



SandSnap: A Pocket-Sized Beach Lab and Open Database

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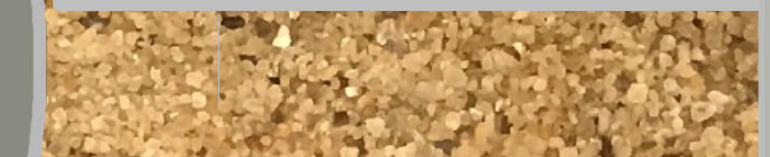
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ORISE Fellow



*FSBPA National Conference
6 February 2025*



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CHL

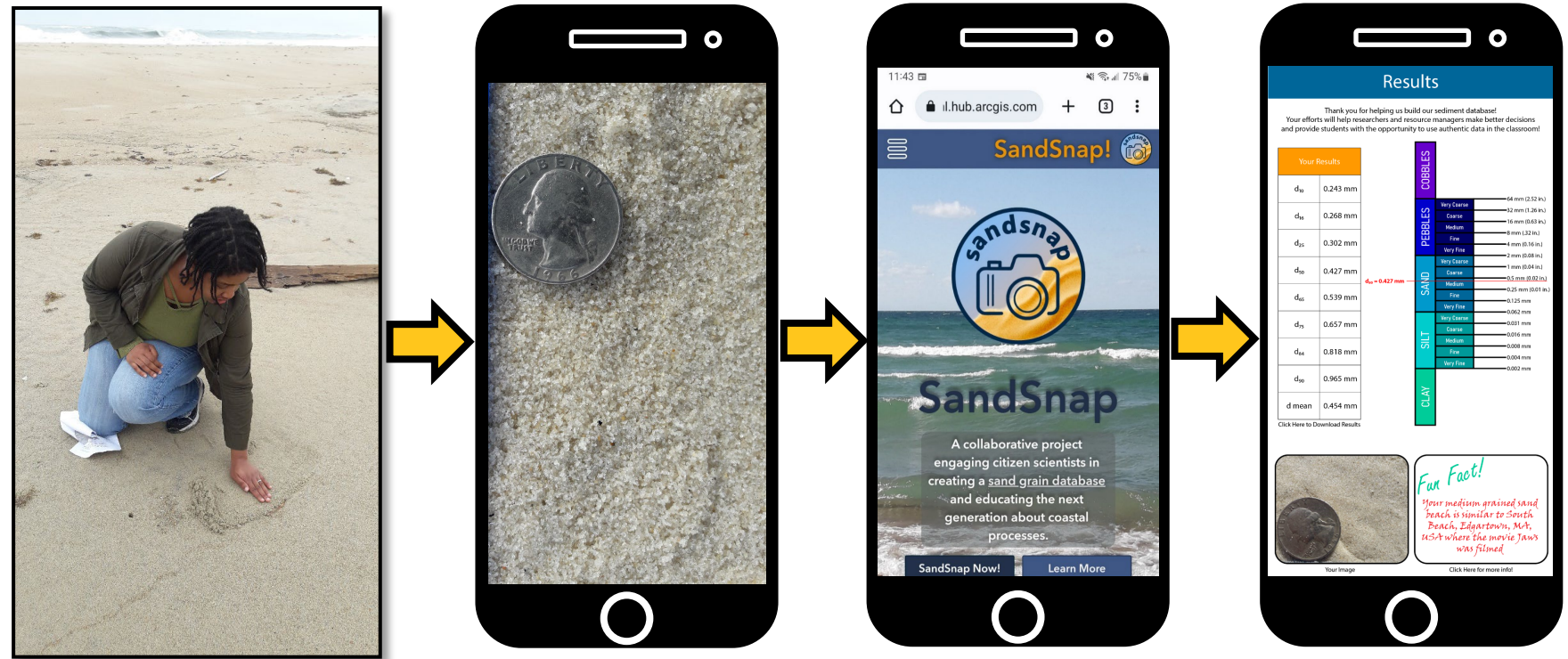
COASTAL &
HYDRAULICS
LABORATORY

What is SandSnap?

