Dynamic Surface Water *Extent* (DSWE)

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Presentation outline

- Dynamic Surface Water Extent (DSWE) Goals and Objectives.
- DSWE assessment.
- DSWE for depression storage estimation.
- Status, plans and aims.

Group on Earth Observations: Lakes and Reservoirs Variable

Global Reservoir and Lake Monitor USDA-FAS / NASA

Our science and management requires higher resolution information on any/all surface water.

Dynamic Surface Water Extent (DSWE)

- Goal: enable surface water monitoring at resolutions useful for land/water resource management, hydrology and biology as well as climate science.

06/04/84 06/05/90 06/08/00 05/27/10

1 km

USGS

DSWE Objectives
(pursued in parallel)

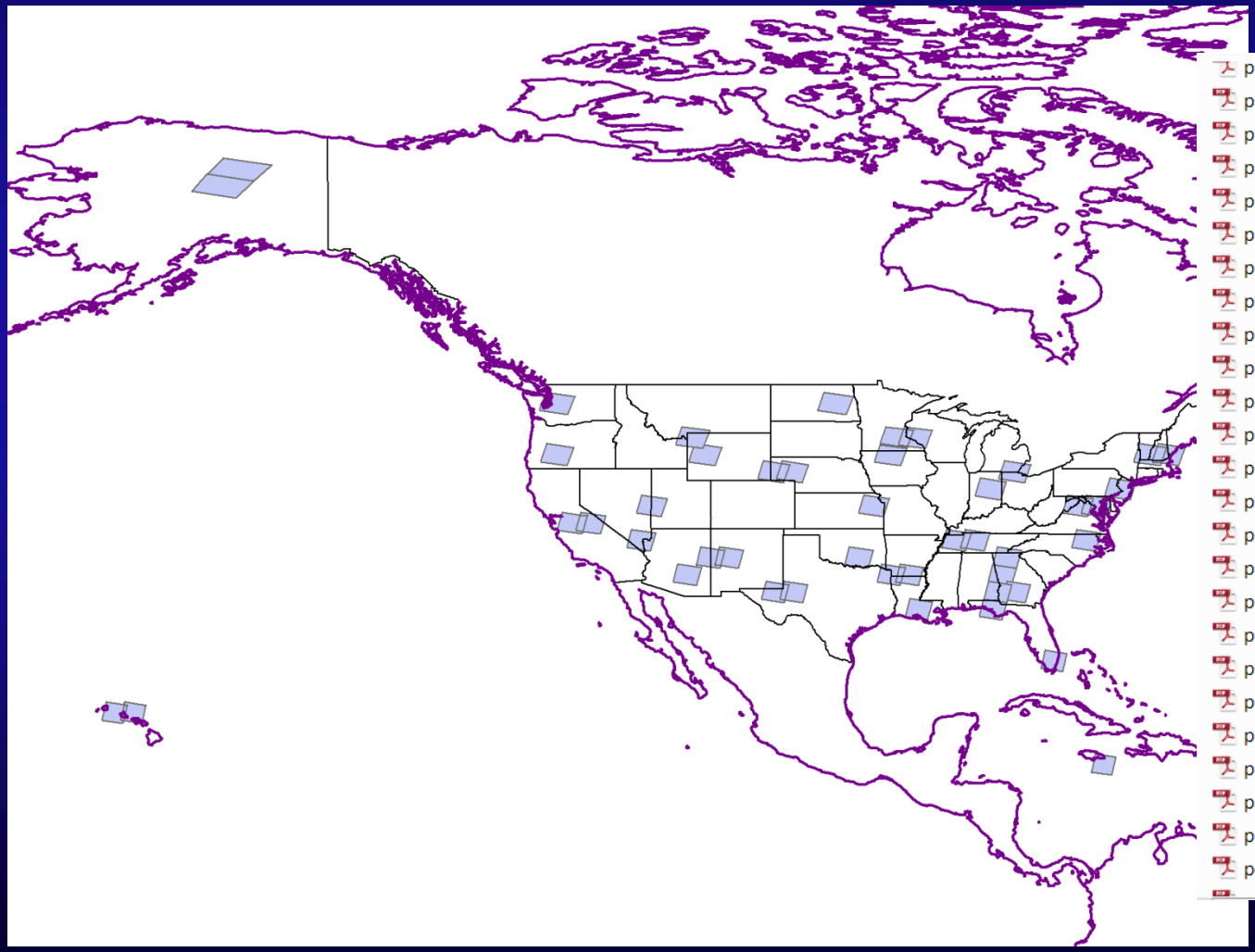
- Define, develop, assess and refine the DSWE.
- Conduct our own science with ECV products.
- Infuse user feedback in product evolution.
- Document product specifications, uncertainty and uses through peer-reviewed publications.

USGS DSWE Product Characteristics

- Pixel based: any cloud free or cloud-shadow free pixel in the Landsat Archive (US/PR).
- “Ancillary data *lite*” (only inputs are land surface reflectance, cfMask and elevation).
- (Presently) 4-band output:
  - Raw DSWE;
  - cloud, cloud shadow revised DSWE;
  - cloud, shadow, and slope revised DSWE; and
  - percent slope.

