Louisiana Barrier Island Comprehensive Monitoring Program 2015-2019 Coastal Surface-Sediment Characterization Analysis: Regional Sediment Characteristic Change Maps

Submitted to:

Coastal Protection and Restoration Authority

Prepared by:

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December 2019

Introduction

It is widely recognized and well documented that barrier islands and deltaic headland shorelines of the Louisiana Coastal Zone are rapidly retreating landward and degrading (e.g. LCA, 2005; Kulp et al., 2011). High rates of delta plain subsidence, ongoing eustatic sea-level rise, low sediment supply, and other processes such as storm impacts collectively contribute to this shoreline loss as shoreline sediment is eroded or becomes inundated by marine waters (Penland and Ramsey, 1990; Kulp et al., 2011). The magnitude of shoreline retreat along coastal Louisiana varies from progradational (over historic time in the Chenier Plain) to widely erosional for modern times, and has been shown to be as much as 40 m/yr locally (Williams et al., 1992; Martinez et al., 2009; Byrnes et al., 2018); this retreat contributed to more than 100 km^2 of annual land loss that has been documented for some select historic time frames across the region (Barras et al., 2003; Couvillion et al., 2011).

Purpose

To more effectively identify the magnitude, rates, and processes of shoreline change a Barrier Island Comprehensive Monitoring program (BICM) has been developed by the Louisiana Department of Natural Resources (LDNR), and implemented by LDNR, University of New Orleans-Pontchartrain Institute for Environmental Sciences (UNO-PIES), and the U.S. Geological Survey (USGS) as a framework for a coast-wide monitoring effort (Kulp et al., 2011). This program is now overseeing by the Coastal Protection and Restoration Authority (CPRA). One part of BICM is the sediment sampling and analysis, which supplements other aspects of the program, including shoreline, seafloor and habitat change analysis. The advantage of BICM over current project-specific monitoring efforts is that it provides long-term morphological datasets on all of Louisiana's barrier islands and shorelines; rather than just those islands and areas that have received restoration (Kulp et al., 2011). BICM additionally specifically provides a larger proportion of unified, long-term datasets that will be available to monitor constructed projects, plan and design future barrier island projects, develop operation and maintenance activities, and assess the range of impacts created by past and future tropical storms. The development of coastal models, such as those quantifying littoral sediment budgets, and a more advanced knowledge of mechanisms forcing large-scale coastal evolution becomes increasingly feasible with the availability of BICM regional datasets.

The BICM Program was established in 2006 to provide long-term data on Louisiana's barrier island systems for planning, design, evaluation, and maintenance of barrier islands restoration projects. The first phase of BICM was completed in 2012, culminating with a workshop on program successes, the initial development process, and lessons learned from data collection and analysis (Kulp et al., 2011; Kindinger et al, 2014). Phase II of BICM stared in 2015, and is projected to be completed in 2020 with similar products and analysis as in Phase I. BICM additionally specifically provides a larger proportion of unified, long-term datasets that will be available to monitor constructed projects, plan and design future barrier island projects, develop operation and maintenance activities, and assess the range of impacts created by past and future tropical storms. The development of coastal models, such as those quantifying littoral sediment budgets, and a more advanced knowledge of mechanisms forcing large-scale coastal evolution becomes increasingly feasible with the availability of BICM regional datasets.