- Interactive web app.
- Citizen scientists collect beach sand images.
- App uploads to GovCloud.
- Processed with AI/ML algorithms.
- Measures grainsize distribution.
- Gamification incentivizes participation.

sandsnap-erdcchl.hub.arcgis.com

Scan Me!

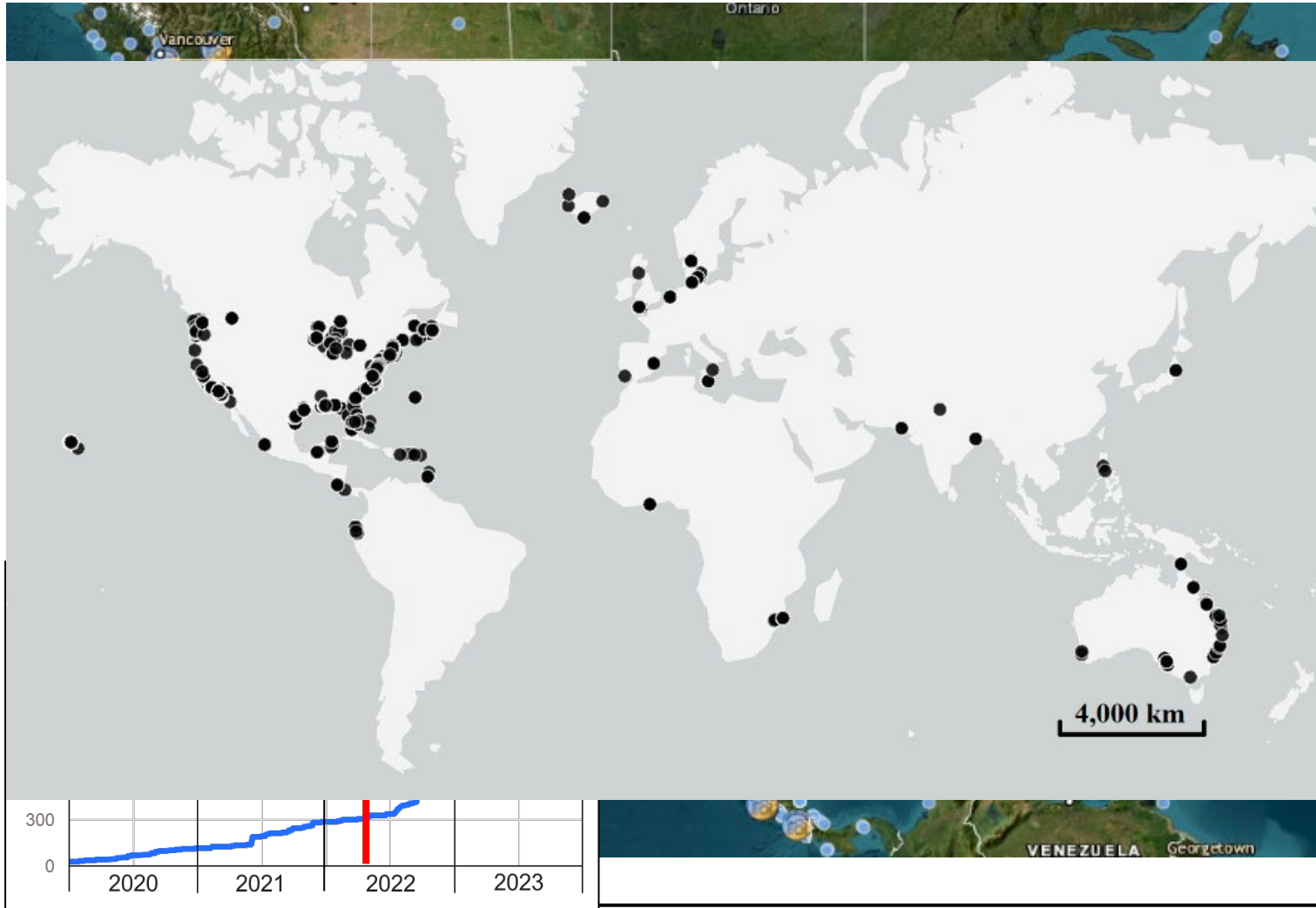


Why is SandSnap Important?

