Monitoring the impact of the Kakhovka Dam break with SWOT and ICESat-2

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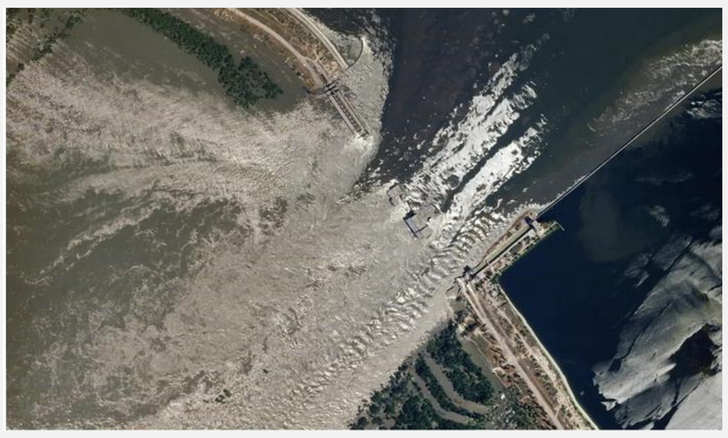
Kakhovka Dam break 06-06-2023, Ukraine

The Kakhovka Dam was 30 meters tall and 3.2 km wide. The breached part was about 85m wide. The reservoir created by the dam was the second-largest reservoir in Ukraine by area.

The Dam was regulated by Russia at the time of the dam break. Up until the 6th of June, the water level had been rising for months reaching a 30-year high.



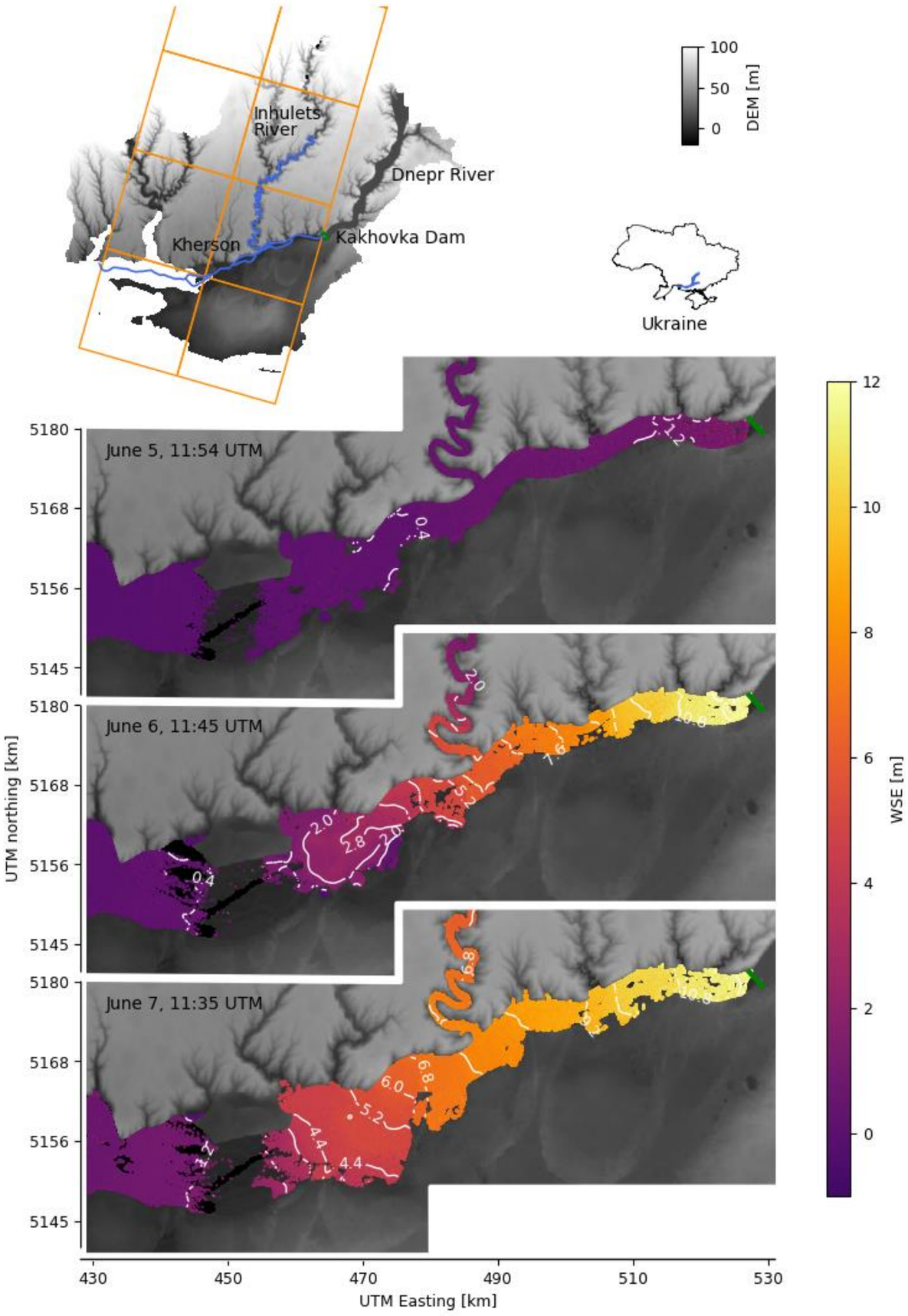
https://www.bbc.com/news/world-europe-65836103

