place thousands of years ago, are contributing to the sinking of a 77,000-square-mile section of coastal Louisiana.

To test their theory, the team developed a physical model of sinking caused by both the weight of the sea-level rise and the flow of glacial sediments into the Gulf of Mexico following the retreat of the great ice sheet that covered much of North America about 22,000 years ago. The model spanned the past 750,000 years.

Results were compared with global positioning system measurements and other geophysical data for Southern Louisiana and the Gulf, collected from multiple sources during the last 60 years. The scientists found the model results were in good agreement with the geophysical data, predicting sinking of between 0.04 inches and 0.3 inches a year. The highest sinking rates were observed where coastal land loss is greatest, near the center of the Mississippi and Atchafalaya River Delta complexes.

The scientists say when these results are combined with sinking totaling about 0.12 inches per year caused by other factors such as compaction and oxidation of sediments, pumping of oil and water by humans, faulting, and sea-level rise, the overall outlook isn't bright.

"Louisiana is slowly losing its battle with the Gulf of Mexico," said Ivins. "Our model predicts this rate of sinking will continue for hundreds of years. Continued sinking, along with the sediment starvation of the coast caused by construction of flood control levees along the Mississippi River, will ultimately lead to the drowning of the coast."

Co-author Ron Blom of NASA added that New Orleans is particularly vulnerable. "When the effect of this sinking near New Orleans is combined with a potential 0.35-inch annual sea-level rise that could result should ice sheet melting accelerate as projected by many climate models, it is possible New Orleans could see a relative sea-level rise of roughly 3.3 feet in the next 90 years," Blom said.

The good news, the authors say, is that, with refinement, their model may help the region prepare better for future large storms and the gradual inundation of the coast.

"Our model gives civil engineers and disaster preparedness managers very precise predictions of how the landscape is changing so that they can better mitigate the effects of this sinking," said Ivins. "Understanding all of the processes affecting the coast is essential for engineering effective solutions." ■