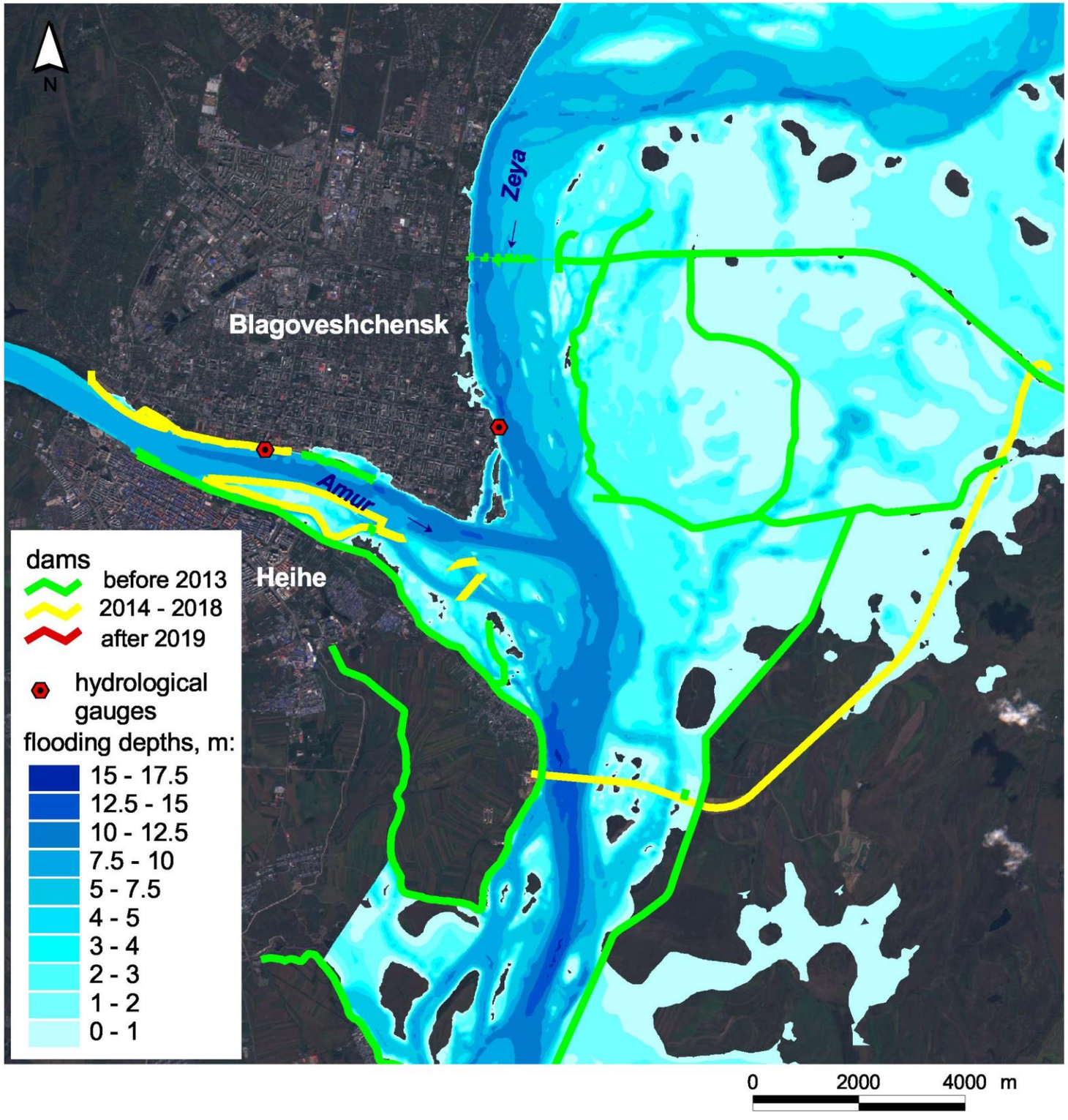
Natural floodplains inundation (reconstruction)