DSWE assessment

- Currently evaluating output for > 60 locations



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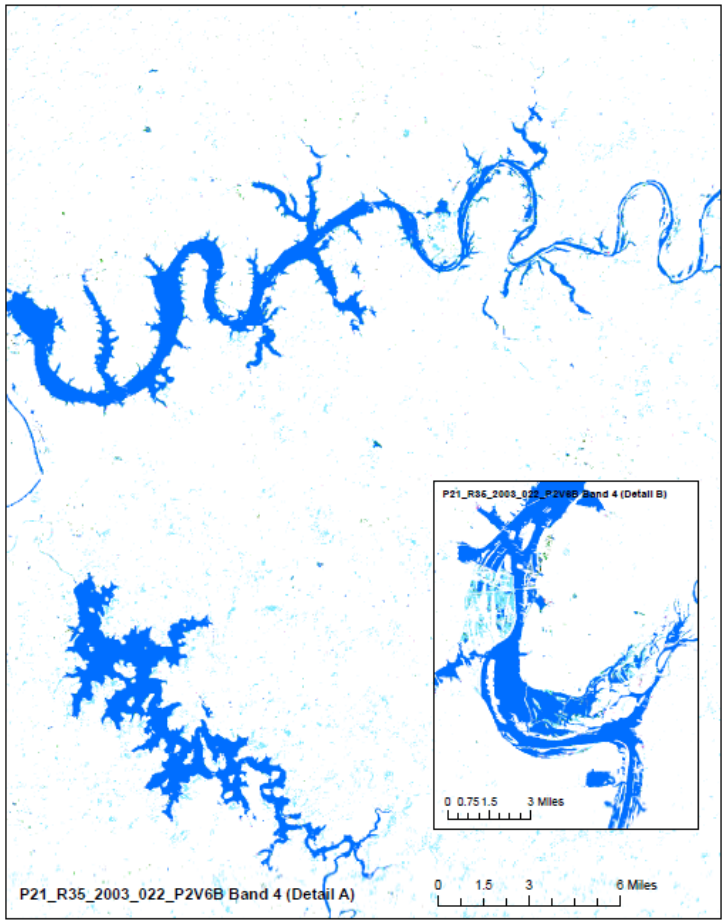
DSWE assessment

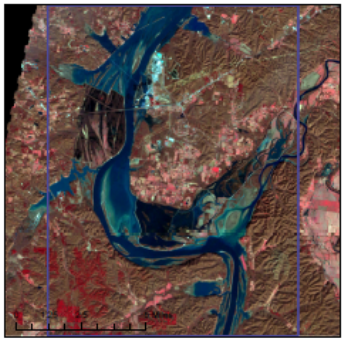
- Chosen for difficulty, application interest, coverage

	Long Name	Path	Row	Overlap	Notes
	DelMar Penninsula	14	33	15	Path/Row for at least 3 evaluation/application sets (including USDA Choptank, USGS Choptank & Pocomoke
	Great Dismal Swamp	14	35	15	Great Dismal Swamp; Pocosin Lakes NWR; Alligator River NWR
	Suncook River NH	12	30	12&13	12/13 Overlap area covers Suncook River above Chicheser NH FIMI site.
	Goose Creek	15	33	15&16	15/16 Overlap area covers Goose Creek VA and Chateau Jones.
	Kentucky Lake	21	35	21&22	21/22 Overlap area covers intereting Kentucky Lake/Between the Lakes Recreation Area. 22/35 includes a La
	National Wetlands I	24	37	24&25	24/25 Covers NWI scalable wetlands research and development site in the lower 48.
	Southern MN site	26	29	26&27	26/27 Overlap covers NUMEROUS FIMI test sites: Faribault, owatunna, Pine Island, Zumbra Falls
	Texas	30	38	30&31	30/31 Overlap covers Land Cover ECV cal/val site
	Nebraska Sandhills	32	31	32&33	32/33 Overlap in Nebraska Sandhills where an abundance of remote sensing research has been/is being cor
	New Mexico	34	36	34&35	34/35 Overlap covers Land Cover ECV cal/val site.
	California/Yosemite	42	34	42&43	42/43 Overlap covers Yosemite. Eastern scene includes Imperial valley. Will also have snow.
	Oahu HI	64	15	64&65	64/65 Overlap covers Island of Oahu
	New Jersey Land Co	13	32	NA	3 Land Cover ECV Cal/Val sites are in this scene
	Tar Basin North Carc	15	35	NA	Tar Basin LiDAR based FIMI site.
	Greater Everglades E	15	41	NA	Covers majority of the Greater Everglades Ecosystem Restoration Science area.
	Northernmost Appa	19	36	NA	Covers the Chattachoochee and Chestatee high accuracy evaluation sites/ACF WaterSMART study area.
	Potato Creek	19	37	NA	Covers the Potato Creek high accuracy evaluation data set in the ACF WaterSMART area.
	Middle ACF	19	38	NA	Covers Spring Creek/Ichawaynotchawee High accuracy evaluation and ACF WaterSMART pilot irrigation area
0	Lower ACF	19	39	NA	Covers southern half of Chipola River high accuracy evaluation data, ACF WasterSMART Pilot and 2 Land Cov
	Blanchard River	20	31	NA	Blanchard River above Findley Ohio is a FIMI site. It also includes Lake Erie edge.
	Indiana	21	32	NA	Covers LC cal/val site and has recent NWI data

DSWE Assessment – Level 1

P21_R35_2003_022_P2V6B



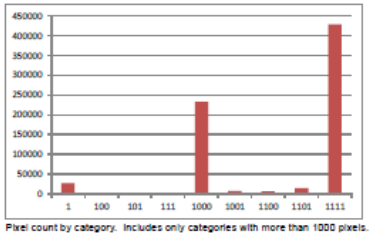


P21_R35_2003_TOA_432 (Detail B)

