CoastalDEM® v2.1

A New, High-Accuracy and High-Resolution Global Coastal Elevation Model Trained on ICESat-2 Satellite Lidar

Climate Central has released CoastalDEM® v2.1[1], a near-global digital elevation model for ocean coastal areas. CoastalDEM v2.1 substantially reduces bias and error scatter, improving on its predecessor, CoastalDEM v1.1, making it the best-performing of all leading, publicly-available, global digital elevation models (DEMs) tested.

CoastalDEM was developed to provide a widely available, near-global digital elevation model for the primary purpose of evaluating coastal flood risk considering storms and sea level rise. With no-cost licenses available and vertical bias demonstrably near zero, CoastalDEM v2.1 is a superior global DEM for sea level rise and coastal flood risk assessments.

CoastalDEM v2.1 is the result of substantial new investment, new neural network architecture, and additional and improved input datasets. It is also informed by feedback from and interaction with many coastal flood risk practitioners and licensees of CoastalDEM from around the world.

Improved Coastal Elevations

In order to assess worldwide accuracy of global DEMs, Climate Central compared land elevation measurements from NASA's ICESat-2 as ground truth to CoastalDEM v2.1, and 5 other recently released, widely-available global DEMs: CoastalDEM v1.1, NASADEM, TanDEM-X, MERIT, and AW3D30. All DEMs were evaluated at their native horizontal resolutions, including both versions of CoastalDEM at 1 arc-second (≈ 30 m or about 98 feet).

CoastalDEM v2.1 virtually eliminates global median bias to less than 0.01 m (0.5 inch). CoastalDEM v2.1 outperforms the other global DEMs by a significant margin in the whole of the most important 0 - 5m elevation band, including all areas regardless of population density. For example, CoastalDEM v2.1 shows a mean vertical bias of -0.03 m (1.2 inches), CoastalDEM v1.1 has a mean bias of -0.06 m (2.4 inches), while the other DEMs show mean biases that range from 1.46 m (4.8 feet) to 2.41 m (7.9 feet) (Figure 1). A little more than an inch compared to almost 8 feet is huge when attempting to evaluate coastal flood risk due to sea level rise.

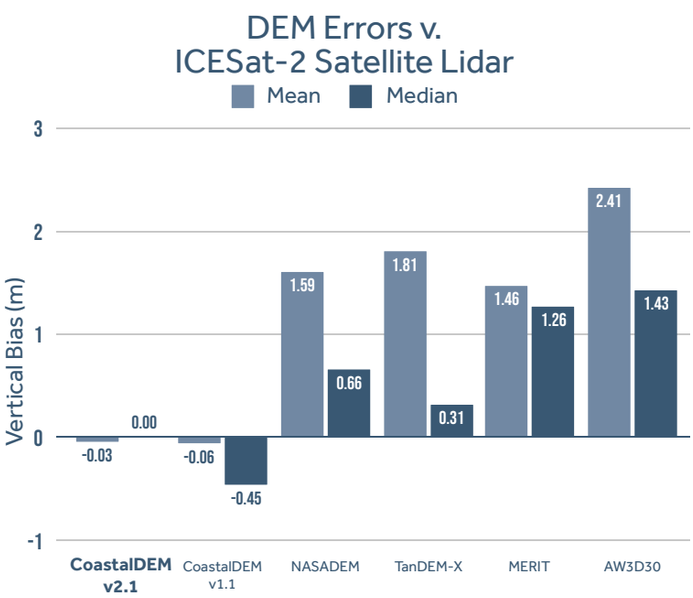

Figure 1: Global mean and median bias error statistics across each global DEM in the less than 5 m elevation band, and all population density bands. ICESat-2 is used as ground truth.

Performance Across Nations

Having a global satellite lidar elevation dataset from ICESat-2 affords the opportunity to evaluate CoastalDEM v2.1's performance across nations. Figure 2 uses Choropleth maps to show CoastalDEM v2.1's low vertical bias as compared to the other DEMs. These views give DEM users an indication of the relative confidence, in terms of bias when compared to satellite lidar ground truth from ICESat-2, they may have in CoastalDEM 2.1 versus the comparable global DEM's accuracy by region and country.

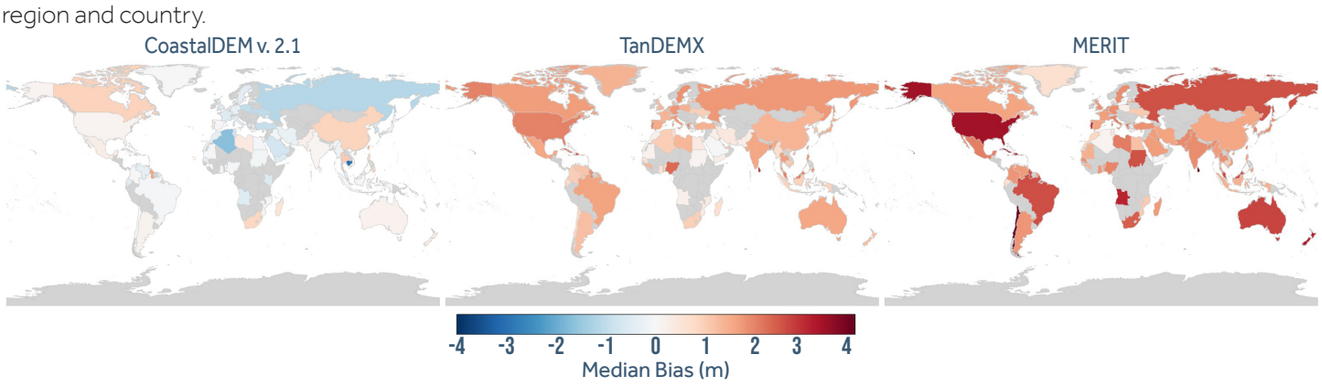

Figure 2: Choropleth maps presenting median bias under CoastalDEM v2.1, TanDEM-X, and MERIT in low-elevation regions across coastal nations, using ICESat-2 as ground truth. Only pixels with elevation < 5 m and population density >1000 people per square km are considered, and only nations with n ≥ 1000 of these pixels are evaluated.

AVAILABILITY

CoastalDEM v2.1 is available at 30 m and 90 m horizontal resolution by license from Climate Central via

https://go.climatecentral.org/coastaldem/

No-cost, non-commercial licenses at 90 m horizontal resolution are available to qualified academic and research organizations.

[1] S. Kulp and B. H. Strauss, "CoastalDEM v2.1: A High-accuracy and -resolution Global Coastal Elevation Model Trained on ICESat-2 Lidar"