Maps of New Orleans with Variable Amounts of Future Sea Level Rise

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Background

- From the 1880's to 2012, sea level has risen by about 20 centimeters due to global warming.[2]
- The rise in global mean sea level will accelerate due to increases in oceanic heating and loss of ice sheet and glacier mass.[4]
- Local sea level can be different than the global mean sea level due to the ocean expanding differently among locations, local tide and elevation, and even melting ice masses.[4] This means that local sea level at different coasts may have different probabilities of damage and safety risks.

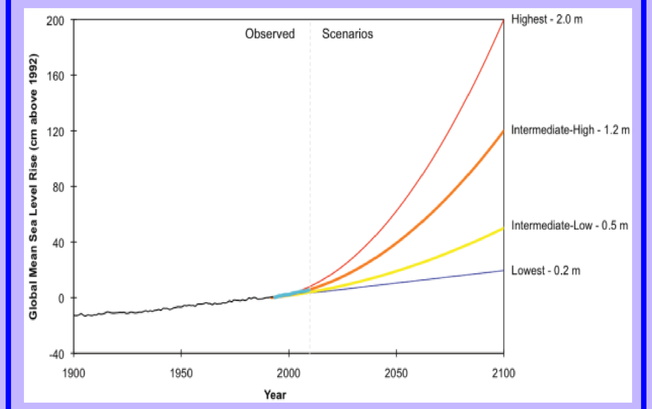


Figure 1: Global Mean Sea Level Scenarios; figure from the 2012 NOAA report.

- Out of 4.7 million people in Louisiana , 1.4 million live less than 3 meters above the high tide level, putting over 600,000 homes at risk.[3]
- New Orleans is ranked first in the nation for largest population living on land less than 1.22 m above local high tide.[2]
- By 2050, Louisiana's local sea level is projected to rise to about 48cm.[3]

Methods

- **Data Collection**
  - UNIX multiuser operating system.
  - Used the Parallel Ice Sheet Model(PISM) to gain a useful understanding on Ice Sheets .
  - NOAA National Centers for Environmental Information coastal digital elevation models.[1]
- **Data Processing**
  - R programming language.
  - Used R code written Caitlin Kupp to construct models displaying different sea level amounts.[6]
  - The code takes data from the DEM, subtracting the desired SLR value from each grid of numbers, producing an image that relates to a SLR of that value.

Abstract

Due to global warming, sea level has risen and is expected to continue rising in the future, which increases the potential of damaging floods. As the flooding potential increases, coastal populations and infrastructure will be put at greater risk than presently. The objective of this research was to analyze how various increases in sea level could decrease the amount of land New Orleans possesses. New Orleans is heavily populated, and it is located on a delta, thus having low elevated topography. The impact of a storm could put many people at risk of relocation, homes at risk of destruction, and local economy at risk from hurt businesses. Therefore, gathering an idea of how various rises in sea level may impact New Orleans could be very important.

Results

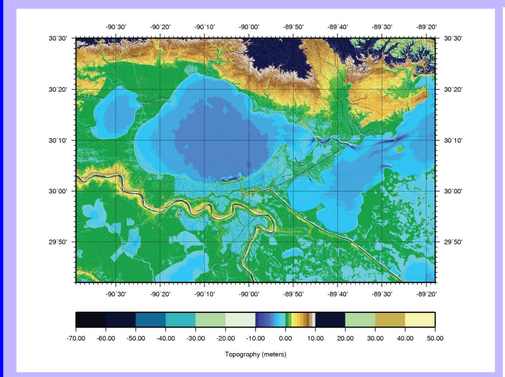


Figure 2 (above): Shaded relief image of New Orleans using NAVD 88 vertical DEM from NOAA.

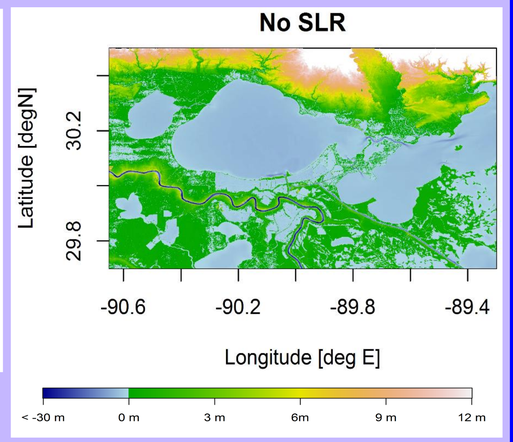


Figure 3 (above) : Constructed model using R Studio that approximately matches the NOAA DEM (upper left).