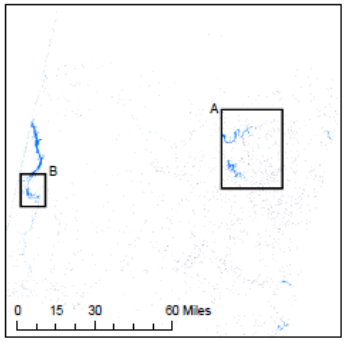
Legend and Pixel Count
p21_r35_2003_022_p2v6b_bnd4.img

0	
1	27829
10	16
11	155
100	2415
101	1653
110	64
111	3305
1,000	233062
1,001	7846
1,010	10
1,011	55
1,100	6494
1,101	14995
1,110	440
1,111	428542

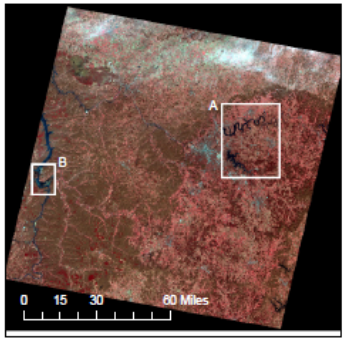
Band 4 is the fully corrected output from the Surface Water Extent model. It includes corrections for clouds, cloud shadows, snow, and slope.



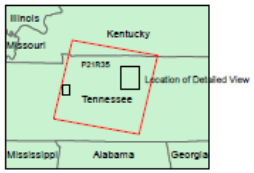
Pixel count by category. Includes only categories with more than 1000 pixels.



P21_R35_2003_022_P2V6 Band 4 (Full scene)



Landsat Bands 4,3,2 (Full scene)



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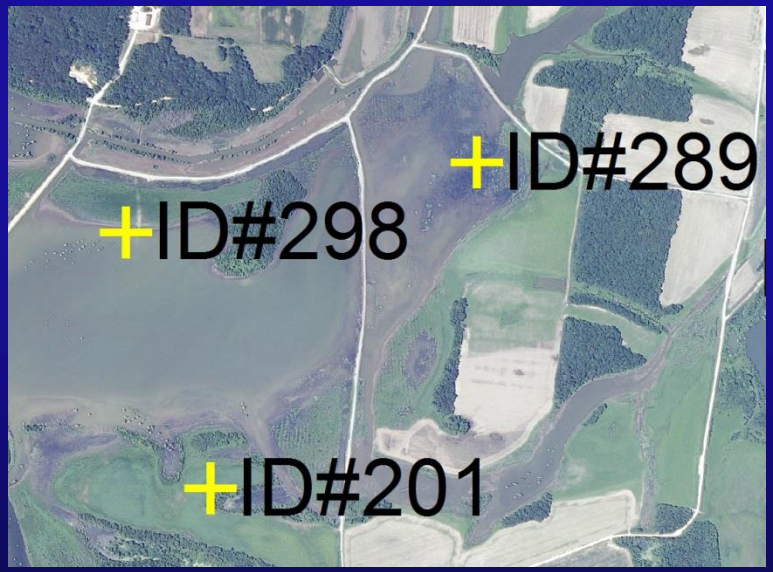
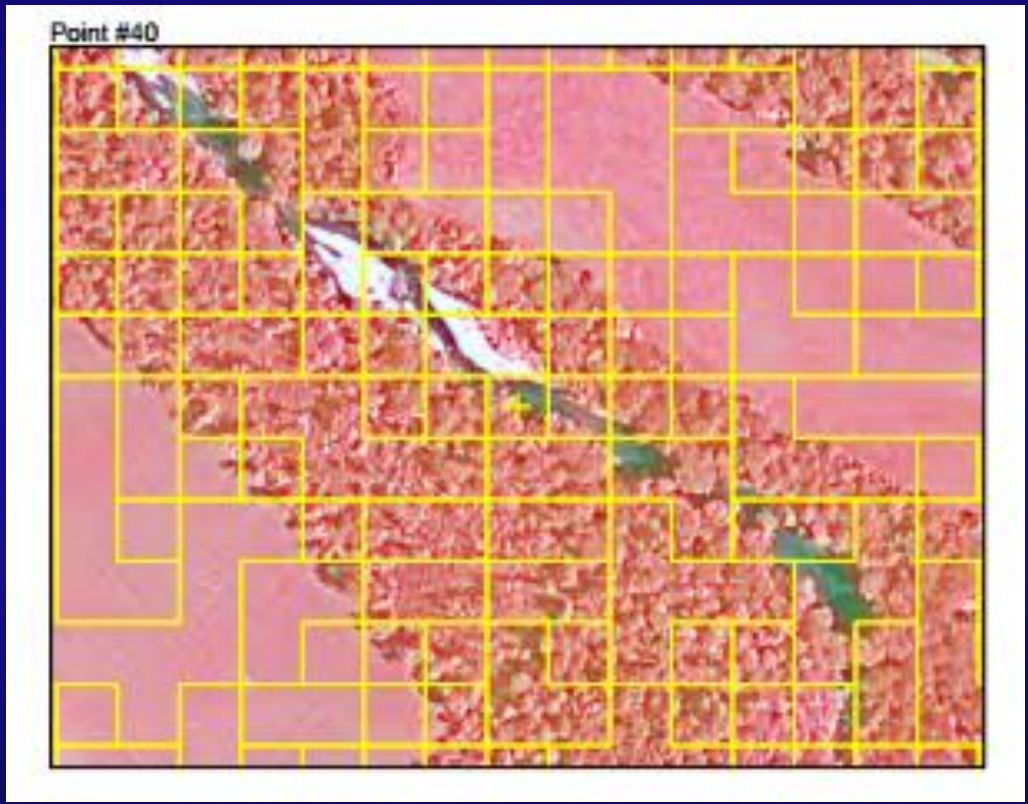
DSWE Assessment – Level 2

Visual interpretation of land cover from high resolution data for stratified, randomly sampled points “registered” to the DSWE input.





