Validating Operational Flood Forecast Models of King Tides via Citizen Science

CATCH THE KING

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City of Newport News

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City of Virginia Beach, VA

Foreground: 2 years of water levels at NOAA's Sewells Point sensor; denotes SLR App mapping events
Background: Drone video captured by Drs. Thomas Alberts and Tom Allen, Old Dominion University

ESRI BLOG

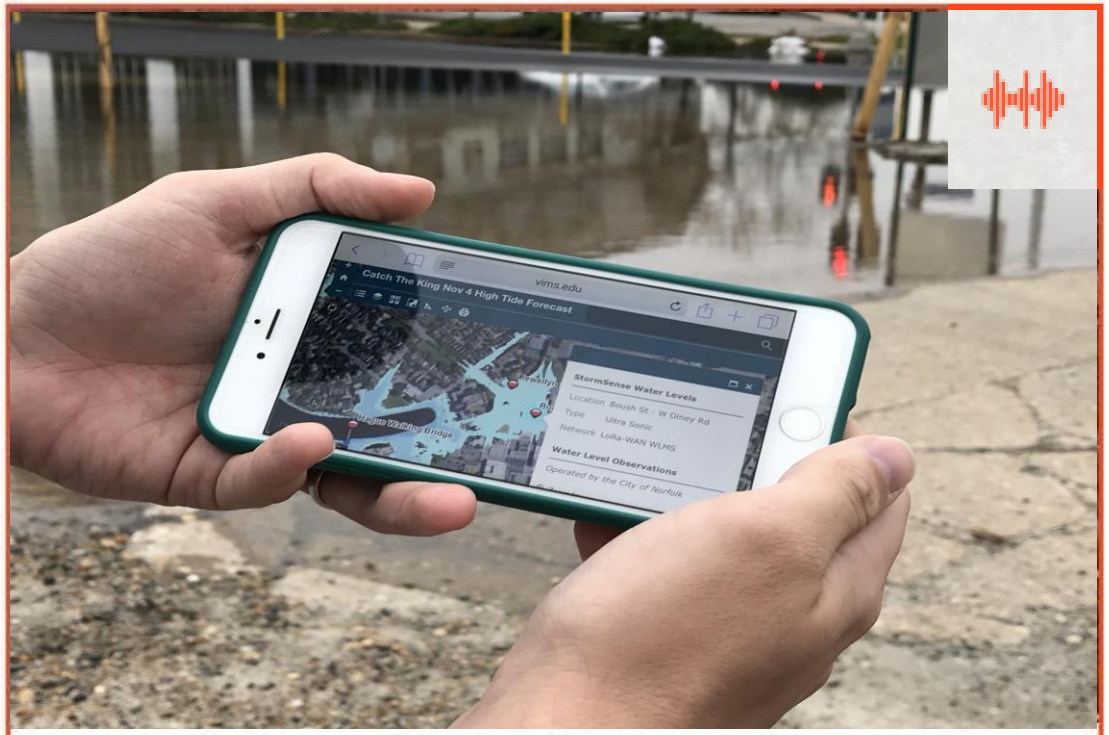
Reporters, Scientists, and Citizens Team to Map Virginia's Highest Tide

Journalists sponsored the 'Catch the King' crowdsourcing event that rallied citizens to capture sea level rise data using an app on their phones.

Mapping

December 13, 2017

Dawn Wright



SEGMENT | 33:58

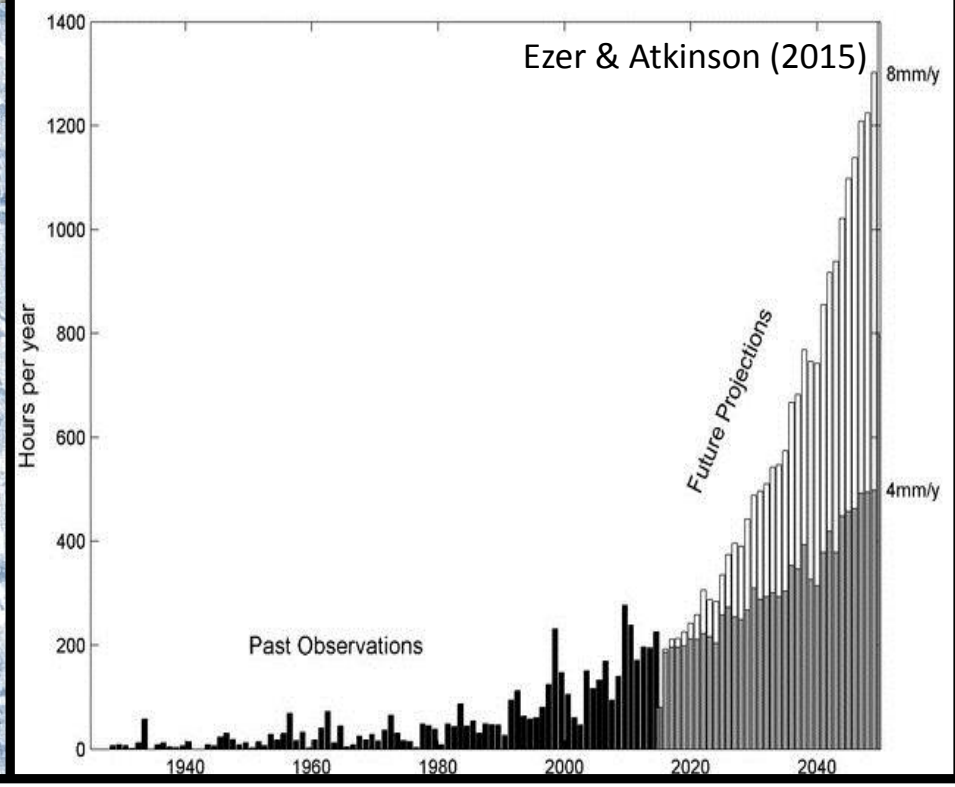
Embracing The Salt And Adapting To Sea Level Rise

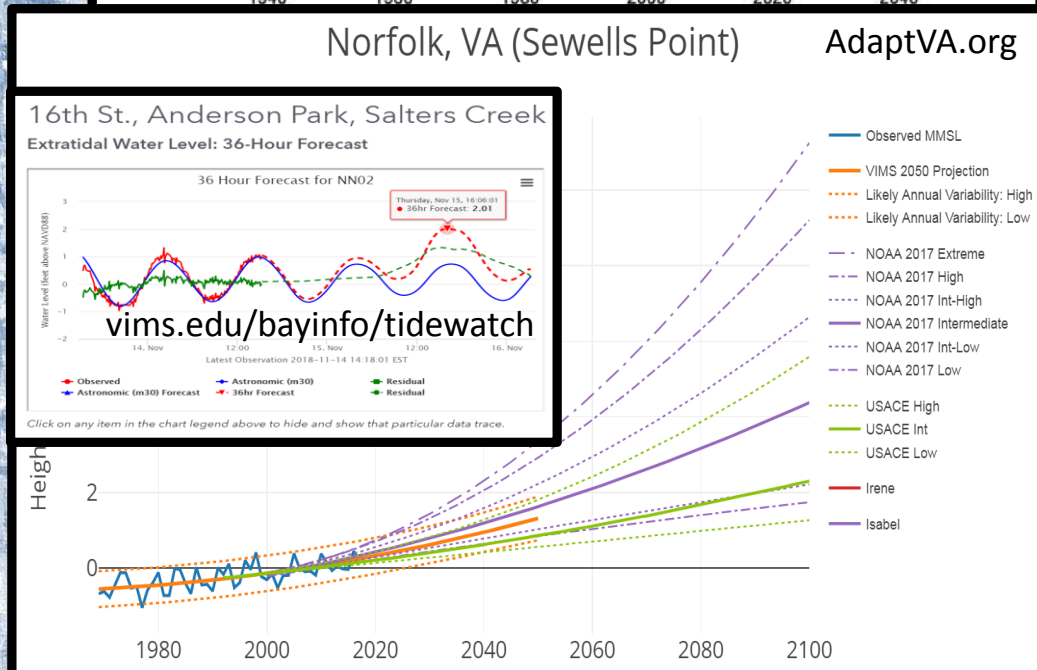
Saltwater intrusion and sea level rise is the new normal for two communities along the east coast.