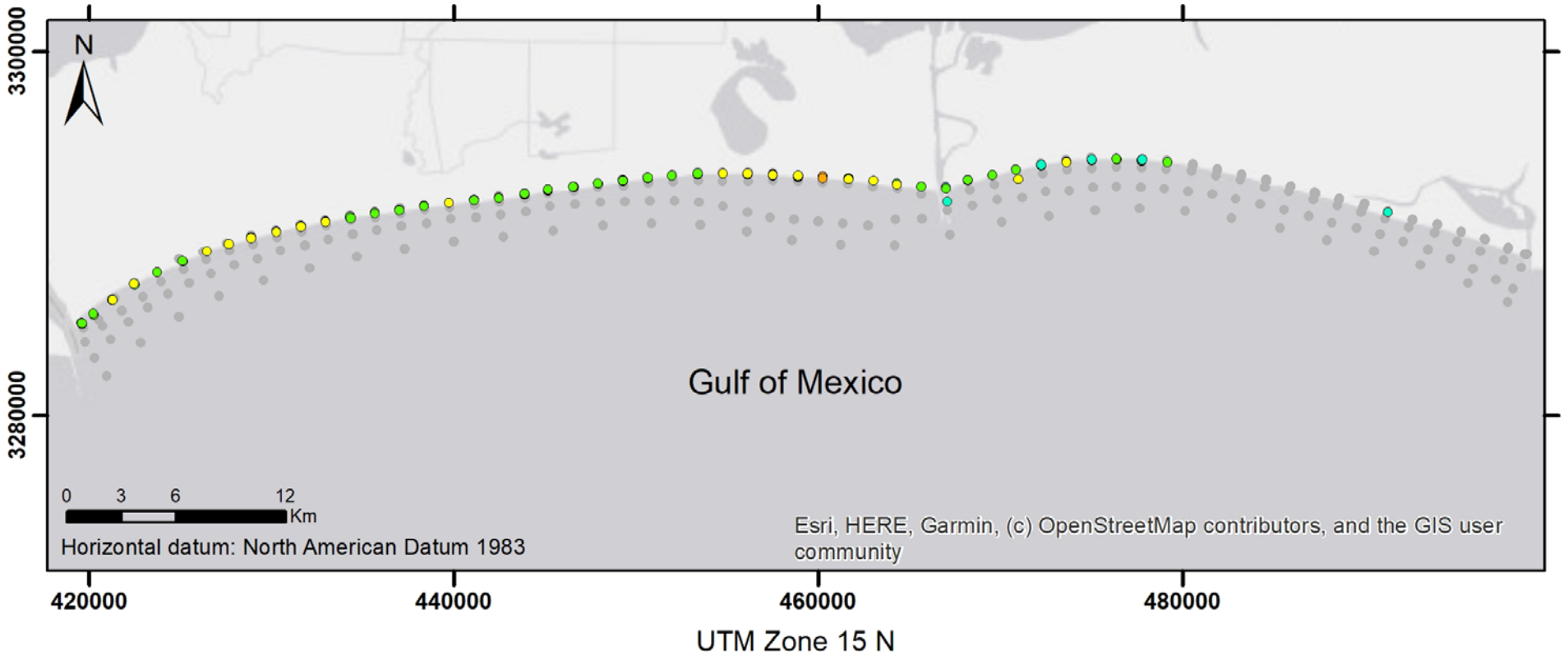
Grain size analysis in coastal systems is commonly used to determine the distribution of clastic sediments, provide insight into local and regional sediment transport trends, and help distinguish among geomorphic environments (e.g. dune, berm, beach face). As noticeable differences in grain size distribution do exist as one proceeds from the dune base, across the beach, and continues offshore (Bascom, 1951; Dean and Dalrymple, 2002), reported changes between environments, or within environments over time (if data exists over time), can be used to infer coastal change, sediment transport trends, and generally used as proxies for regional to local sediment change (Stauble, 2003; Georgiou et al., 2018, 2019).

These factors constitute critically important elements of any effort that is aimed at effective coastal restoration, sediment nourishment, or management. The specific purpose of this report is to show the locations of sediment samples collected in 2015 throughout coastal Louisiana. The report provides standardized maps for each BICM Program region (Figure 1). Delineating sample locations classified by the difference in sand content (%) and mean grainsize (D_{50}) from 2008 to 2015 datasets. Maps were made using ArcMap 10.3.1.

Figure 1: Base depicting the Barrier Island Comprehensive Monitoring Program regions edited from Kulp et al. 2015.

Barrier Island Comprehensive Monitoring (BICM) Program - Surficial Sediment: Western Chenier Region, Percent Sand Change 2008 to 2015

Indicated by Particle Size Analysis



Difference in Percent Sand

- no comparable point
- < -25
- -25 - -15
- -15 - -5
- -5 - 0
- 0 - 5
- 5 - 15
- 15 - 25
- > 25

Grain Size Analysis

Samples from this location were taken by surface grab samples on land and by Ponar offshore. They were visually analyzed for percent sand. Samples estimated to be greater than 70% sand were analyzed using laser particle diffraction methods, to determine sediment characteristics of each sample including but not limited to sand content and D_{50} (Kulp et al 2011).