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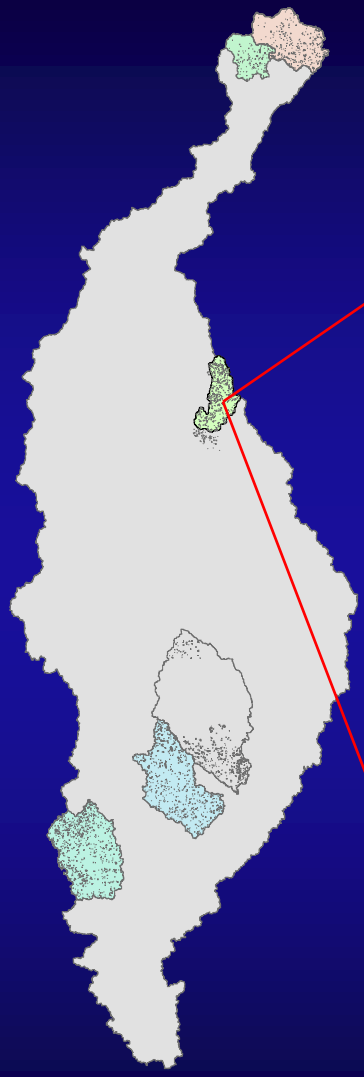
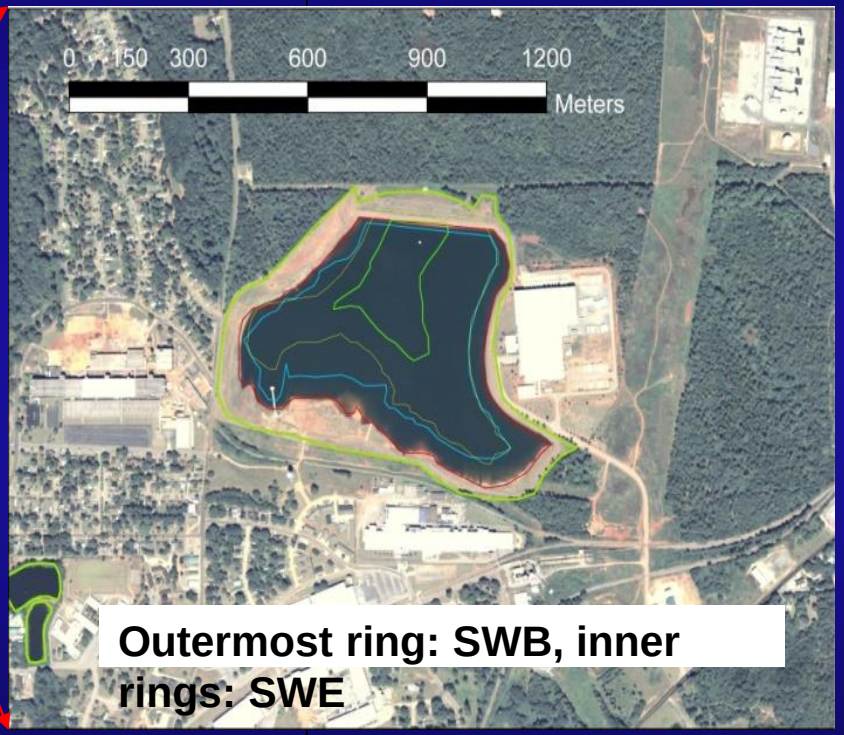
DSWE Assessment – Level 3



Compare against fine-resolution vector data from “coincident” *non-Landsat* collections (Radar, *LiDAR*, UAS)



The dynamics of surface water extent (SWE) for just one of more than 1000 surface water bodies (SWBs) in one intensive study area shown.