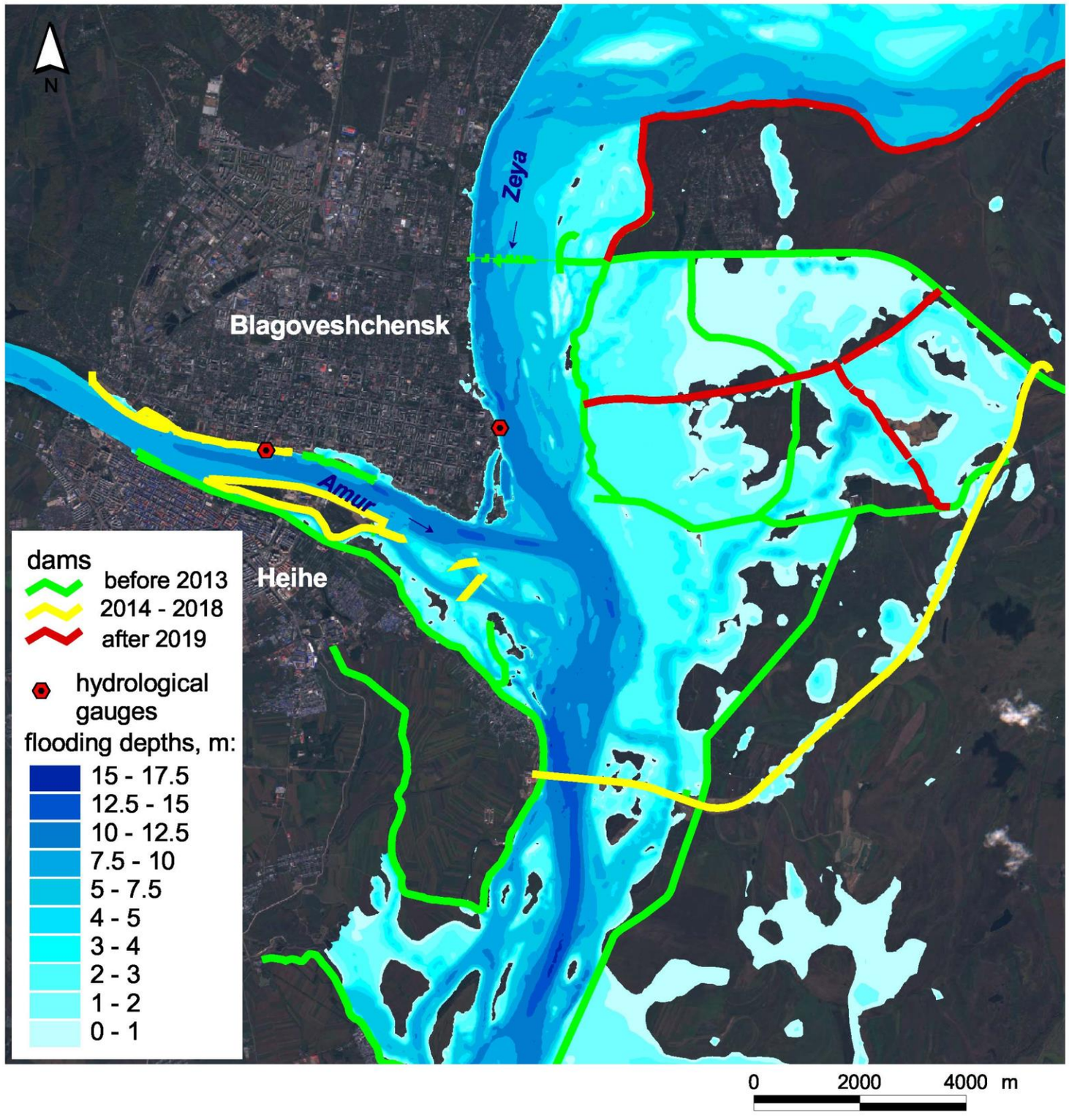
Inundation with dams constructed before 2013



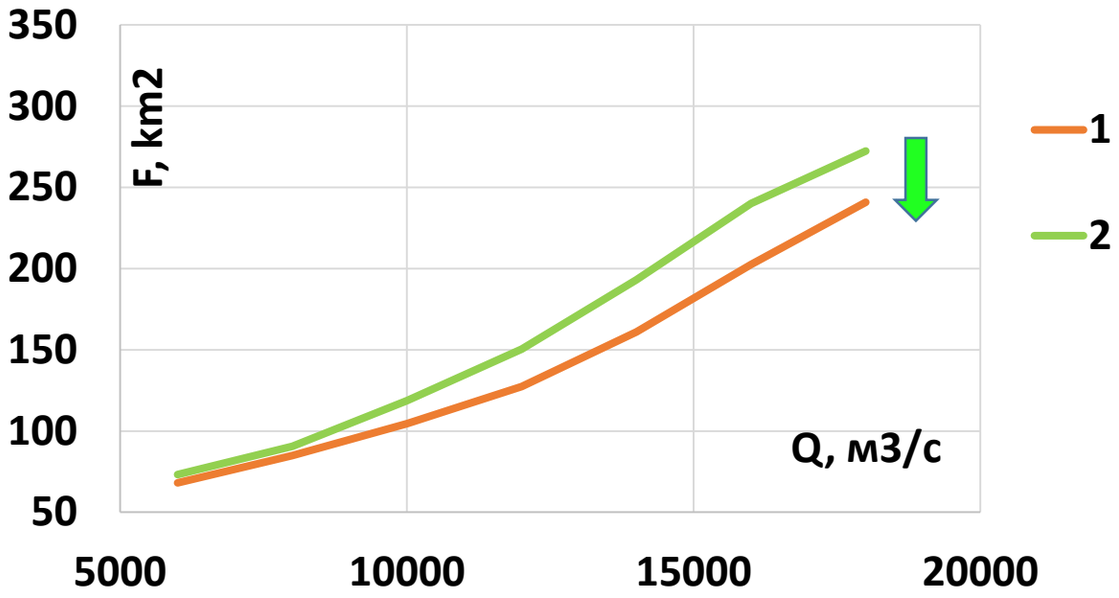
Inundation with dams constructed in 2013-2018