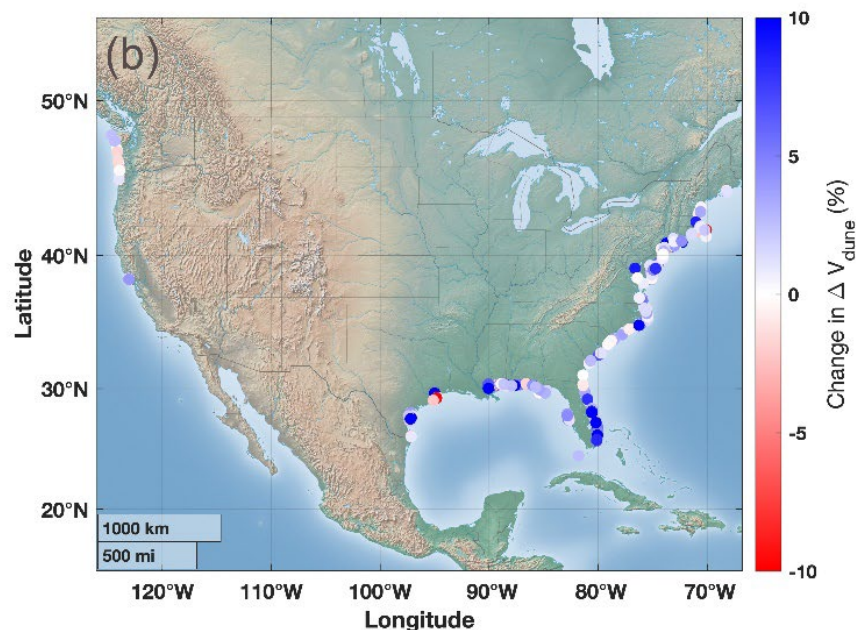
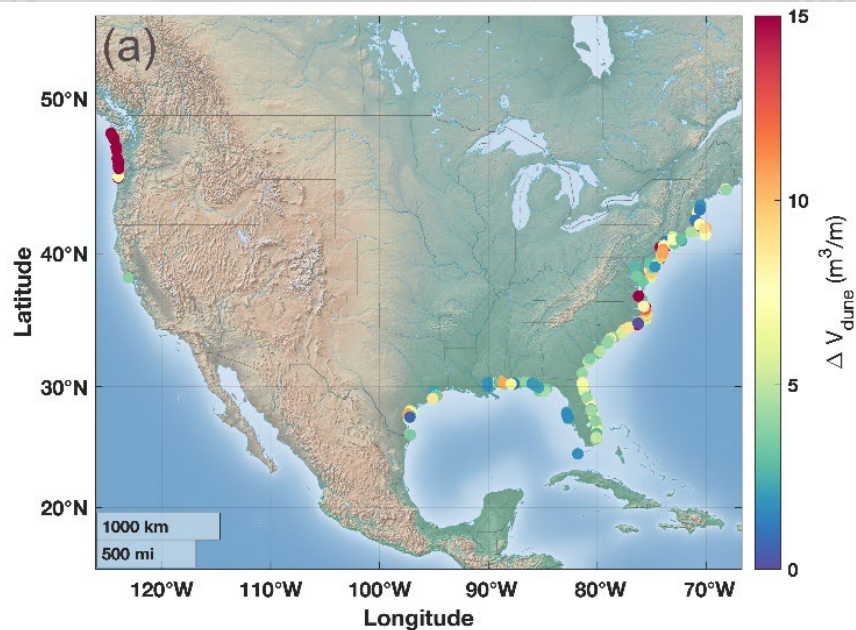
sandsnap



- **Build open beach grain size database.**
 - Doesn't currently exist.
 - Grainsize largest uncertainty source in morphology models.
- **Save money.**
 - Crowdsourcing sediment data collection saves \$500/sample -> estimated value creation of \$2M/year.