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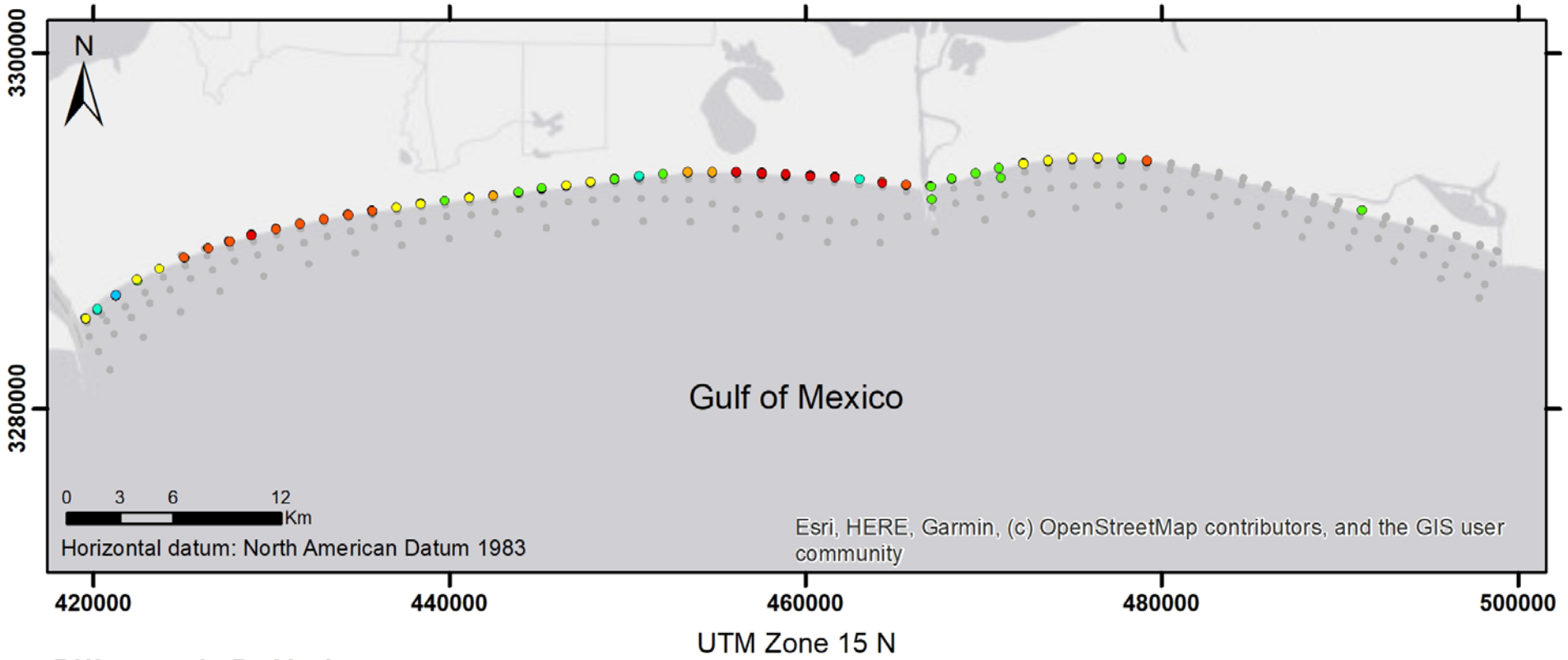
Barrier Island Comprehensive Monitoring (BICM) Program - Surficial Sediment: Western Chenier Region, D_{50} Value Change 2008 to 2015

Indicated by Particle Size Analysis



Difference in D_{50} Vaules

- no comparable point
- < -100 µm
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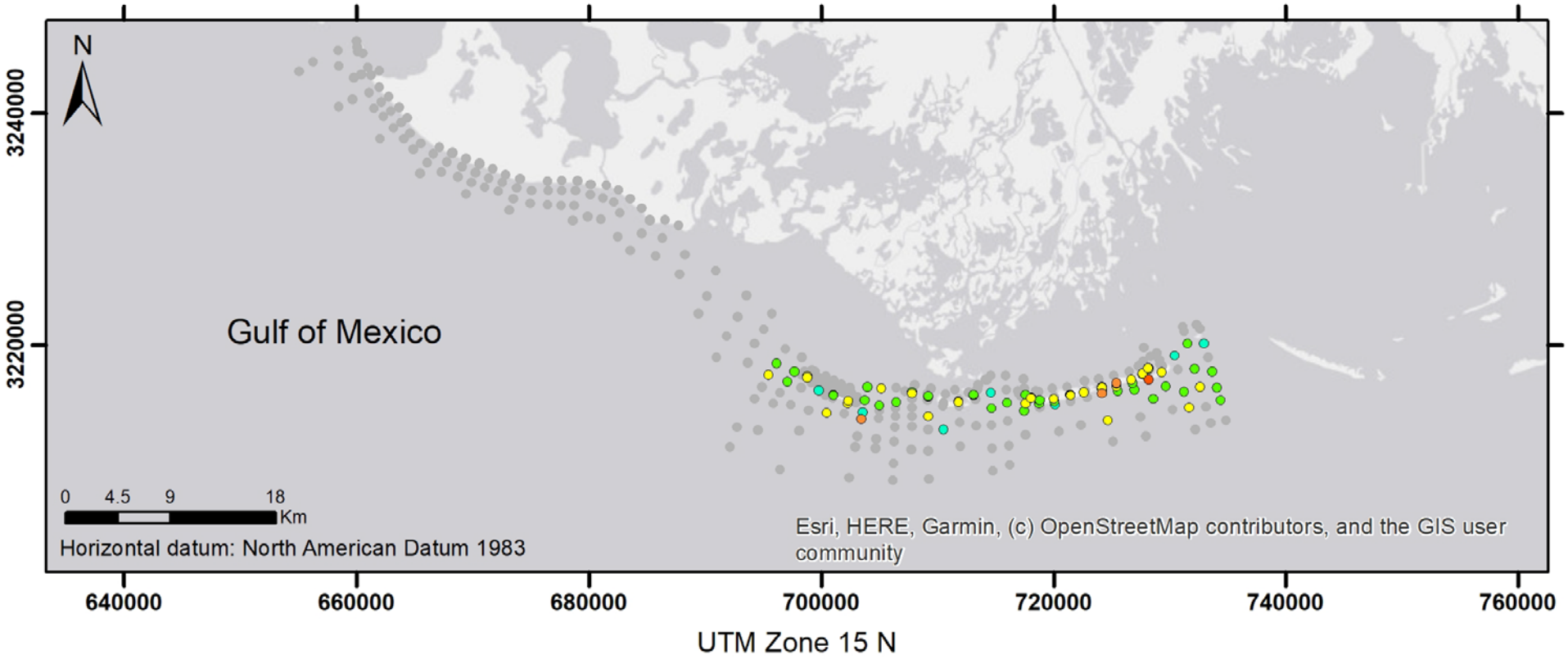
Barrier Island Comprehensive Monitoring (BICM) Program - Surficial Sediment: Early Lafourche Delta Region, Percent Sand Change 2008 to 2015