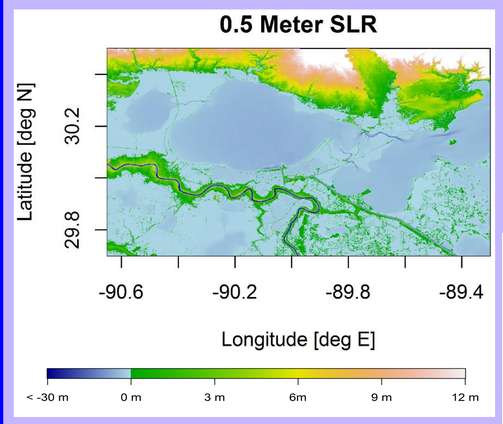
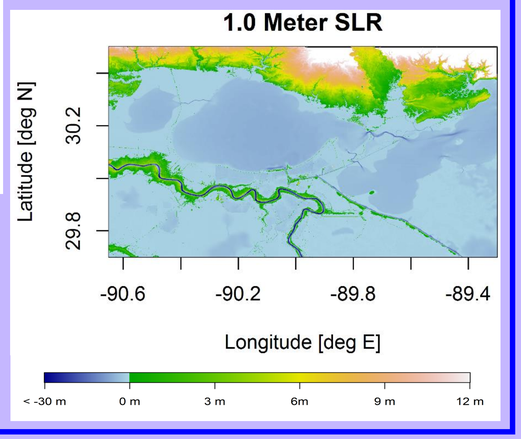


Figure 4 (right): Constructed model of New Orleans with a meter of sea level rise.

Figure 4 (left): Constructed model of New Orleans with half a meter of sea level rise.



Results

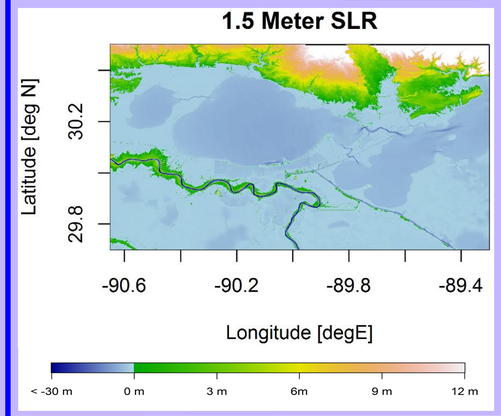


Figure 4 (left): Constructed model of New Orleans with a meter and a half of sea level rise.

Discussion

From the models and research, three significant understandings have been attained:

1. New Orleans is potentially threatened by the increasing sea level.
2. Based off of our models, New Orleans will be considerably at risk when taking into account Climate Central's projections that the coast of Louisiana will have SLR of 48cms by 2050.
3. Ice sheet melting is extremely important as it impacts sea level and possibly increases the threat of submerging cities like New Orleans.

References

[1] Love, M.R., C.J. Amante, L.A. Taylor, and B.W. Eakins, 2011. Digital Elevation Models of New Orleans, Louisiana: Procedures, Data Sources and Analysis, NOAA Technical Memorandum NESDIS NGDC-49, U.S. Dept. of Commerce, Boulder, CO, 46 pp.

[2] Strauss, Ben, Claudia Tebaldi, and Remik Zlemlinski. "Surging Seas Sea Level Rise Analysis by Climate Central." *Surging Seas*. Climate Central, 2012. Web. 23 July 2015.

[3] *Facts and Findings: Sea Level Rise and Storm Surge Threats for Louisiana* (n.d.): n. pag. Climate Central. Web. <http://slr.s3.amazonaws.com/factsheets/Louisiana.pdf>.

[4] Church, J.A., P.U. Clark, A. Cazenave, J.M. Gregory, S. Jevrejeva, A. Levermann, M.A. Merrifield, G.A. Milne, R.S. Nerem, P.D. Nunn, A.J. Payne, W.T. Pfeffer, D. Stammer and A.S. Unnikrishnan, 2013: Sea Level Change. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[5] Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, J. Hall, R. Horton, K. Knuuti,R. Moss, J. Obeysekera, A. Sallenger, and J. Weiss. 2012. Global Sea Level Rise Scenarios for theUS National Climate Assessment. NOAA Tech Memo OAR CPO-1. 37 pp.

[6] Kupp, Caitlin (2015): **Contrasting Inundation Patterns of Two Pacific Islands Under Sea-Level Rise**, Thesis, The Pennsylvania State University, advised by K. Keller.

Acknowledgements

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