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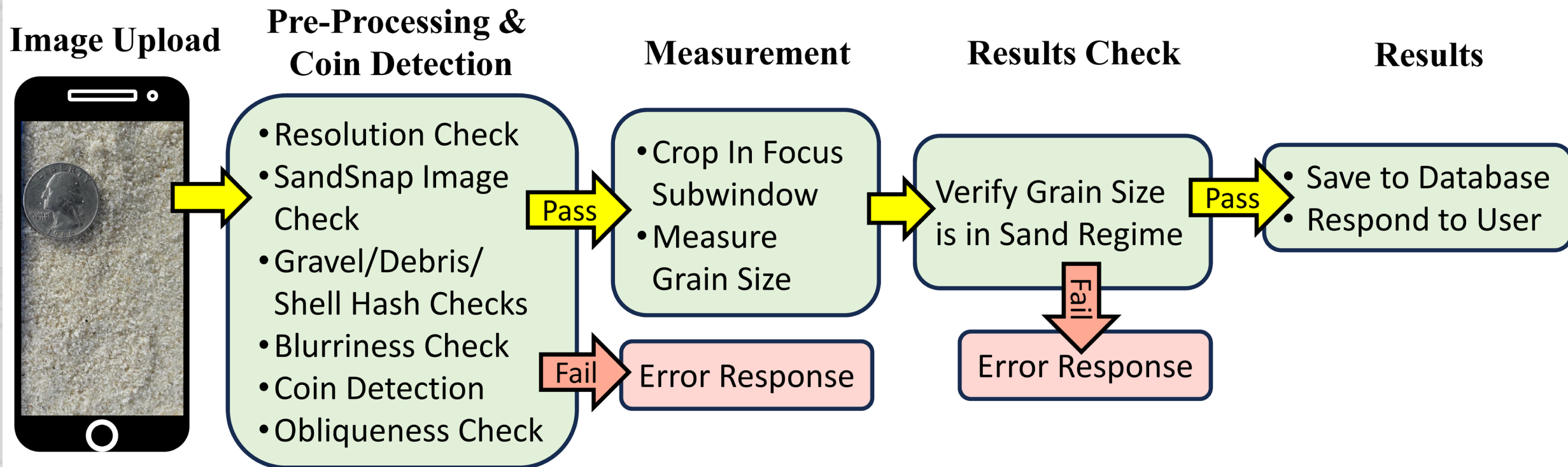
Applications



- **Beneficial Use of Dredged Sediment**
 - USACE dredges NAV channels
 - Many states have strict gradation requirements for beach nourishment
- **Wind-blown sediment transport modeling.**
 - AeoliS - Δ dune volume w/ d_{50} vs full gradation.
 - Pacific NW saw decrease in dune growth.
 - 8% sites had increase in dune growth > 10%
- **Coastal Resilience and Vulnerability Studies**
- **Project Scoping and Initial Feasibility Studies**



How Does SandSnap Work?



User Interface



SandSnap Now!

Your efforts will help researchers and resource managers make better decision and provide students with the opportunity to use authentic data in the classroom.



Learn More

To understand how and why coastlines change, we must know the grain size of the sand on the beach.



Explore Database

Our interactive dashboard provides a summary of data collected by our SandSnap Citizen Scientist contributors and computed grain size measurements.

SAND	Coarse	1 mm (0.04 in.)
	Medium	0.5 mm (0.02 in.)
	Fine	0.25 mm (0.01 in.)
	Very Fine	0.125 mm
	Very Coarse	0.062 mm
SILT	Coarse	0.031 mm
	Medium	0.016 mm
	Fine	0.008 mm

Get the Data

All of our data is accessible to the public and available for download in CSV, JSON, or Shapefiles and through a Feature Map Service.

[View Recent Submissions](#)

■ Survey123 (ESRI)

- Geo-tagging.
- Mapping.
- Data export.
- Submission form.
 - ▶ Location (tries to use phone GPS).
 - ▶ Beach Name.
 - ▶ Town (tries to auto-populate).
 - ▶ State (tries to auto-populate).
 - ▶ Country (tries to auto-populate).
 - ▶ Coin type (nickel, penny, etc.).
 - ▶ Beach location (berm, swash, etc.).