Indicated by Particle Size Analysis



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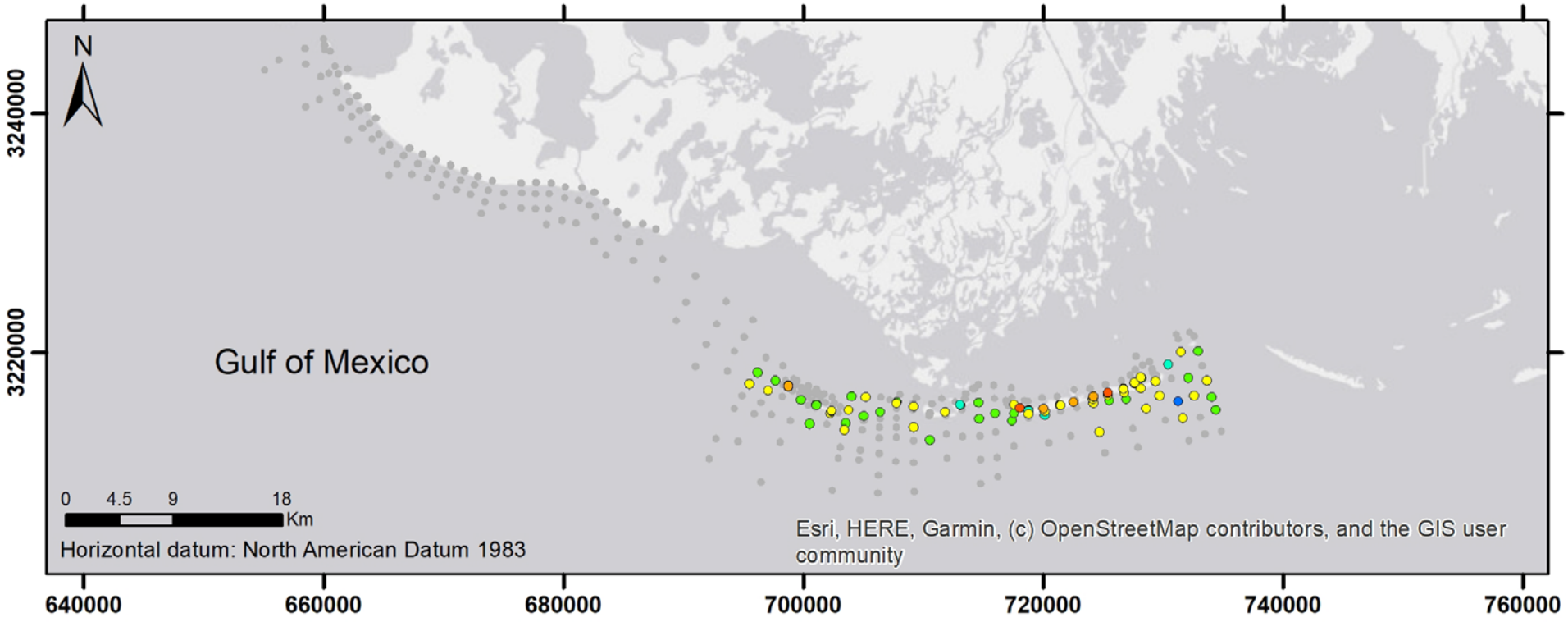