SCIENCE FRIDAY

Outline

1. The Anatomy of Flood Monitoring
   - A. Volunteers, Teachers, and Tide Captains
   - B. To Our Enthusiastic Media Partners
   - C. School Groups and Student Projects
   - D. Modeling Researchers
   - E. To the App Developers
2. Data Review
   - A. App Data and Model Comparison
   - B. What We Learned
   - C. Conclusions





Catch the King Tide 2018

Thank You & Review

1. Thank You To:
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Thanks to Our Many Volunteers:

- We were able to validate and improve flood prediction models
- 42 unique volunteer training events around Hampton Roads resulted in:
  - 347 people on Sat., Oct. 27 caught 33,847 GPS max. flood extents & 1,126 chrono-geotagged pictures
  - 141 people on Fri. Oct. 26 caught 3,881 GPS max. flood extents & 136 chrono-geotagged pictures

Catch the King — 10/27/2018 Rank By # of Volunteers

Final Statistics based upon Participation by Locality via the Sea Level Rise App (as of 11/01/2018)

#	Final Stats for 10/27	GPS Points	Volunteers
1	Norfolk	13078	121
2	VA Beach	8893	79
3	Hampton	2959	30
4	Gloucester / Mathews	2101	24
5	York / Poquoson	2428	21
6	Chesapeake	1241	20
7	James City / Williamsburg	1914	16
8	Newport News	531	12
9	Portsmouth	306	11
10	Outside HR	265	9
11	Suffolk	131	4
	TOTAL	**33847**	**347**

Background Drone Imagery of Norfolk's Hague on Oct. 27, 2018 courtesy of Dr. Thomas Alberts, ODU

Thanks to Our Volunteers

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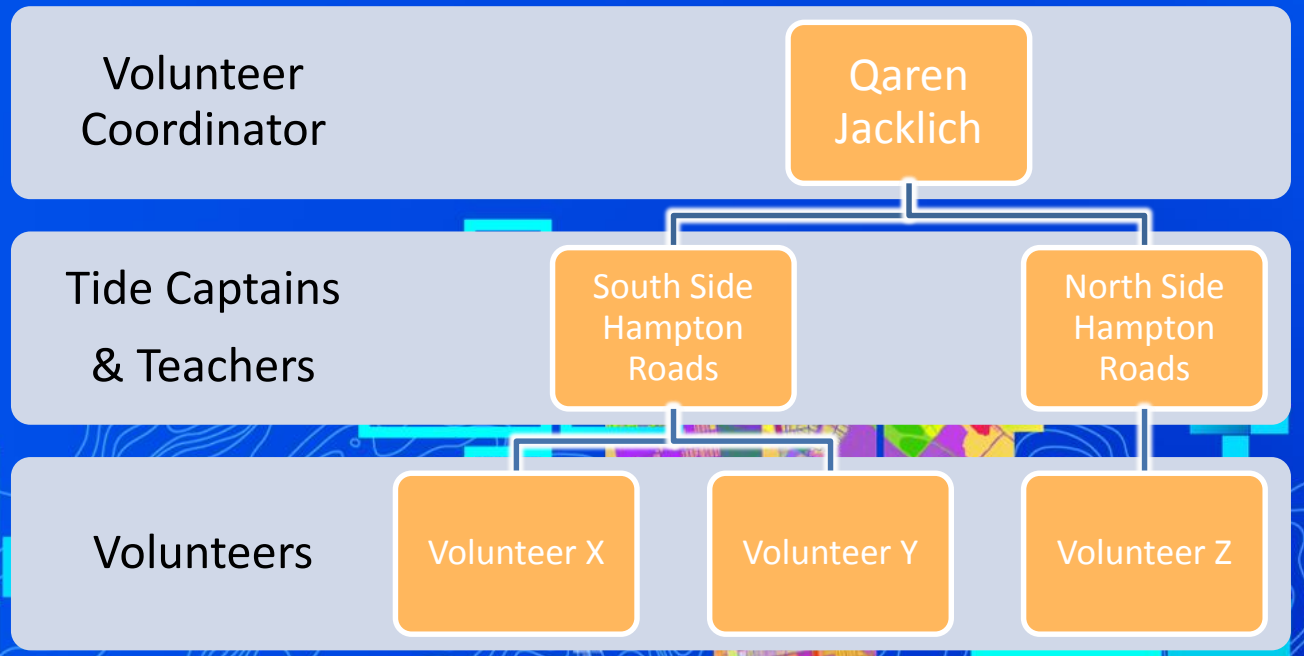
Thanks to You and Your Perseverance!

The sheer number of volunteers involved in this effort made organization tough:



Thanks to Media Partners

Thank You & Review

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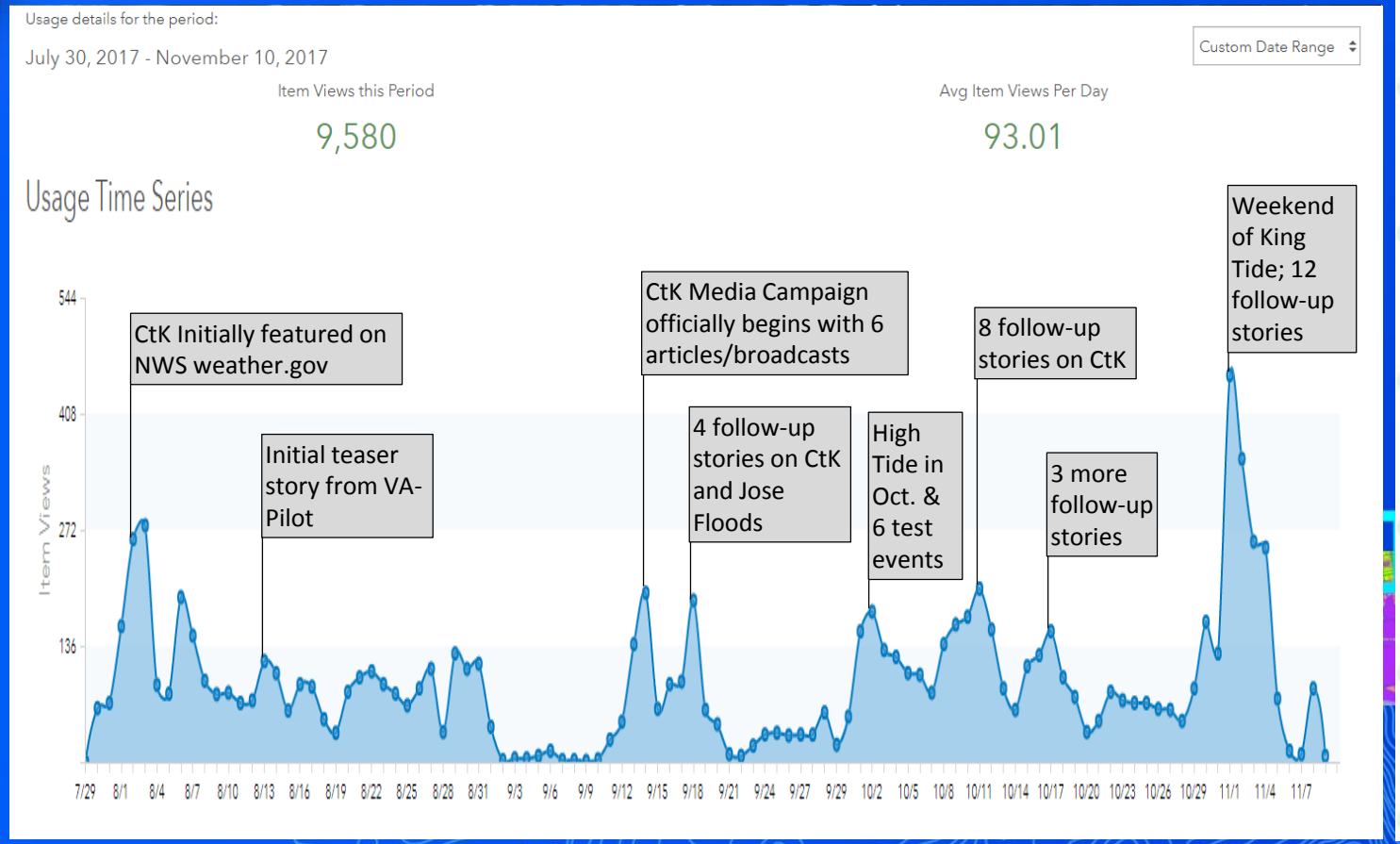
- Embedded and linked to volunteer recruitment forms, App download, and interactive story map:



Thanks to Participating Schools

Thank You & Review

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- WHRO helped get 116 elementary, middle, and high school classrooms to choose Catch the King as their science class project.
- The event touches on 6 major SOLs, including physics, trigonometry, chemistry, and water quality.