Level -3 single waterbody DSWE / NAIP comparison example

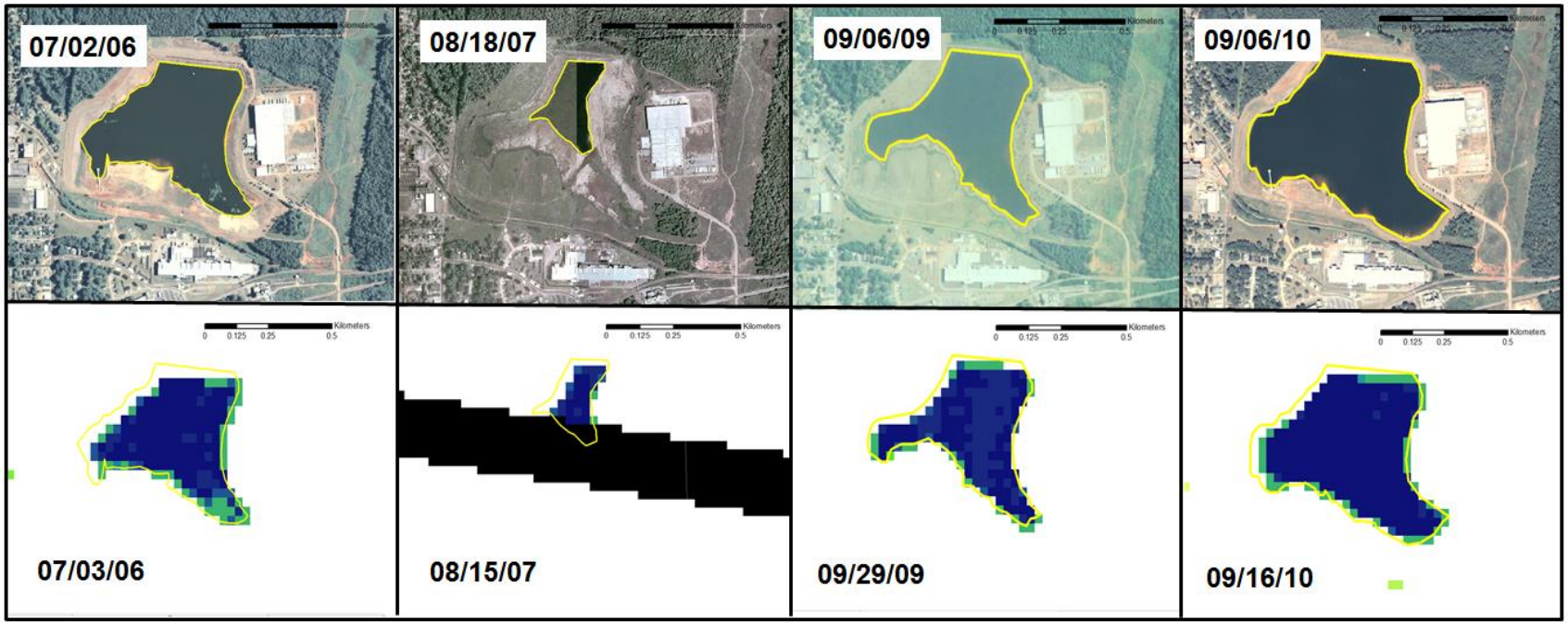


Figure 7. Surface water extent through time for a single water body as interpreted from NAIP (top row) and derived from Landsat (bottom row). Dates of capture for each are indicated. This level of detail allows detailed visual and rigorous statistical assessment of DSWE.

0.5 km

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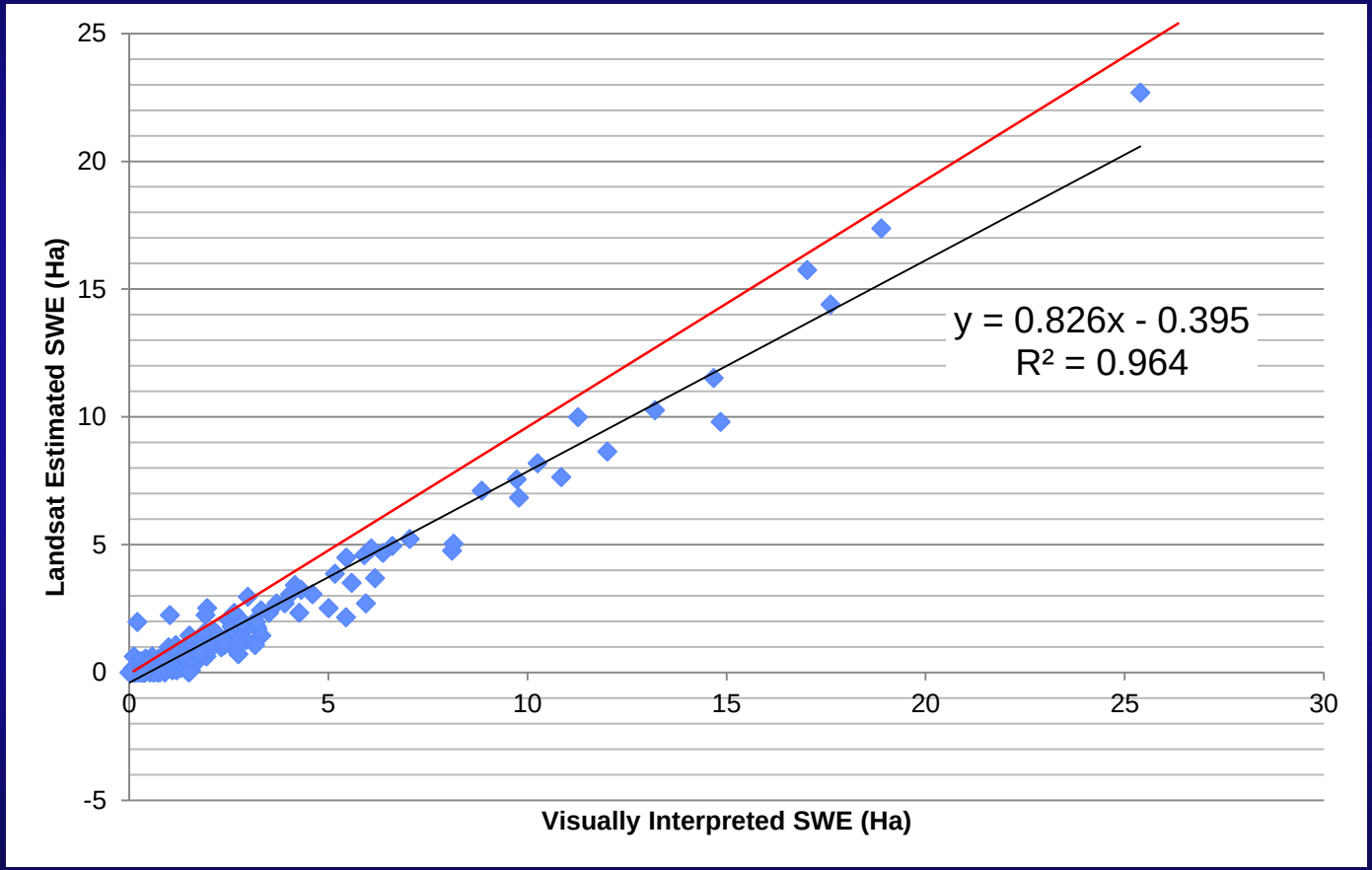
DSWE Assessment – Level 3

Potato Creek uncertainty assessment: 07/03/2006 surface water extent (hectares) for “matched” water body locations.