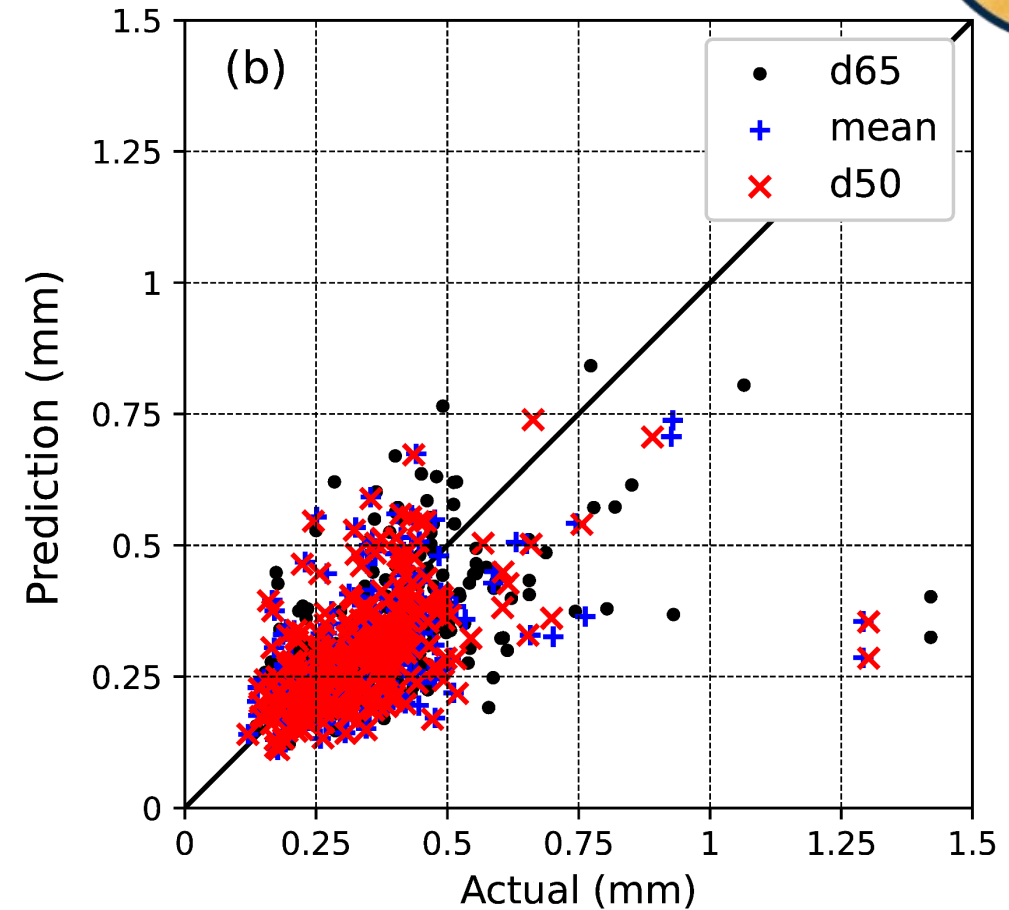
- Image Upload.

■ Databricks Backend

Gradation Accuracy



- 263 Test Images
- 113 Different Sites
- Ranging:
 - Sedimentology
 - Phone Cameras
 - Users
- d_{50} Results:
 - Bias: -0.045 mm
 - Mean Percent Error: -7.2%
 - Median Abs Percent Error: 22.4%



Location Accuracy



- Duck, NC
- USACE and Locals on the Beach
- 25 Submissions
- Submission point surveyed with RTK GPS
- Average Error of 12.7 m
- All selected the cross-shore morphological position