Thanks to Flood Forecasters

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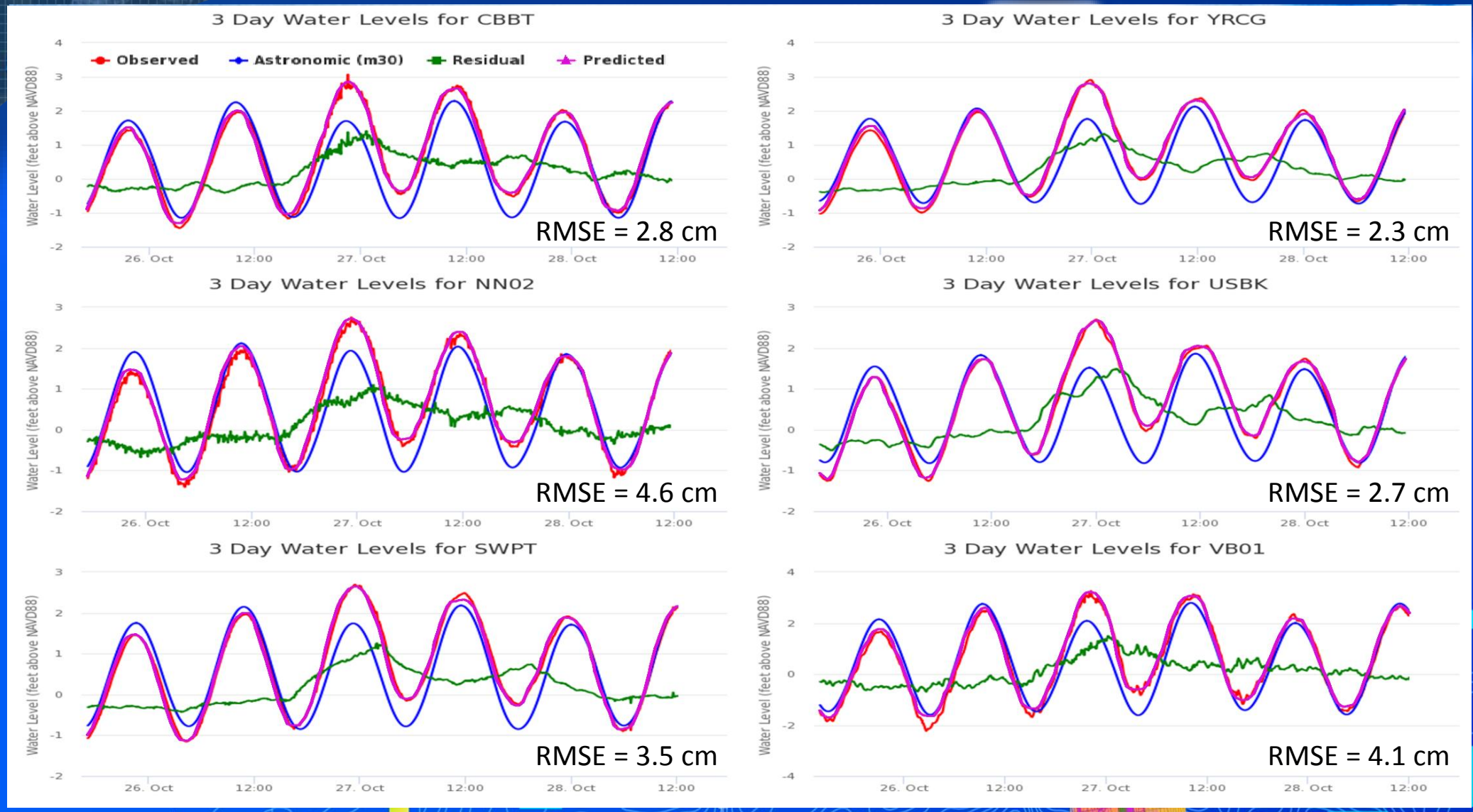
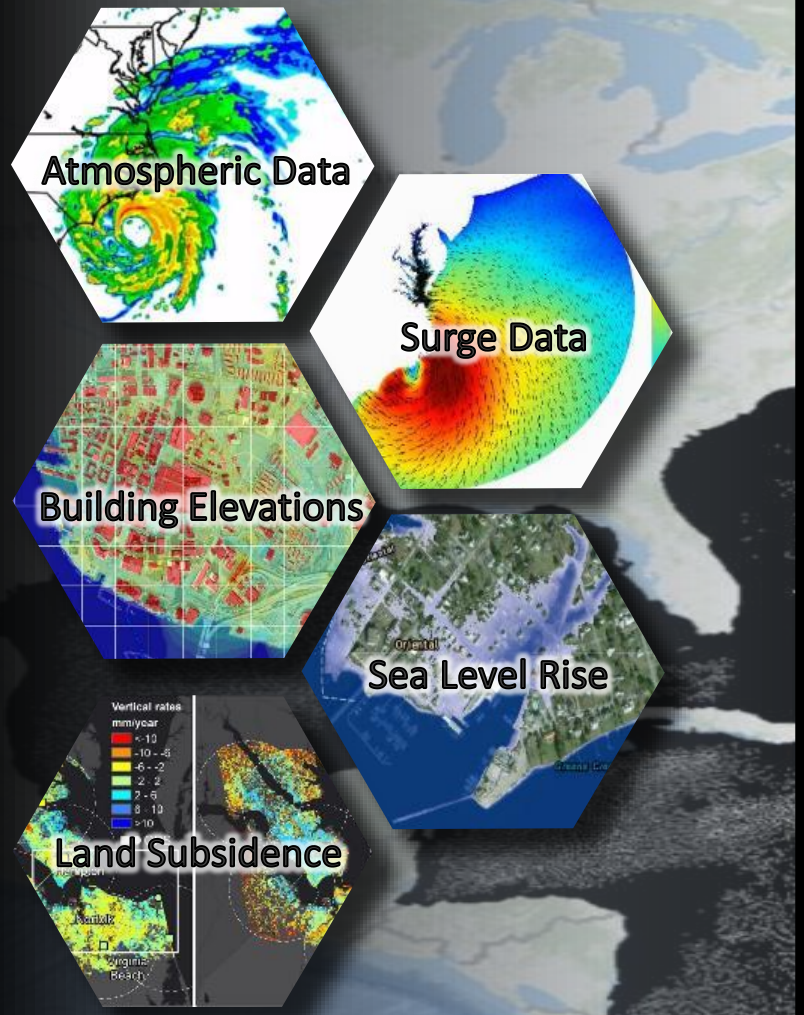