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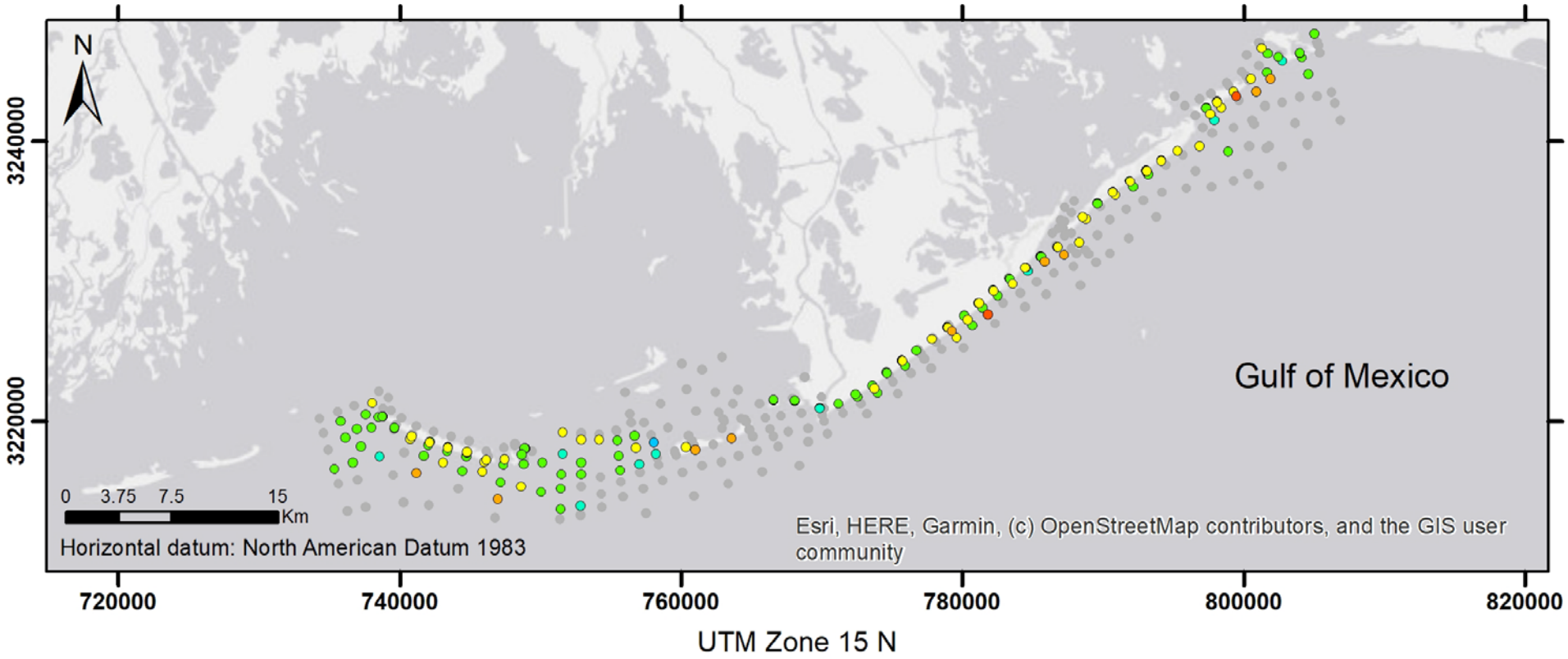
Barrier Island Comprehensive Monitoring (BICM) Program - Surficial Sediment: Late Lafourche Delta Region, Percent Sand Change 2008 to 2015

Indicated by Particle Size Analysis



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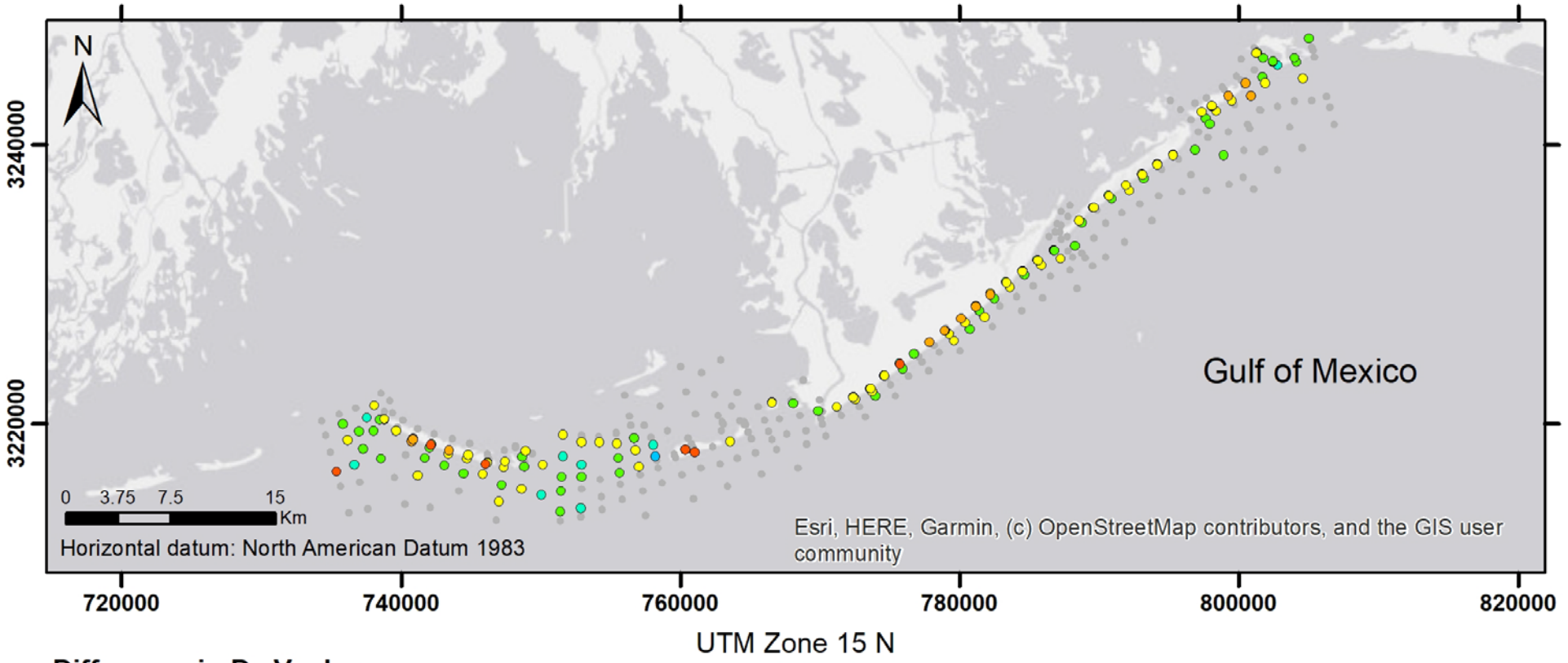

