High-accuracy wind data for coastal regions is needed today, e.g., for the assessment of wind resources. Synthetic Aperture Radar (SAR) is the only satellite borne sensor that has enough resolution to resolve wind speeds closer than 10 km to shore but the Geophysical Model Functions (GMF) used for SAR wind retrieval are not fully validated here. Ground based scanning light detection and ranging (LiDAR) offer high horizontal resolution wind velocity measurements with high accuracy, also in the coastal zone. This study, for the first time, examines accuracies of SAR wind retrievals at 10 m height with respect to the distance to shore by validation against scanning LiDARs. Comparison of 15 Sentinel-1A wind retrievals using the GMF called C-band model 5.N (CMOD5.N) versus LiDARs show good agreement. It is found, when nondimensionalising with a reference point, that wind speed reductions are between 4% and 8% from 3 km to 1 km from shore. Findings indicate that SAR wind retrievals give reliable wind speed measurements as close as 1 km to the shore. Comparisons of SAR winds versus two different LiDAR configurations yield root mean square error (RMSE) of 1.31 ms-1 and 1.42 ms-1 for spatially averaged wind speeds.