VIMS SCHISM Storm Tide Forecasts translated to the Street Level



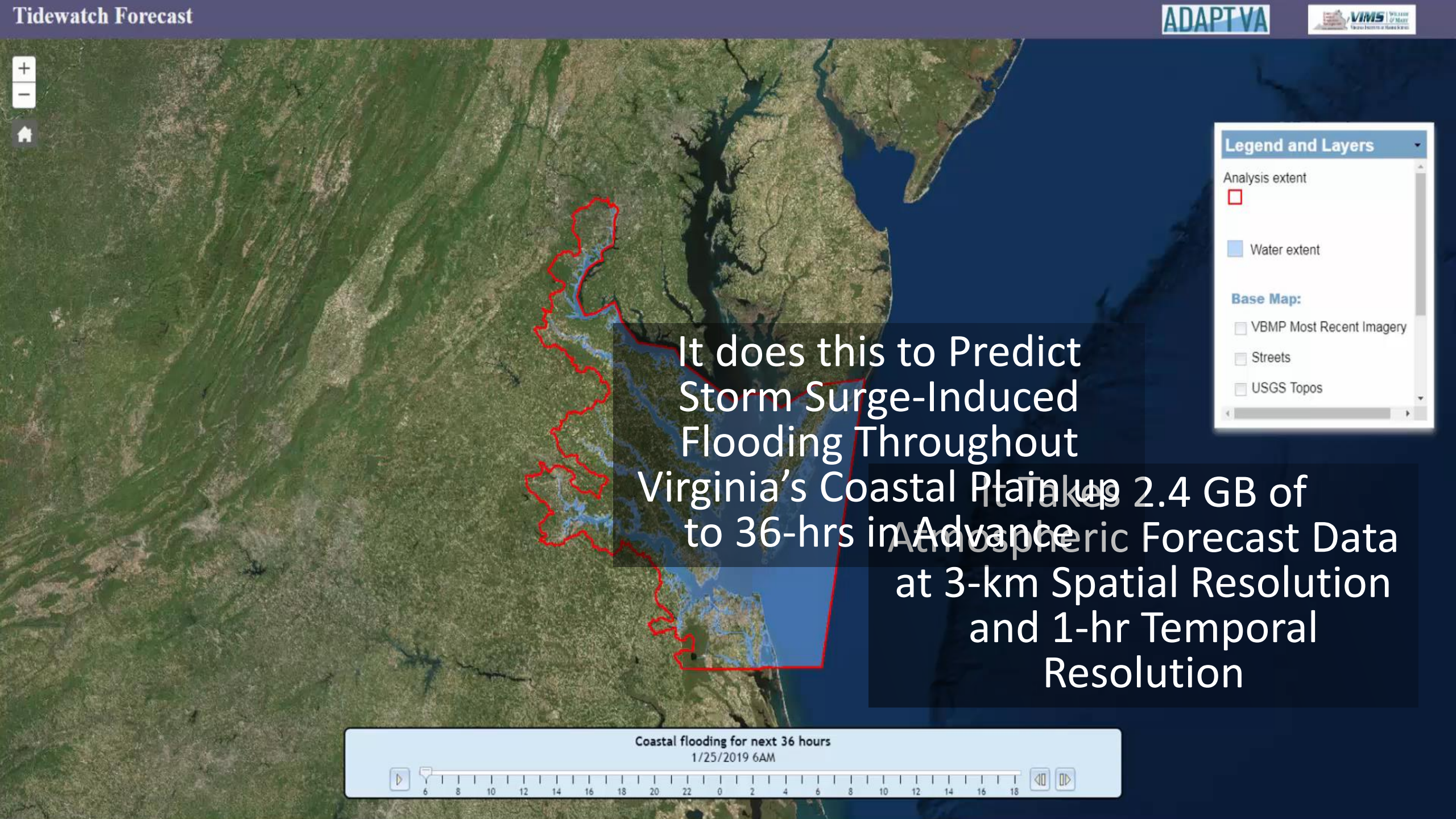
ARCUSER

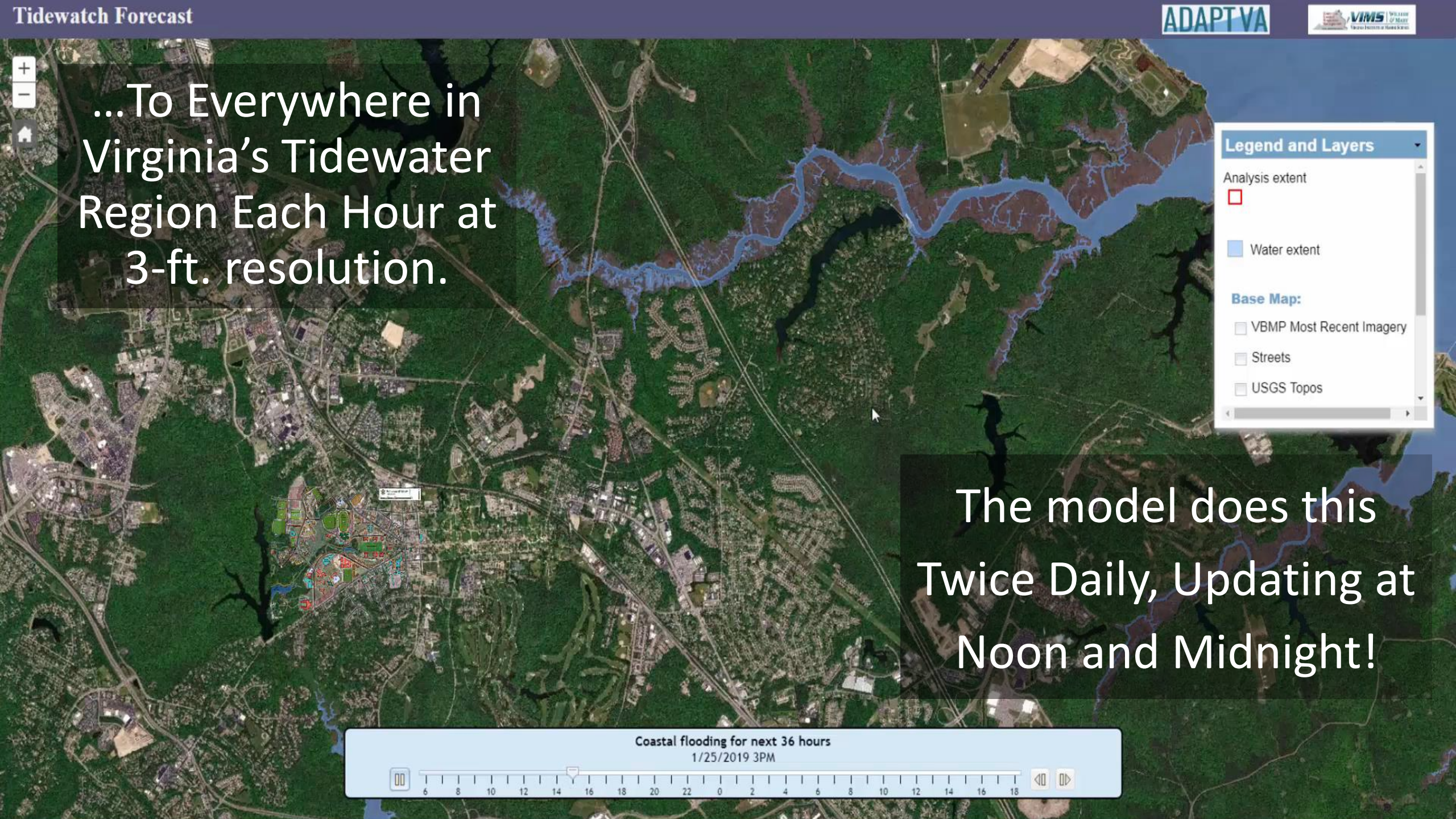
Leveraging Web 3D for Street-Level Flood Forecasts

