A Norfolk house being raised due to chronic flooding on 51st Street.

Initiative Keeps Tabs on RISING SEAS

New research findings have added to the momentum of the Old Dominion University Climate Change and Sea Level Rise Initiative (CCSLRI) that President John Broderick launched in 2010.

Recent studies have identified a "hot spot" of accelerated sea level rise from Cape Hatteras, N.C., to Boston, and researchers have speculated that a diminished flow of the Gulf Stream might be partly to blame. Now, data analysis by a team of oceanographers led by ODU faculty member Tal Ezer has given that hypothesis new scientific footing.

The findings were published earlier this year by the Journal of Geophysical Research: Oceans.

Ezer is professor of ocean, earth and atmospheric sciences at ODU 's Center for Coastal Physical Oceanography (CCPO). His co-authors on the latest publication are Larry Atkinson, Slover Professor of Oceanography and director of ODU's CCSLRI; William Bryce Corlett, an ODU alum and now a graduate student at the University of Southampton in England; and José Blanco, a Chilean scientist who has worked extensively with ODU's CCPO.

"Several papers show the acceleration of sea level rise in the mid-Atlantic. This new paper confirms the hypothesis for why it's happening," Ezer said. "In addition to the well-known causes for coastal sea level rise – global sea level rise and land subsidence in some places – this study points to a new source of sea level rise that is not yet fully understood: changes in ocean currents."

Findings of the researchers can explain why in some regions, such as Hampton Roads, the sea level has been rising two to three times faster than the average global sea level, and why the rate of the rise has increased in recent years.

The Gulf Stream flows like a huge river – a half-mile deep and more than 50 miles across – at about 100-200 miles off the east coast of the United States. It transports about 500 times the volume of water of the Amazon River. After flowing along the Florida eastern coast, the Gulf Stream separates from the coast at Cape Hatteras, N.C., and then turns northeastward, bringing large amounts of warm tropical waters into the cold North Atlantic Ocean. This causes it to play an important role in Earth's climate and weather.

When the Gulf Stream turns eastward it pulls water away from the mid-Atlantic shore, and the water level on the inshore side of the Gulf Stream, along the mid-Atlantic coast, is kept about 3-5 feet lower than the water on the other side of the Gulf Stream. Basic dynamic oceanography implies that this water elevation difference across the Gulf Stream is proportional to the speed of the stream, so the theory is that changes in the flow of the Gulf Stream would affect the coastal sea level in the mid-Atlantic more than any other coast.

"But does it really happen? And can observations confirm this theory? Those were the challenging issues tackled in this latest research," Ezer said.

Based on computer climate models, scientists have hypothesized for some time that a warming climate in the Arctic will slow the Atlantic Ocean circulation and reduce the Gulf Stream transport. The new study analyzed data that suggest the Gulf Stream may have started slowing already, and the accelerated sea level rise that has been measured in the mid-Atlantic area over the last few years is related to the changing Gulf Stream.

The research involves a new data analysis method developed by Ezer and Corlett that was published in Geophysical Research Letters in October 2012. The method can separate between long-term variations that may relate to climatic changes and faster changes such as seasonal cycles.

"These results indicate that sea levels in all those (mid-Atlantic measurement) stations are driven by the same force, and the candidate for that force was clearly the Gulf Stream," Ezer said. "Even more surprising was the very high statistical correlation found between changes in the Gulf Stream strength and the coastal sea level; the result was exactly as predicted by the theory, but real data rarely show such clear results."