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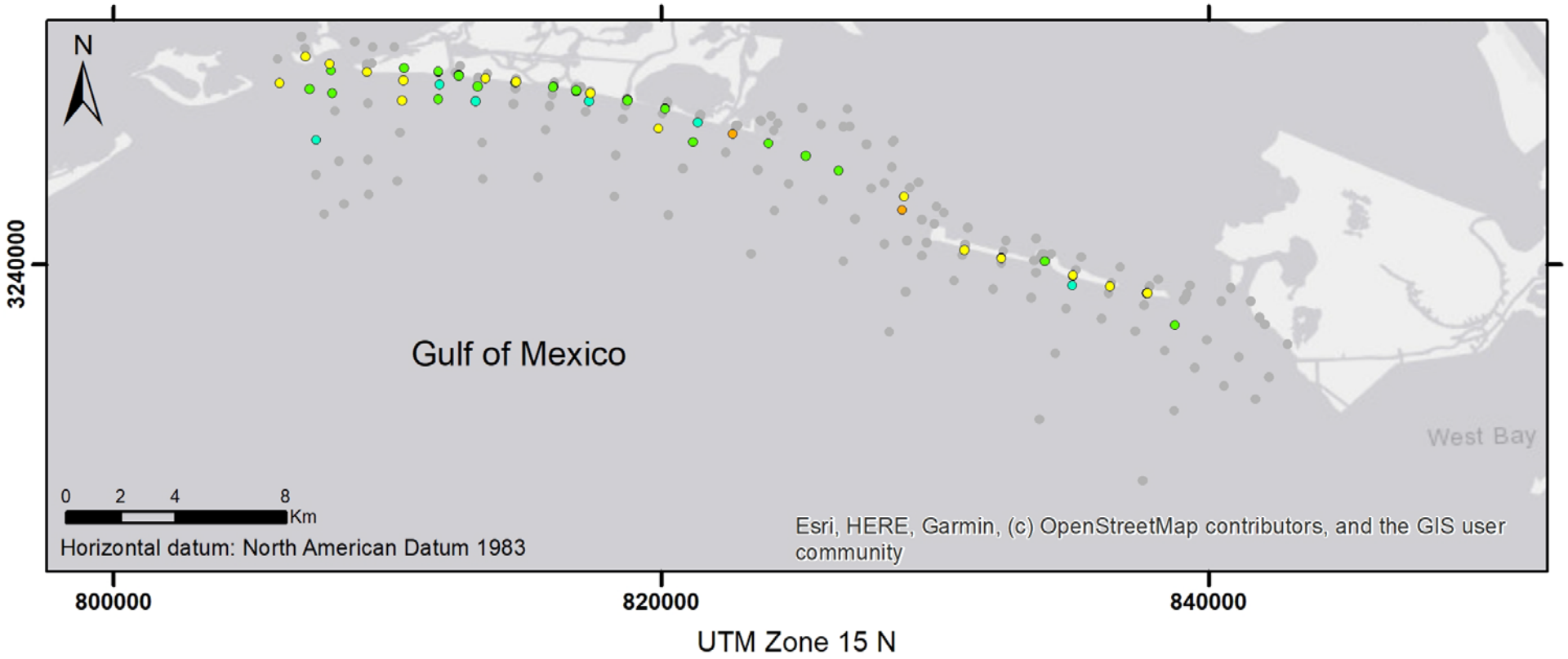
Barrier Island Comprehensive Monitoring (BICM) Program - Surficial Sediment: Modern Delta Region, Percent Sand Change 2008 to 2015