FOCUS
Fall 2018

JDL GT
Jon Derek Loftis, Geoff Taylor

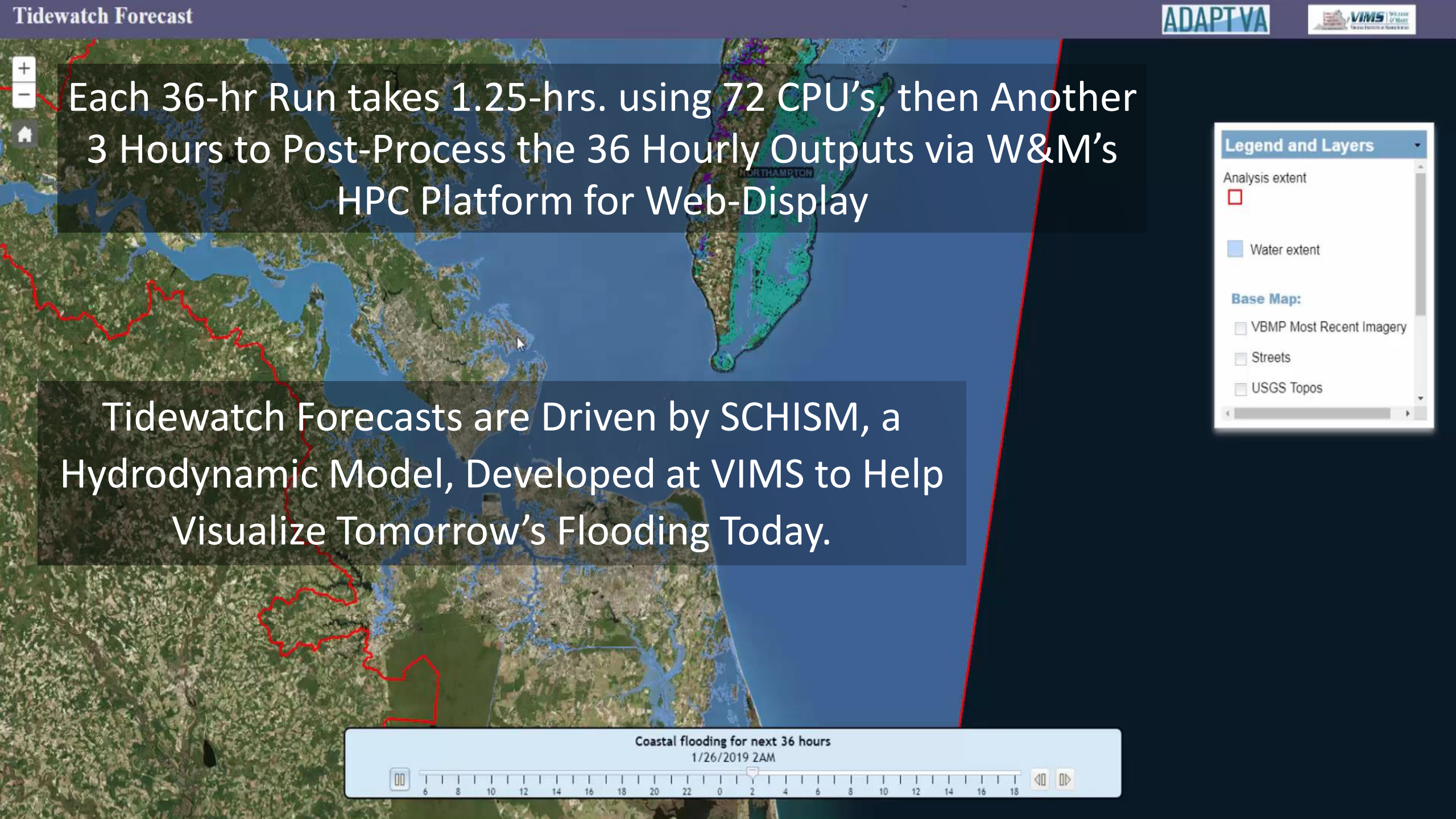
Download article
PDF 399 KB


Tidewatch Forecast
ADAPTVA
VIMS
Legend and Layers
Analysis extent
Water extent
Base Map:
VBMP Most Recent Imagery
Streets
USGS Topos
It does this to Predict Storm Surge-Induced Flooding Throughout Virginia's Coastal Plain up to 36-hrs in Advance
It Takes 2.4 GB of Atmospheric Forecast Data at 3-km Spatial Resolution and 1-hr Temporal Resolution
Coastal flooding for next 36 hours
1/25/2019 6AM
6 8 10 12 14 16 18 20 22 0 2 4 6 8 10 12 14 16 18


Tidewatch Forecast
ADAPTVA
VIMS
…To Everywhere in Virginia's Tidewater Region Each Hour at 3-ft. resolution.
Legend and Layers
Analysis extent
Water extent
Base Map:
VBMP Most Recent Imagery
Streets
USGS Topos
The model does this Twice Daily, Updating at Noon and Midnight!
Coastal flooding for next 36 hours
1/25/2019 3PM
6 8 10 12 14 16 18 20 22 0 2 4 6 8 10 12 14 16 18

Each 36-hr Run takes 1.25-hrs. using 72 CPU's, then Another 3 Hours to Post-Process the 36 Hourly Outputs via W&M's HPC Platform for Web-Display

Tidewatch Forecasts are Driven by SCHISM, a Hydrodynamic Model, Developed at VIMS to Help Visualize Tomorrow's Flooding Today.



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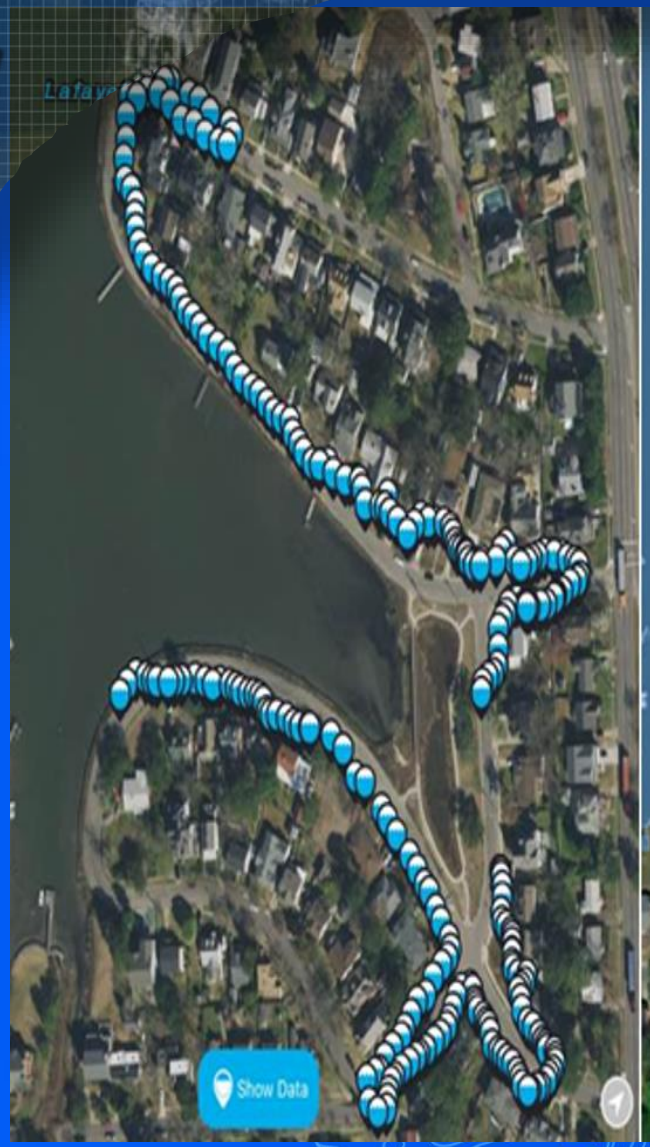