*n = 209

1 to 1 line

Landsat-based depression storage

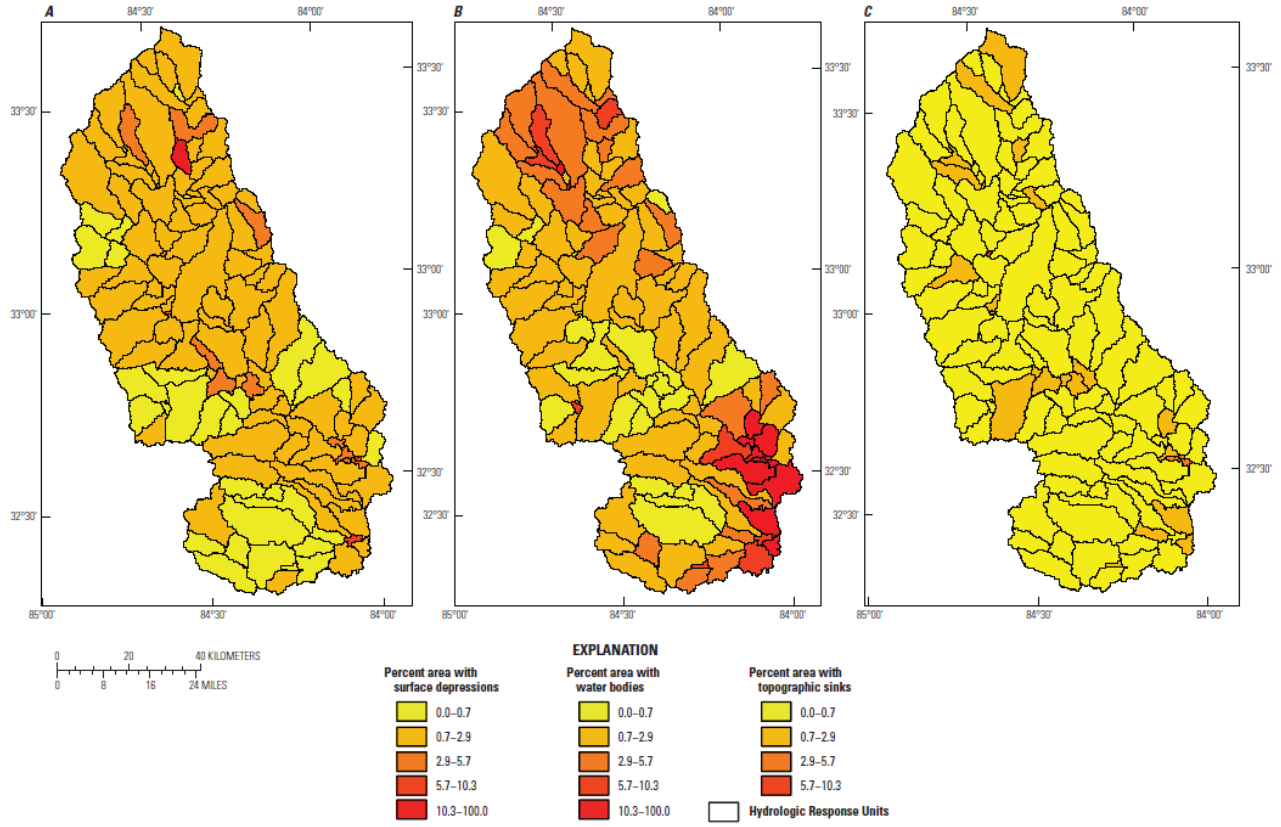


Figure 17. Hydrologic Response Units derived for this study are color coded to indicate the percentage of Hydrologic Response Unit area that is occupied by: (*A*) Enhanced Thematic Mapper Plus-derived surface depressions; (*B*) National Hydrography Database-designated water bodies; and (*C*) digital elevation model-derived sinks.

Vigor et. al. 2010. Effects of including surface depressions in the application of PRMS to the Upper-Flint Basin, GA