Indicated by Particle Size Analysis



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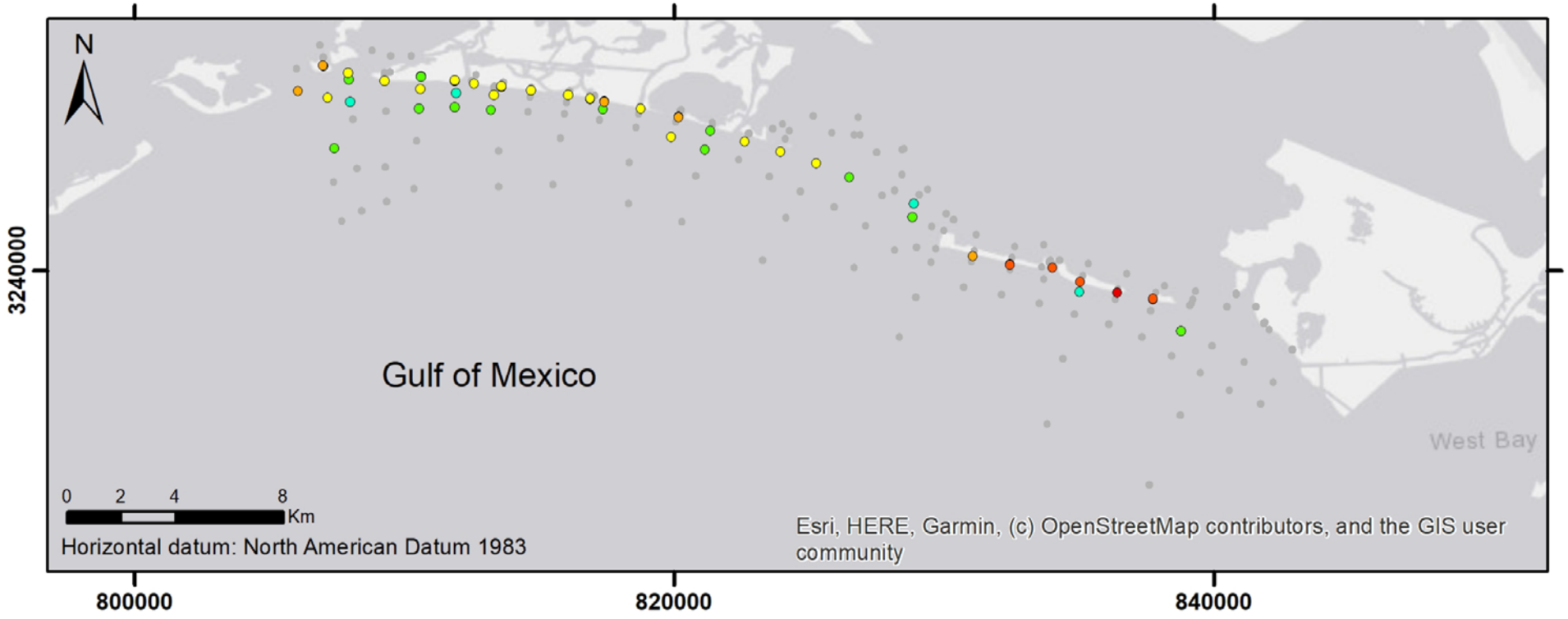
Indicated by Particle Size Analysis



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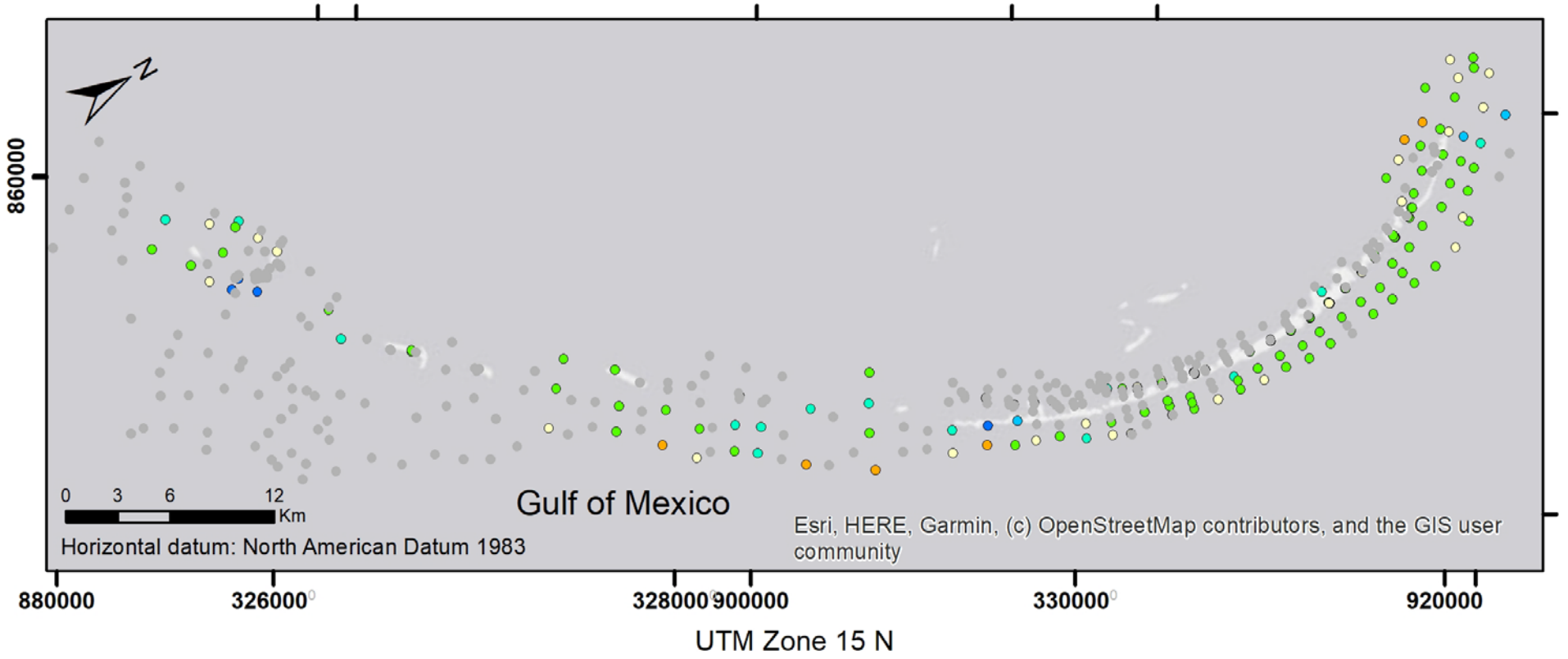
Barrier Island Comprehensive Monitoring (BICM) Program - Surficial Sediment: Chandeleur Region, Percent Sand Change 2008 to 2015

