Sinking levees

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Most of New Orleans is sinking at an average rate of 6mm a year. In some areas, subsidence is occurring at a rate of as much as 29mm/year. That's according to research published in this week's edition of the journal Nature by scientists from the University of Miami Rosenstiel School of Marine and Atmospheric Science.

Titled, "Subsidence and Flooding in New Orleans," the authors conclude that when global sea level rise is factored into their analysis, the average rate of subsidence of the city relative to sea level is even higher – 8mm on average per year.
"When you multiply this over 20, 30, or even 100 years, you can see that New Orleans will be lower, and this information should be factored into reconstruction plans, as we look at subsidence that is up to 3 feet in 40 years," said the lead author of the paper, Dr. Tim Dixon, Rosenstiel School geophysics professor. "What we found is that some of the levee failure in New Orleans were places where subsidence was highest. These levees were built over 40 years ago and in some cases, the ground had subsided a minimum of 3 feet which probably put them lower than their design level."

Through analysis of satellite radar imagery, and using structures in the city that strongly reflect the radar signal, the researchers were able to see where land is subsiding the most in New Orleans.

The team generated a map from space-based synthetic-aperture radar measurements, and note in their paper that it "revealed that parts of New Orleans underwent rapid subsidence in the three years before Hurricane

Katrina struck in August 2005. One such area was next to the Mississippi River-Gulf Outlet (MRGO) canal: levees failed here during the peak storm surge and the new map indicates that this could be explained by subsidence of a meter or more since the levee's construction."

To make the map, the team used 33 scenes recorded from Canada's RADARSAT satellite. The technique involves phase comparison of 33 radar images taken at different times along the same orbit and exploits points on the ground that strongly reflect radar, termed "permanent scatterers."

"While it may not trouble people that the ground is nearly one inch lower each year in places, in the long term, the impacts could be rather significant," said Dr. Falk Amelung, one of the paper's co-authors, also from the University of Miami Rosenstiel School. "While most people aren't accustomed to thinking about 100 years out, it's important to recognize that a large part of New Orleans is sitting on sediments that will only continue to sink into the Gulf of Mexico, and it will only get harder and harder to ensure the levees' durability. By 2106, for example, the ground will be nearly three feet lower on average."

"Global warming poses further challenges to this issue, as well," said Shimon Wdowinski another co-author from the University of Miami Rosenstiel School. "As the larger Mississippi Delta slowly slides into the Gulf of Mexico, the levees will be further tested if global warming increases the intensity and frequency of hurricanes."

The researchers conclude that their subsidence estimates for the levees "are probably minimum estimates when considered over the lifetime of the levees, given that subsidence was most rapid in the first few years after their construction in the 1960s. Levee failure may have resulted from overtopping because the levees were too low.

"Data from the U.S. Army Corps of Engineers collected after hurricanes Katrina and Rita confirm that water overtopped some levees that subsequently failed. Alternatively, the high subsidence rates the team observed might reflect active faulting or a weak, easily compacted soil, promoting failure at or near the levee base."

Source: University of Miami Rosenstiel School of Marine & Atmospheric Science