SIR 2010-5062

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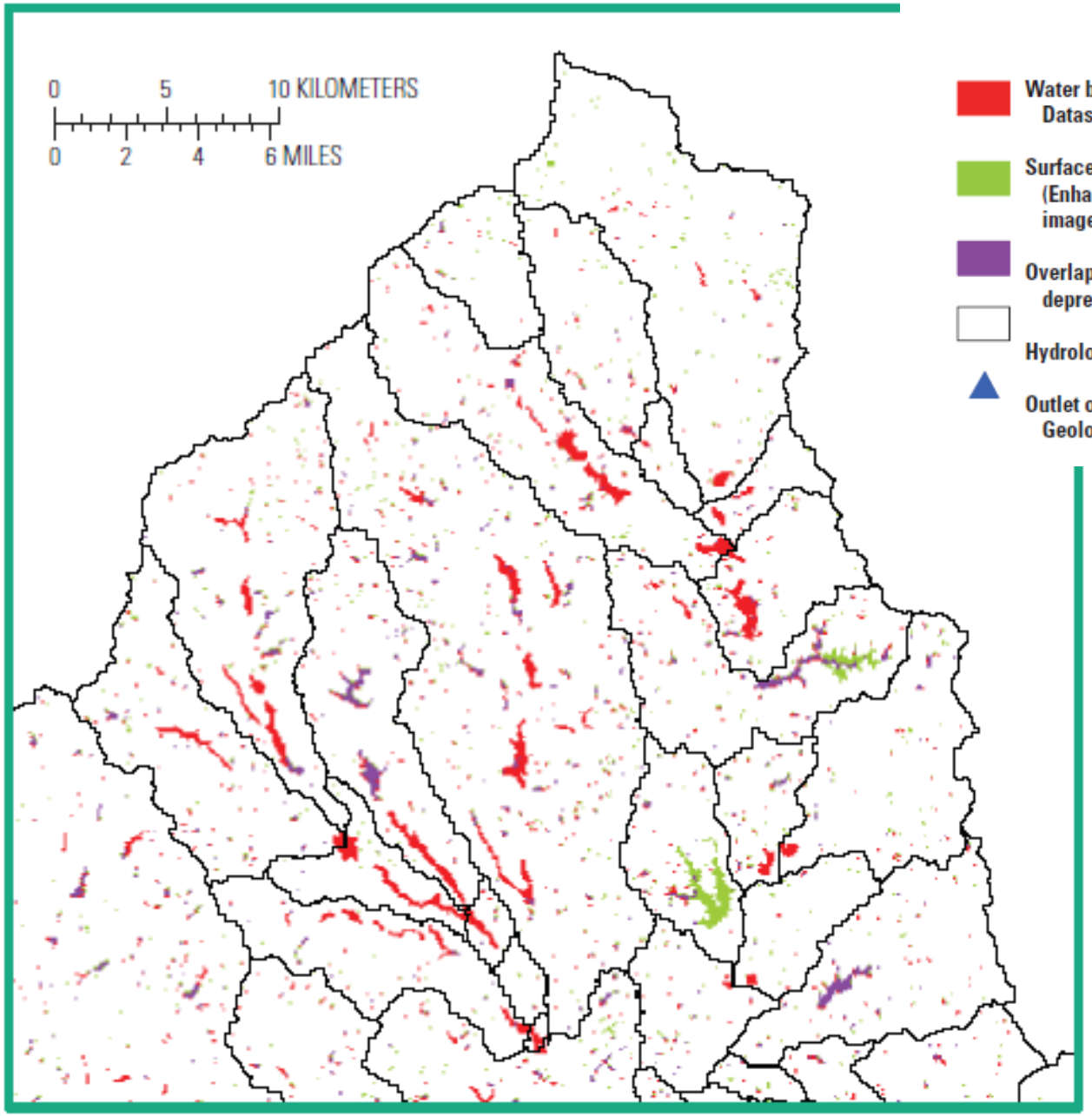
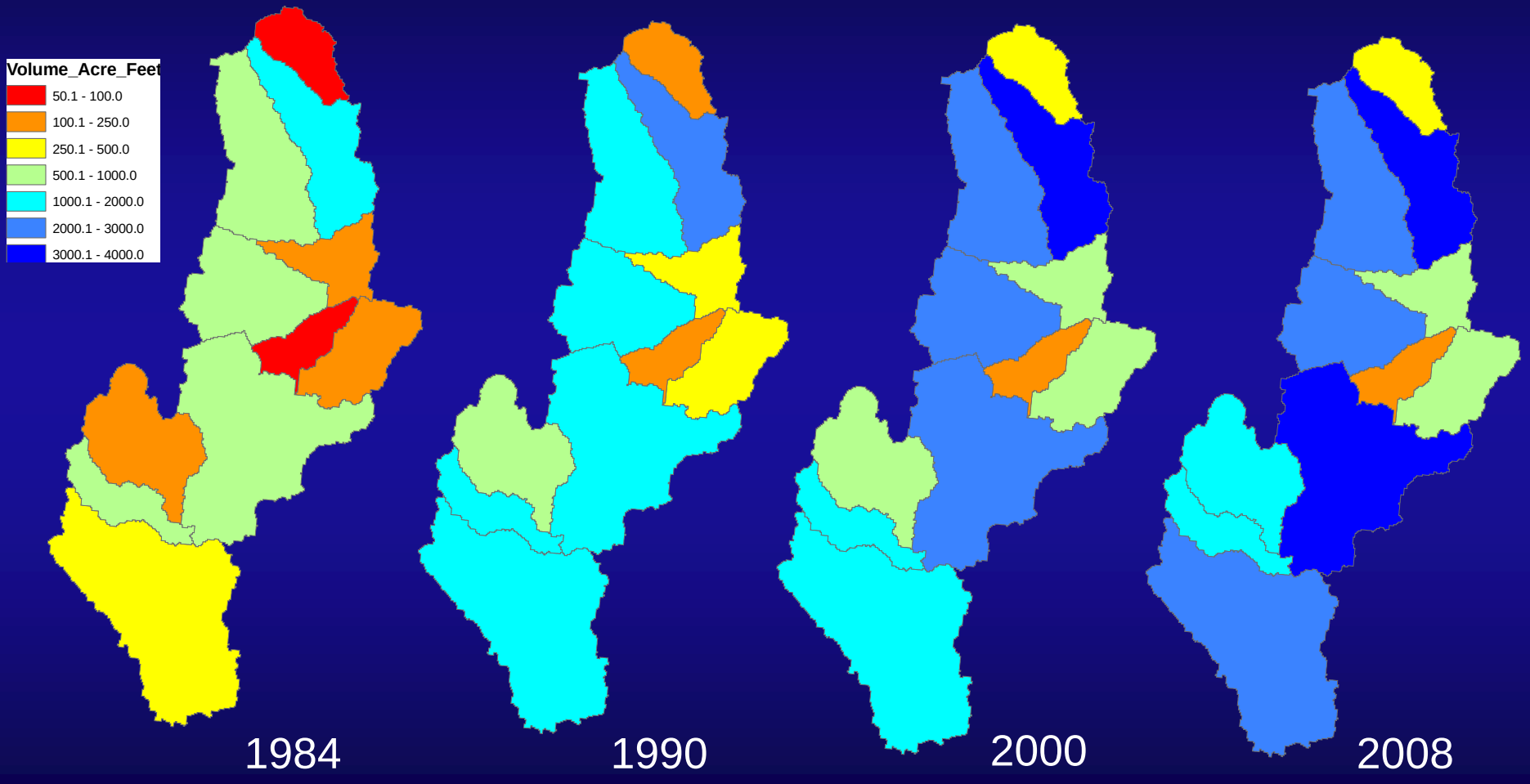


