Technologies to Characterize and Communicate Global Impacts of Sea Level Rise

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A great deal of scientific effort has focused on improving projections of global mean sea-level rise for this century under different greenhouse gas emission scenarios, with most estimates falling between 0.5m and 2m. Without adequate mitigation or preparation, such a future could be disastrous for coastal communities around the world. However, communicating the importance of these projections to the general public is an ongoing challenge for climate scientists.

It is essential that such findings are translated into clear, accurate, and localized impacts in order to capture the attention of non-technical audiences. To do this, we have developed a free, publically available interactive online sea level map. We use the Google Earth Engine platform, allowing dynamic real-time map generation so that users may explore a far-reaching range of scenarios, assumptions, and time frames, including scenarios integrating sea level projections and coastal flood events. Beyond these capabilities, we have developed a new narrative-driven user interface that lets users quickly find map-setting combinations that address questions meaningful to them. The interface pairs selected maps with clear written descriptions, and provides simple ways to explore different settings that invite users of all backgrounds and skill levels to explore. The new map tool offers public and private decision-makers a new source of local climate-impacts insights.

In this presentation, I also discuss the technologies we have developed to extend these maps beyond the US. Historically, accurately assessing global-scale coastal vulnerability has been very difficult, as globally-available digital elevation models - such as NASA's SRTM - suffer from large errors, overestimating elevations by an average 2m or more. We, instead, have applied an improved global coastal elevation model we have developed using artificial neural networks, CoastalDEM, that reduces mean vertical bias to 10cm. A global vulnerability assessment with our new model suggests that SRTM has gravely underestimated coastal threats from sea level rise. CoastalDEM roughly triples the central estimate of current global population occupying land at risk of permanent inundation through sea-level rise by 2100, as compared to assessments based on SRTM data.

Finally, I discuss the future in generating hyper-local flood visualizations for sea level rise and extreme storm risk communication. Previously, we have used elevation data along with photos of iconic global landmarks to hand-craft a number of photorealistic renderings of projected sea level rise at these locations. Users have found these images particularly engaging, with hundreds of millions of visitors over the last several years. However, due to the manual nature of crafting these visualizations, this approach is not scalable. To solve this, we have recently developed new technology to fuse photo and lidar data taken from a vehicle-top rig to rapidly and fully automatically render 3D flood surfaces superimposed onto street-level images. With this new tool, we hope to generate these images at thousands of homes and businesses across coastal cities in the US.

Author Biography

Dr. Scott Kulp serves as Principal Computational Scientist for Climate Central's Program on Sea Level Rise, where his research interests include the impacts of sea level rise on coastal communities. Dr. Kulp leads Climate Central's CoastalDEM project, which has received international attention from thousands of media outlets around the world. Scott holds a Ph.D. in Computer Science from Rutgers University for his work on the topic of cardiac blood flow simulations. He also holds a B.S. in Computer Science and Mathematics from Ursinus College.