Indicated by Particle Size Analysis



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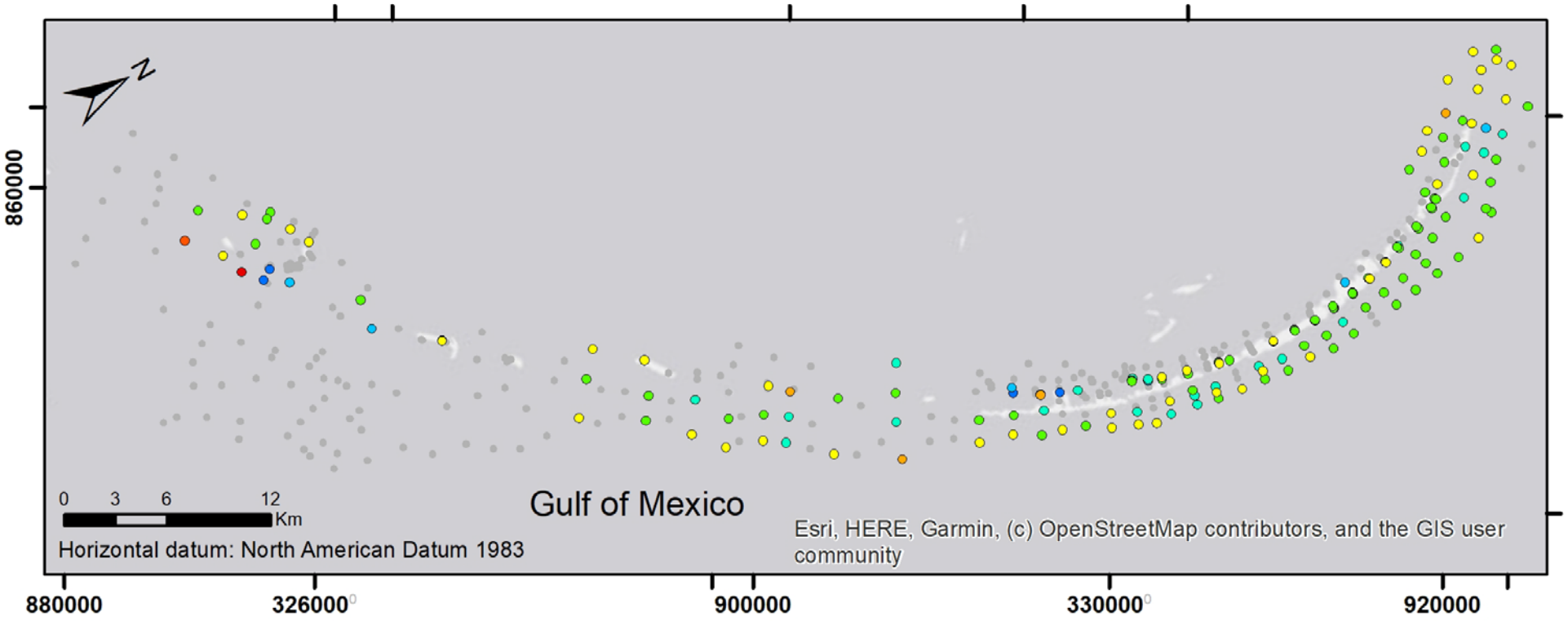

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