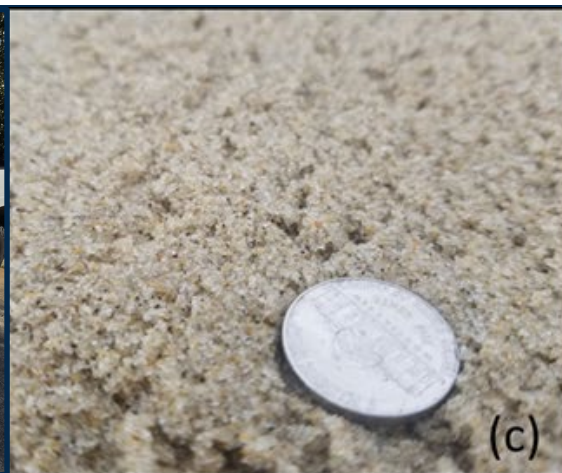




Common Issues



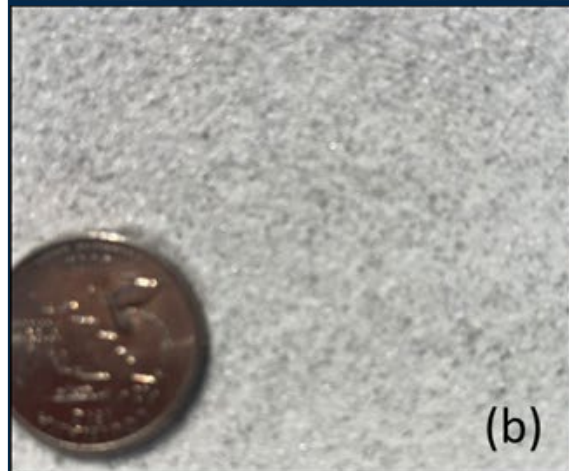
(a)



(c)



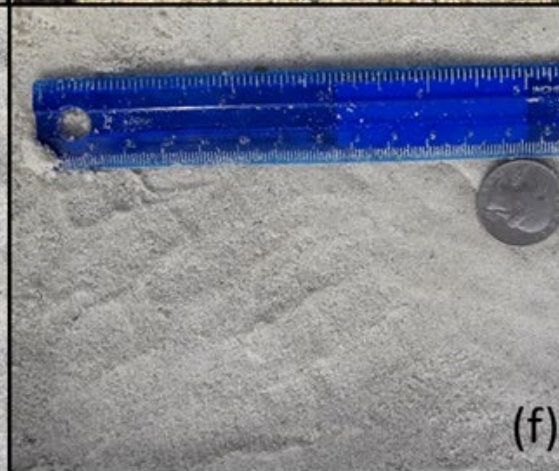
(e)



(b)



(d)



(f)



Database



SandSnap! US Army Corps of Engineers

Data Viewer Maximize Table Field Descriptions Export Instructions

SandSnaps Additional Images

Gulf Shores AL : 0001

Thisted unknown: 0002

Wassenaar ZH Cape Blanco North Beach: 0003

Wassenaar ZH Cape Blanco South Beach: 0004

Wassenaar ZH Mullet Bay: 0005

Wassenaar ZH Bay Rouge: 0006

Map showing sample locations across North America, Europe, and Africa.

SandSnaps! Additional Images

Search

SandSnapID	City	State	Country	Calculated Grain S...	Sample ID
S1	Patillas	PR	Puerto Rico	Fine Sand	PR001
S2	Loiza	PR	Puerto Rico	Medium Sand	PR002
S3	Long Branch	NJ	United States	Medium Sand	LB06192020SWASH

Total: 2,370 | Selection: 0

Full Gradation
($d_{10}-d_{90}$)