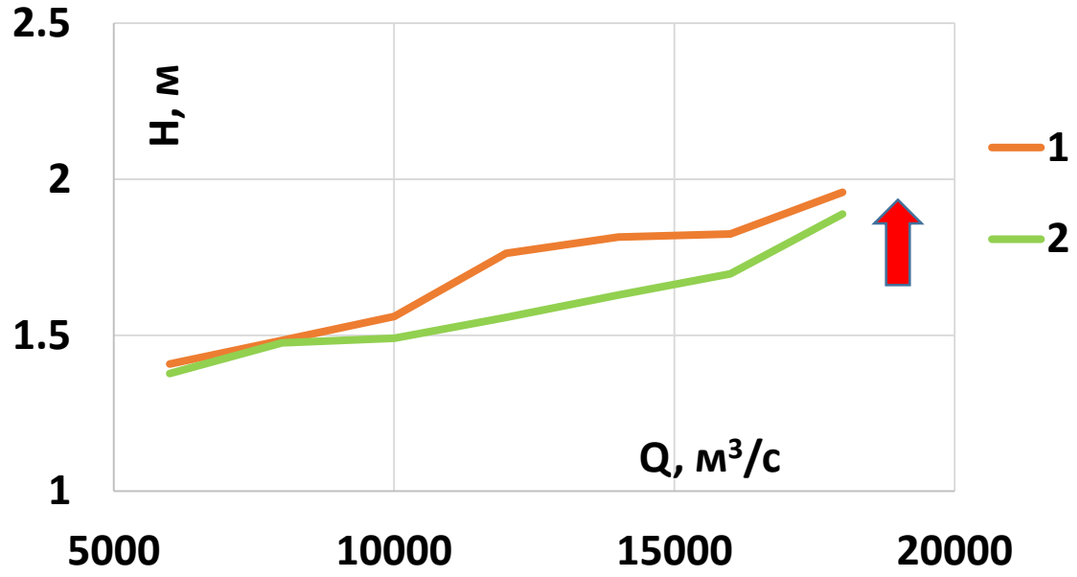


Inundation with dams constructed in 2013-2018



Inundations characteristics



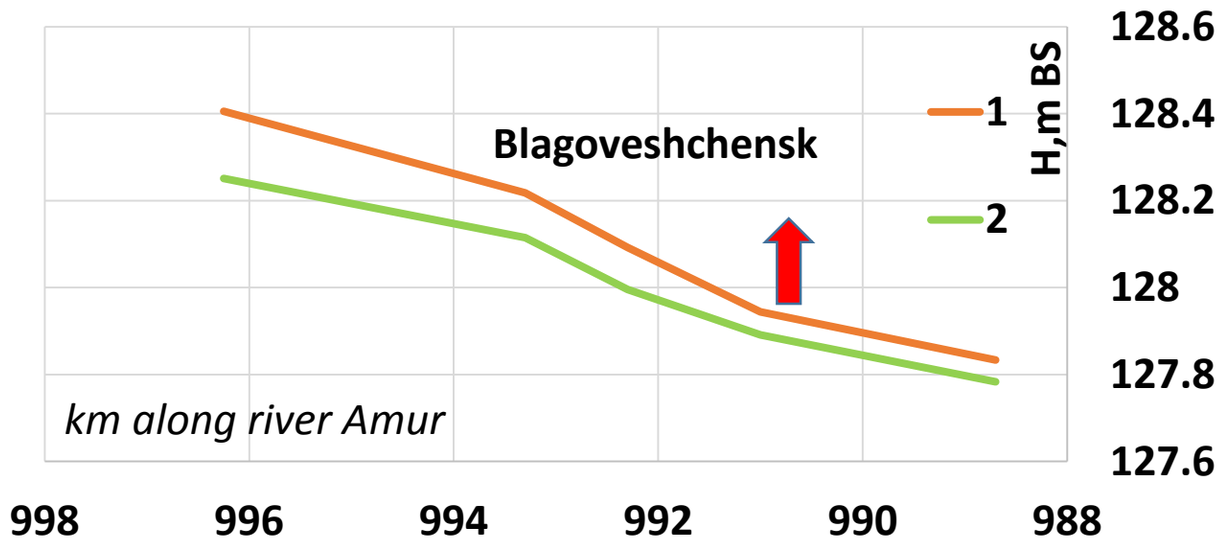


Inundation area

Water depths

natural

modern



water levels