Emergent wetland classes largely undetected by DSWE *predecessor* algorithm.

Satellite-based, multi-decade total surface water volume by response unit (Potato Cr.)



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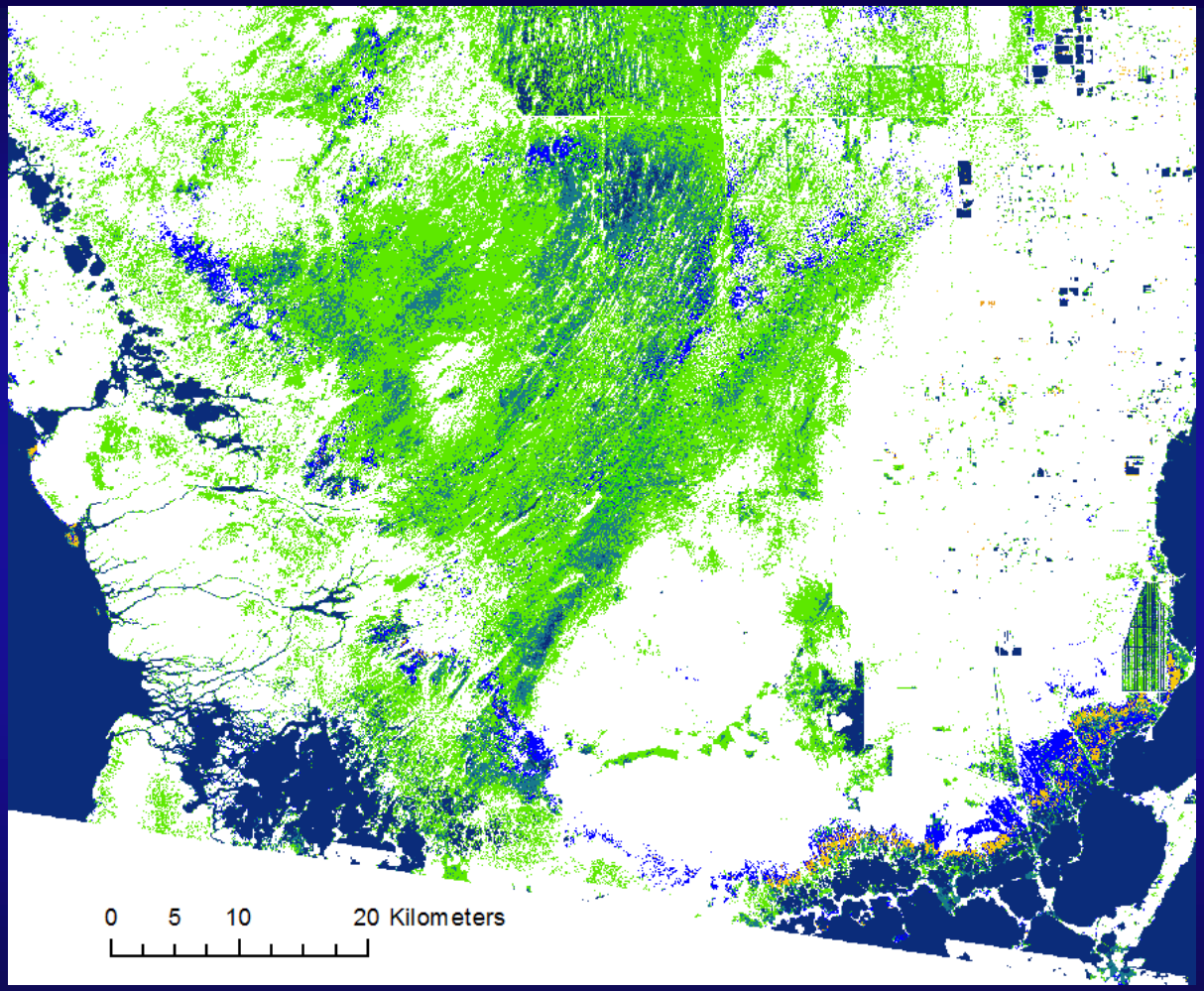
DSWE partial water pixel test



A more robust algorithm is effective at capturing surface water in mixed (vegetated) pixels.

Rigorous testing underway in Florida.

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Status, plans and aims

- Status: DSWE algorithm to provisional status. (March 15, 2015).
- Plans: DSWE operational status (pending collaborative assessments).
- Aims: Expand small surface water body mapping, SWE tracking and surface volume estimation research (FY16 and beyond).

Thank you!

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