Database Stats

Successful SandSnaps: 2,374

USA SandSnaps: 1,758

Errors: 20%

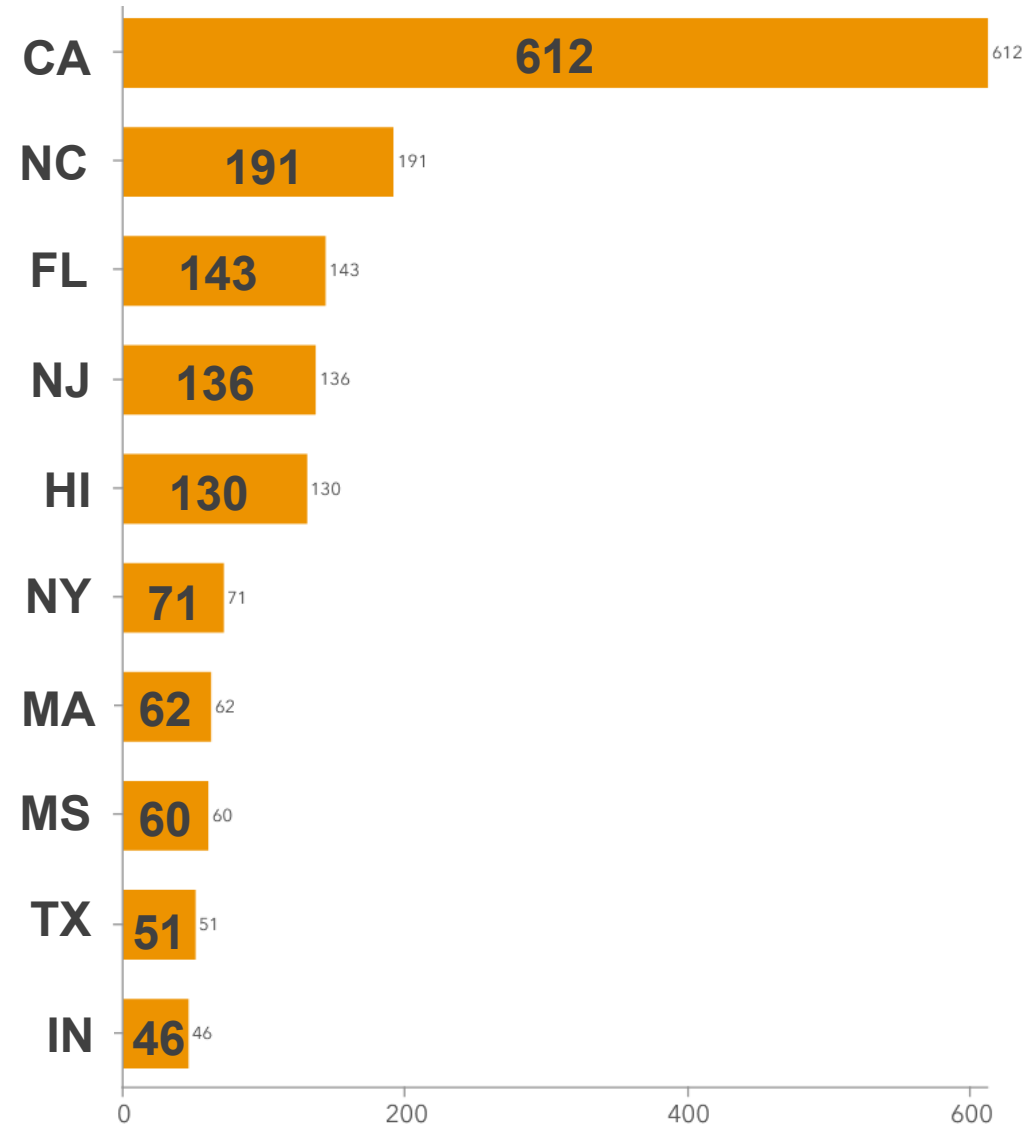
of States: 32

of Countries: 53

(Feb. 3, 2025)