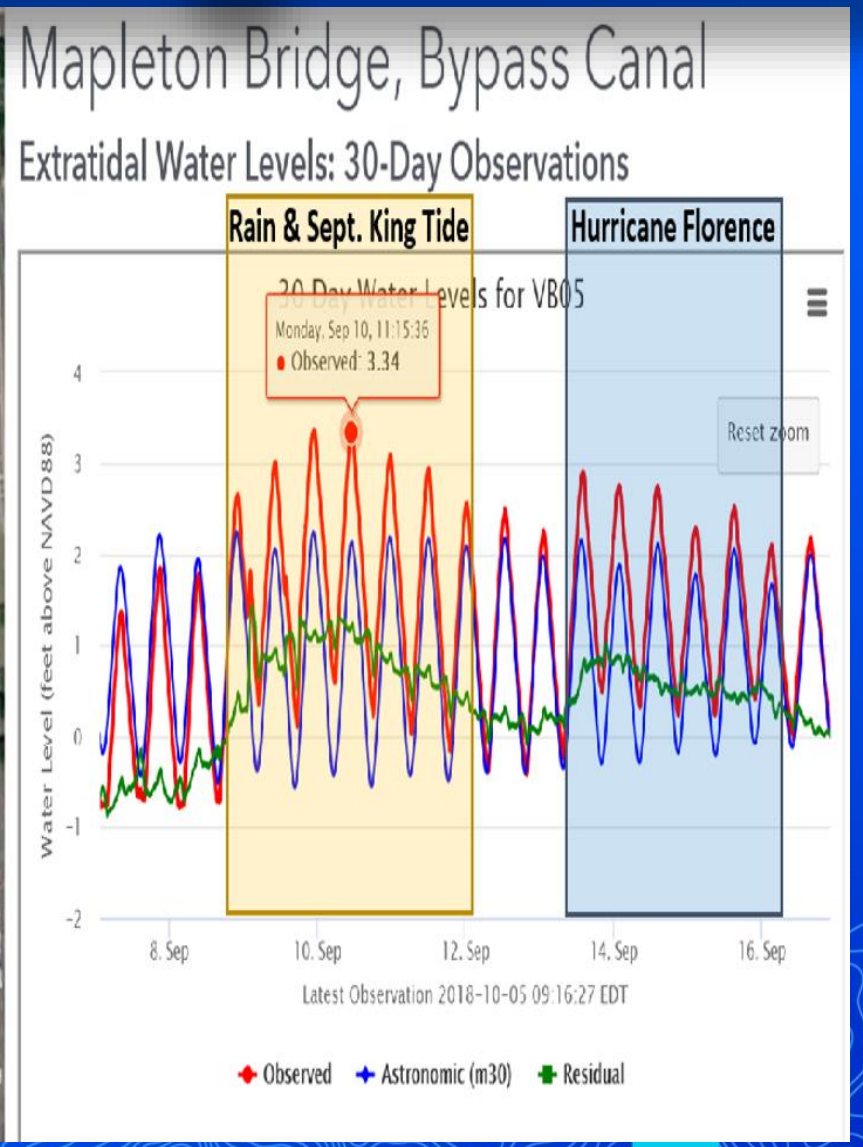

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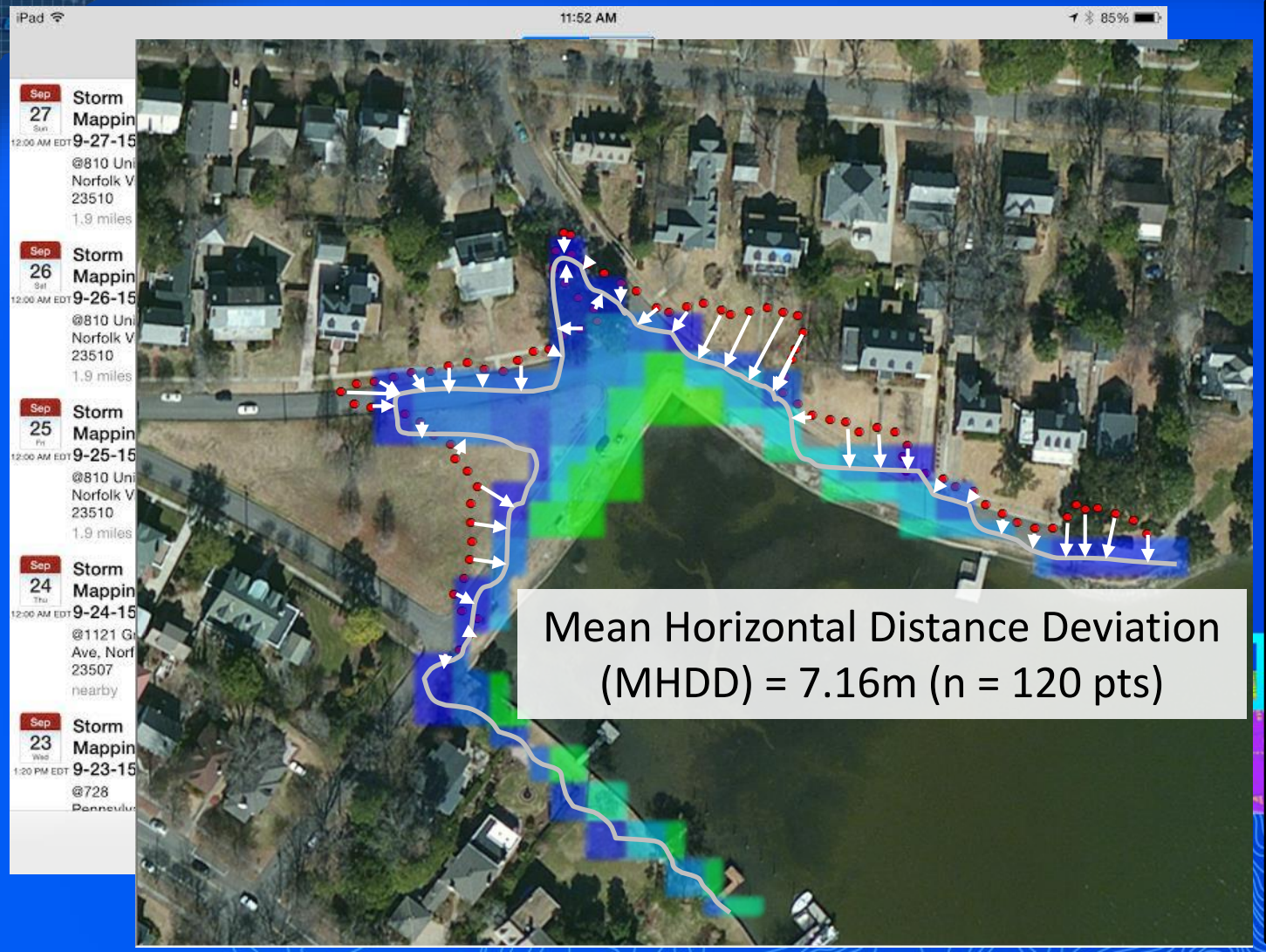

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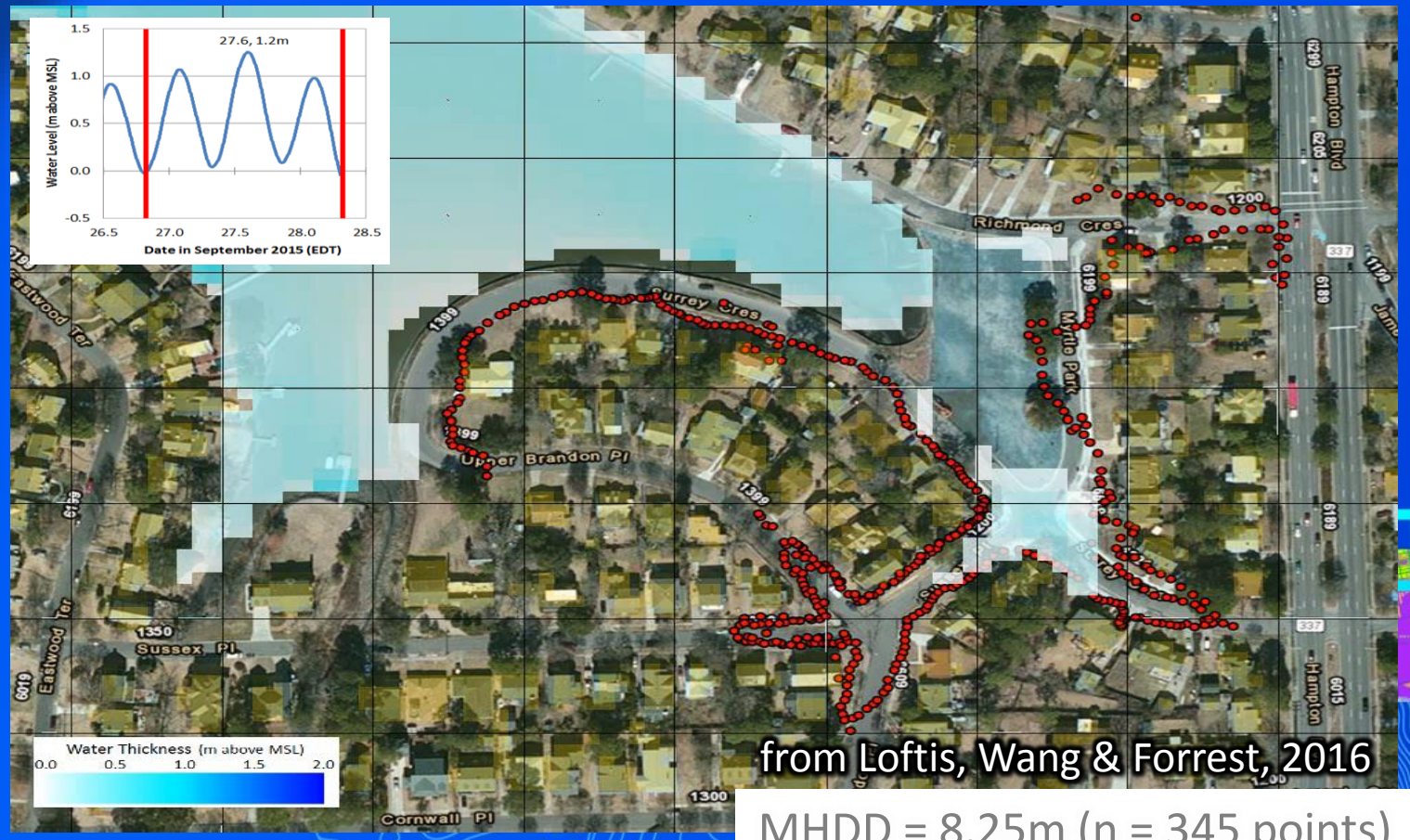
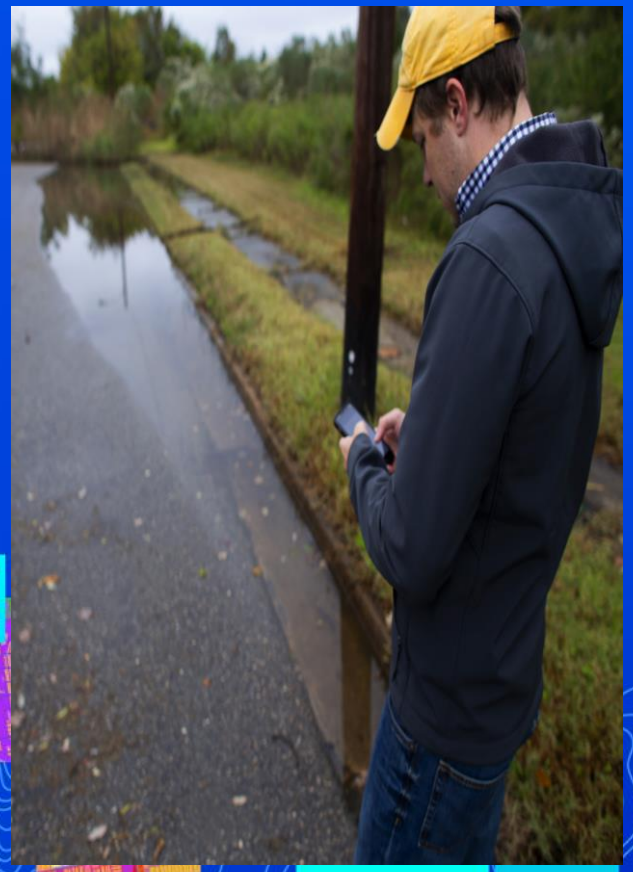
Animation of Forecast Modeled Extents on September 27, 2015 in Surrey Crescent
Plotted with Maximum Inundation Extents from Sea Level Rise App



from Loftis, Wang & Forrest, 2016

MHDD = 8.25m (n = 345 points)