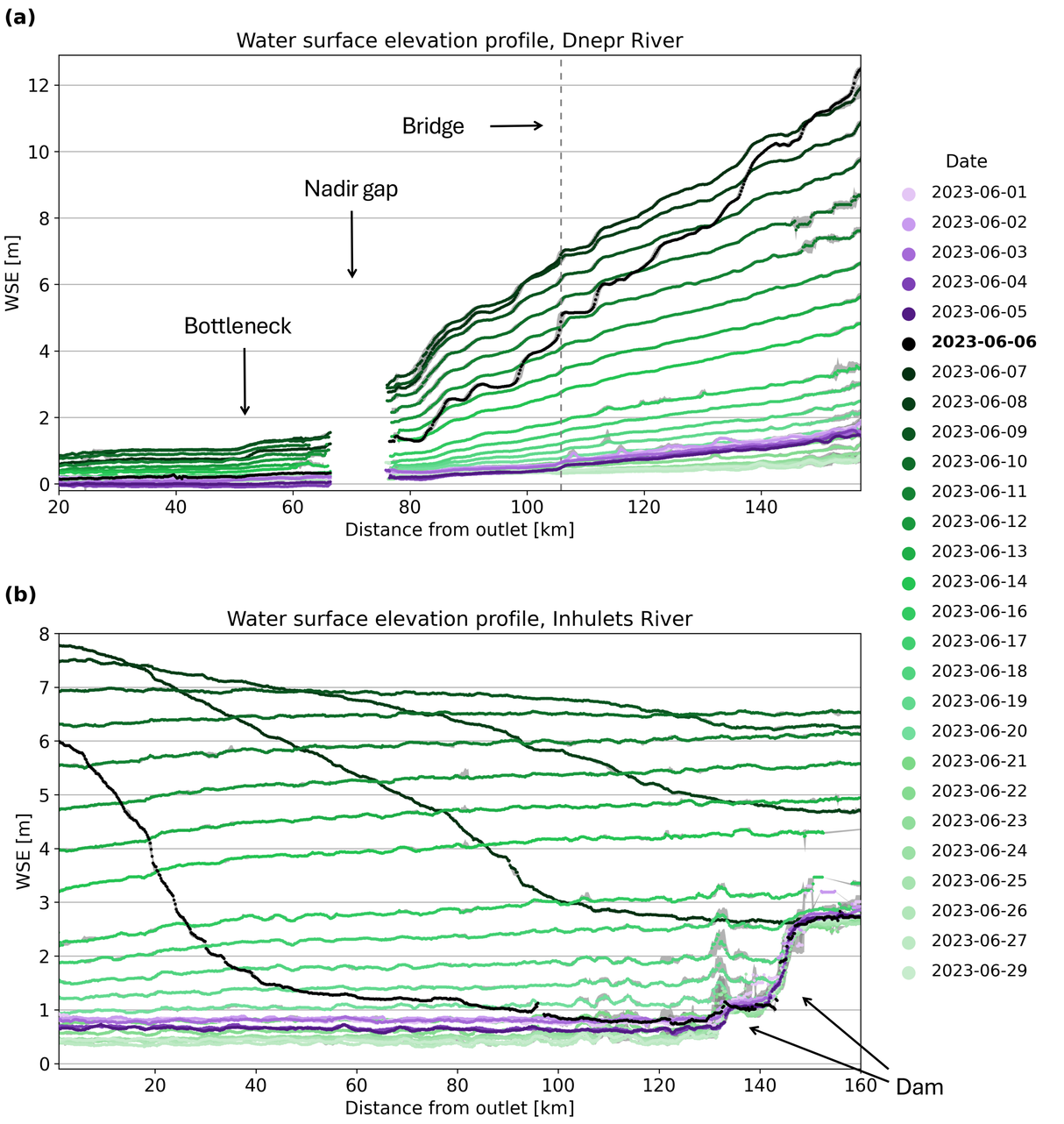
Floodwave through Downstream Dnepr and Inhulets

The floodwave caused by the dam break travels downstream through Dnepr River exiting into the Dniprovs'ka Gulf. The wave also enters the Inhulets River – a tributary to Dnepr - and travels upstream.

Below is an overview of the wave evolution on the days around June 6 where the dam was destroyed.

The water surface elevation profiles in the left column illustrate the evolution of the wave through the two rivers. The water level rose up to 12 meters in Dnepr River and up to 7 meters in Inhulets River.