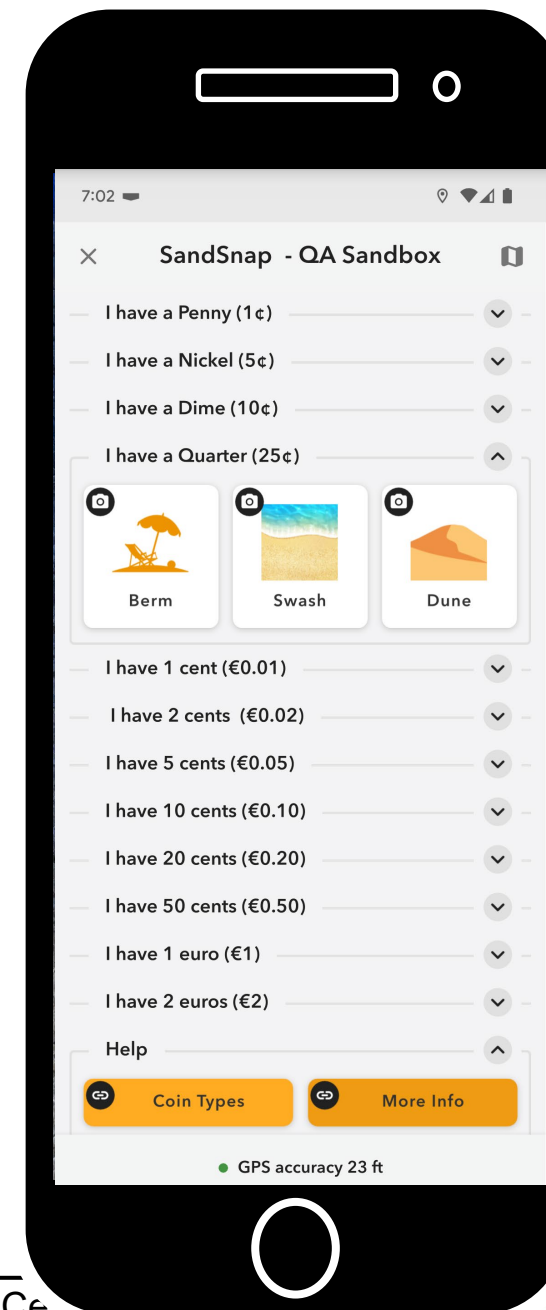


Top 10 States



Coming Soon

- **Additional Currency Types**
 - **Euros**
 - **Canadian**
 - **Mexican Pesos**
 - **Other**
- **Phone App**
 - **Testing “Quick Capture” App**
 - **Very useful if there’s no service**
- **Bulk Upload of Images**
- **Bulk Download of Images**



More Coming Soon

Technical Investigations:

- **Mixed Sediment Beaches**
 - Sand + Gravel, Sand + Shell Hash, Pebbles, Shell Hash
 - Meta's Segment-Anything (Version 2)
- **Sediment Shape**

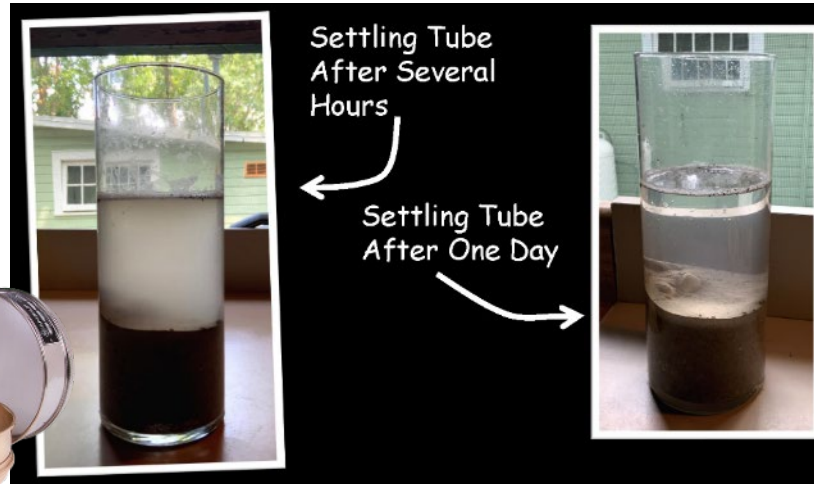


Outreach Efforts – K-12



Initiatives:

- Library “Discovery Bags”
- In-person event activities
- Class lesson plans
- Science Fair Projects



STEM Activities:

- “Sorting It Out” – Sieve & Sand Castle
- “That Settles It” – Settling Tube
- “Digging In Deeper” – Petri Dish & Hand Lens
- “It’s a Snap” – SandSnap

Summary

- SandSnap is Continually Improving
- Class Lesson Plans & Science Fair Projects are Ready
- The Database is Growing But **WE NEED YOU!**



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