Review of App GPS Data

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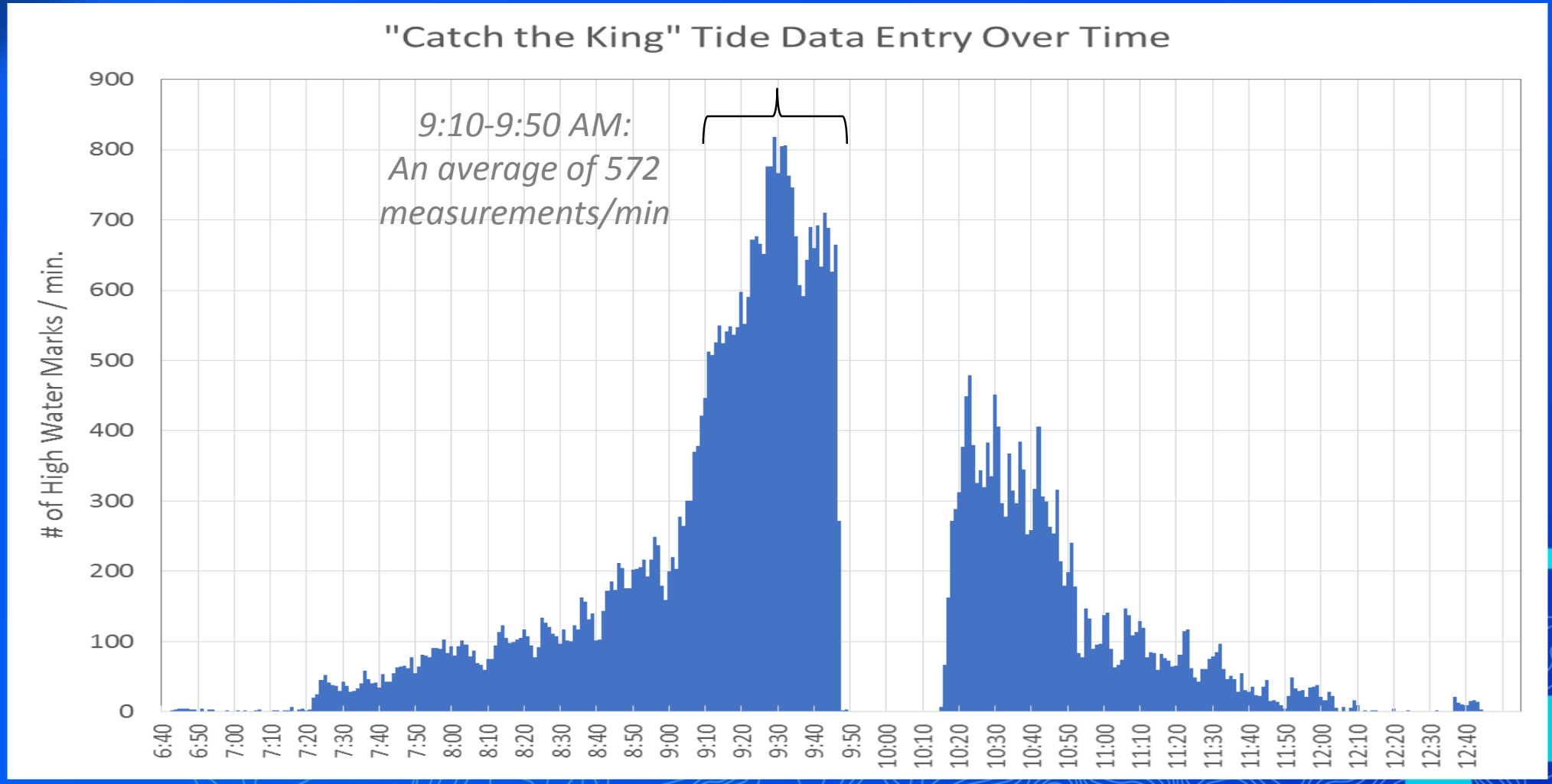
Nov. 5th, 2017 King Tide Data Collection Statistics



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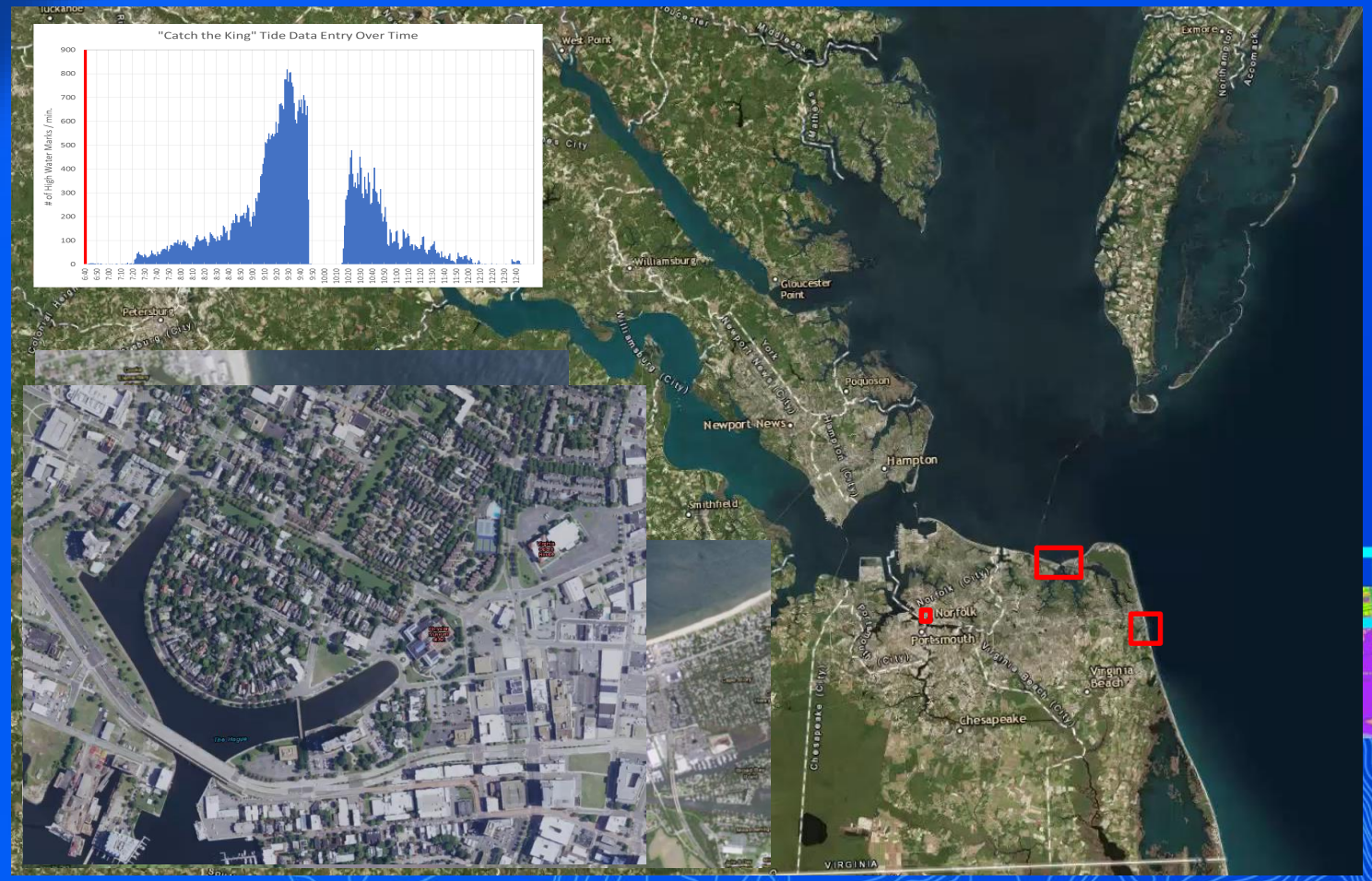
Dynamic Time Lapse of GPS Data Entry on Nov. 5th