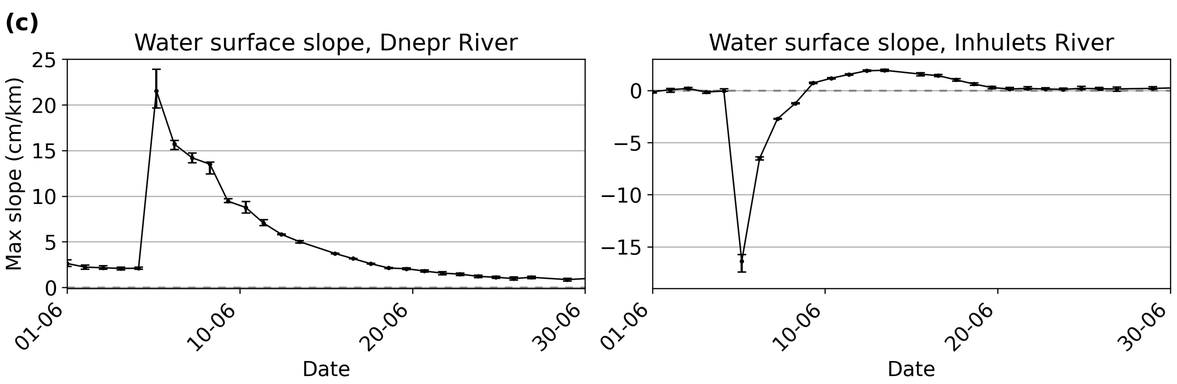




Slope changes

The Dnepr River's water surface slope rose from 2 cm/km to 22 cm/km in one day due to a flood wave from a dam break. The reservoir emptied after about 20 days. The new downstream slope is now 1 cm/km—lower than before the break.

The flood wave flowing upstream in the Inhulets River reverses the flow and creates negative slopes up to –16 cm/km. As the wave passes, water accumulates and then drains, causing a temporary increase in slope for about a week before returning to normal.

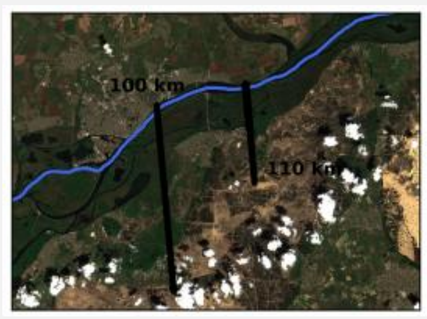


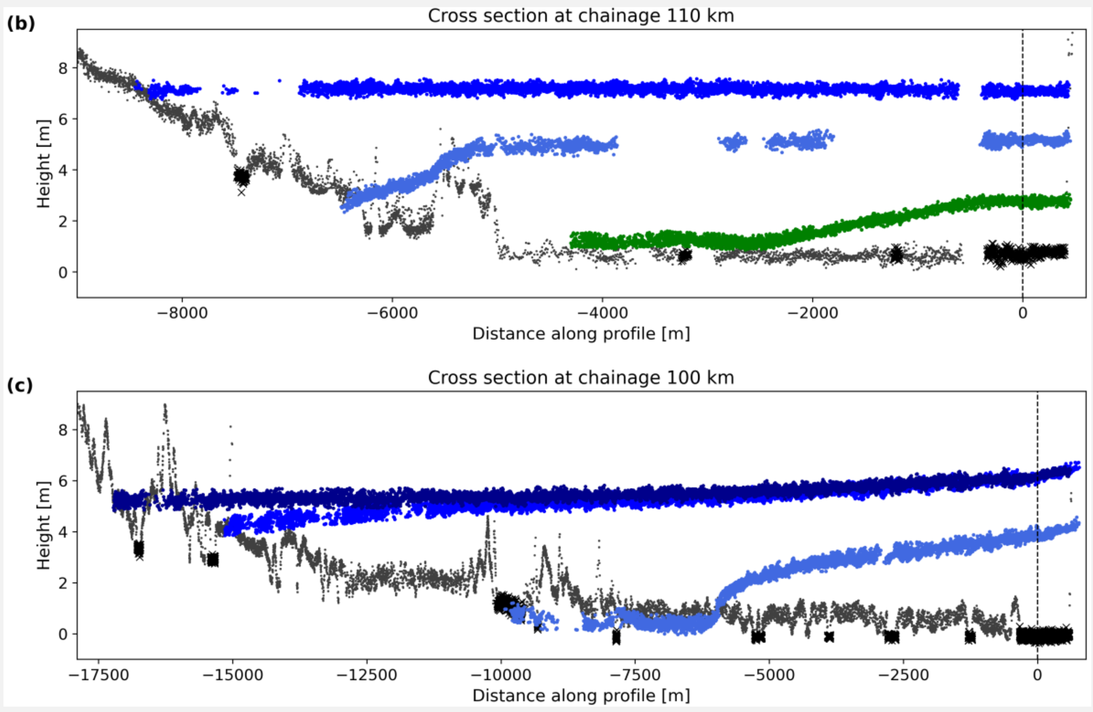
Cross section profiles

ICESat-2 and SWOT data are sampled at two cross sections during the flood wave. These show the temporal, transverse evolution of the wave into the floodplains.

The green prfile measured by ICESat-2 gives a unique indication of the wave evolution 6 hours after the dam break.

Each wave profile illustrate distinct wavefront extends and slope. The maximum slope is observed at T=12h for the profile located at chainage 100 of 444 cm/km.





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