Interactive Flood Map Comparison

http://bit.ly/2zcS7Ba

Review of App GPS Data

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King Tide Data Web Map: (http://www.vims.edu/kingtide)

What We Learned from ➔

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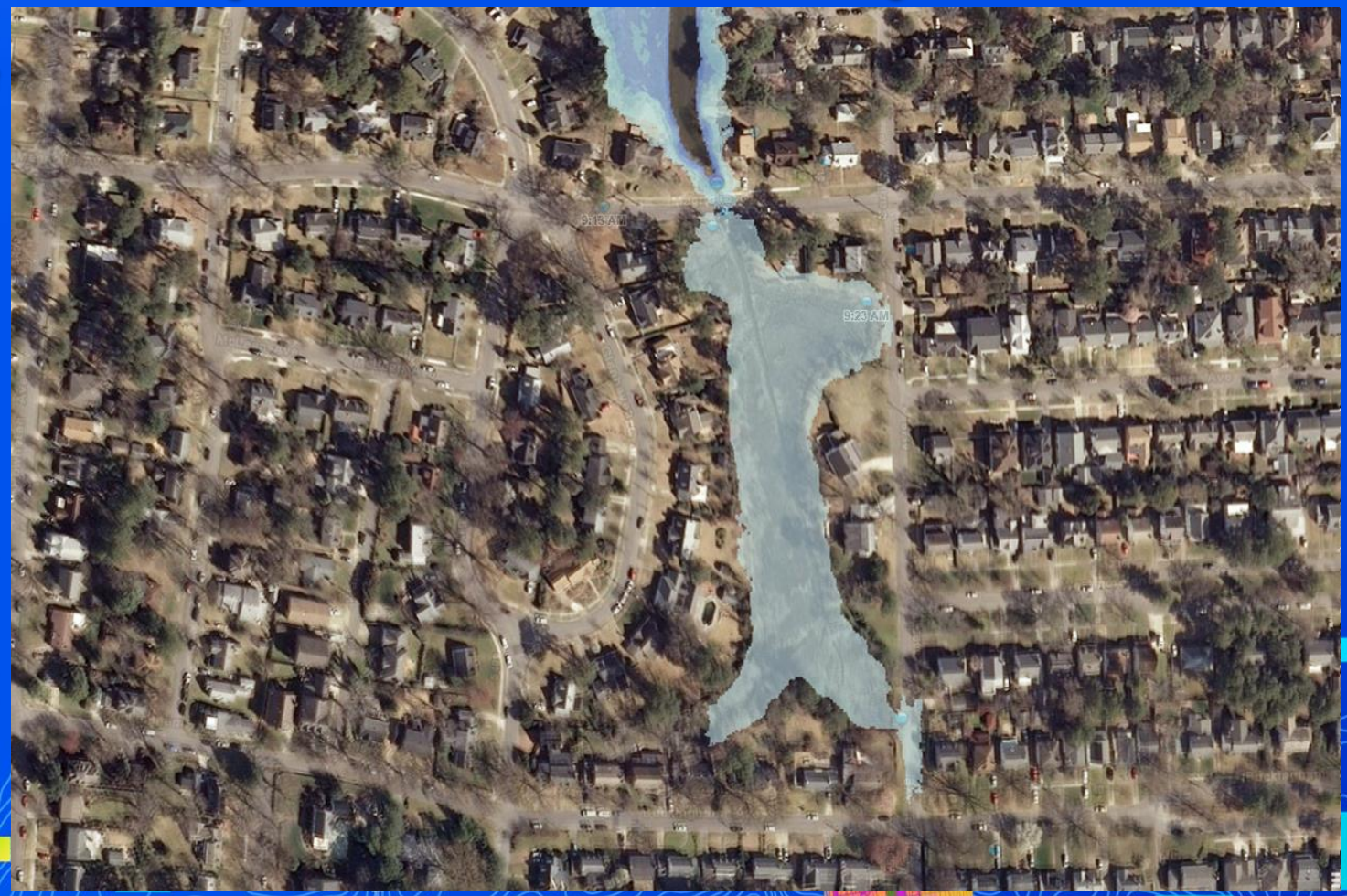
One of the biggest unanticipated benefits of Catch the King was the free hydrologic correction of fine-scale drainage features missing from aerial lidar surveys.

This can be laborious to fix and involves field surveys to confirm; often costing several $100k for private firms to correct! VA got this for free through CtK.

Examples of Crowdsourced Hydrocorrection



In Conclusion

CATCH THE KING

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1. More specific experiments and area-focused measurements should be done to confirm hydro-correction estimations.
2. Results from environmental surveys suggest that nutrients transported into the water system due to tidal flooding should be included for better estimation of TMDLs in water quality studies.
3. VIMS' 2018 flood forecast was accurate:

≈1.8 in. (3.7 cm) ≈24.6 ft. (6.2 m)

In Conclusion

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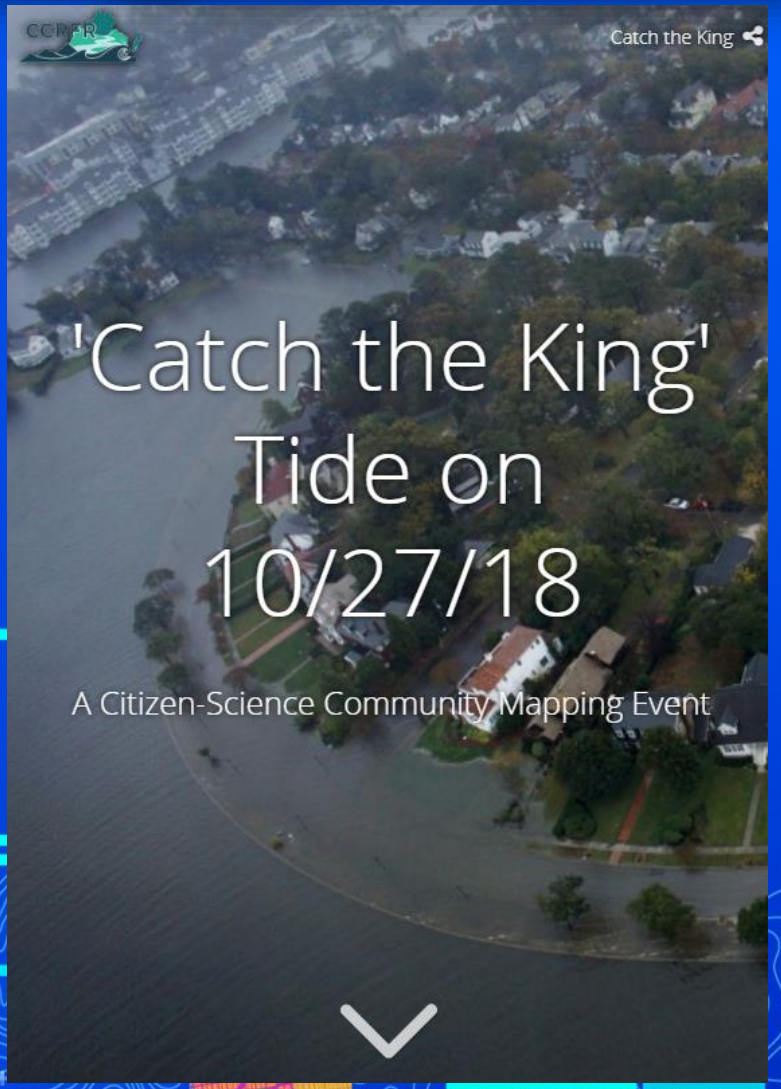
4. Catch the King effectively crowdsourced hydro-correction. Ground-truthing information is valuable. Some waterways weren't accurately represented by LiDAR:
   - Including ditches and narrow creeks
   - Areas canopied by trees during flyovers
5. Engaging the public affords scientists greater extensibility for these type of projects (i.e. private property access).
6. Year-round mapping efforts have been spearheaded by WHRO to keep mapping going through to Catch the King 2019.



A Big Thank-You to All of Our Volunteers:

- Qaren Jacklich, Volunteer Coordinator
- Dave Mayfield, Tides that Bind, CtK
- Skip Stiles, Wetlands Watch
- David Richards, Concursive
- Alfonso Macías-Tapia, ODU
- Margaret Mulholland, ODU
- Kyle Spencer, City of Norfolk
- David Hendrickson, Daily Press
- Cathy Lewis, WHRO
- Olivia Basco, Hampton Roads Academy