

COMPUTING WATER-LEVEL GRADIENT VECTORS TO ASSESS CHANGES IN SHEET FLOW AND DIRECTION

Paul Conrads¹, Bryan McCloskey², Eduardo Patiño³

1 USGS South Atlantic Water Science Center

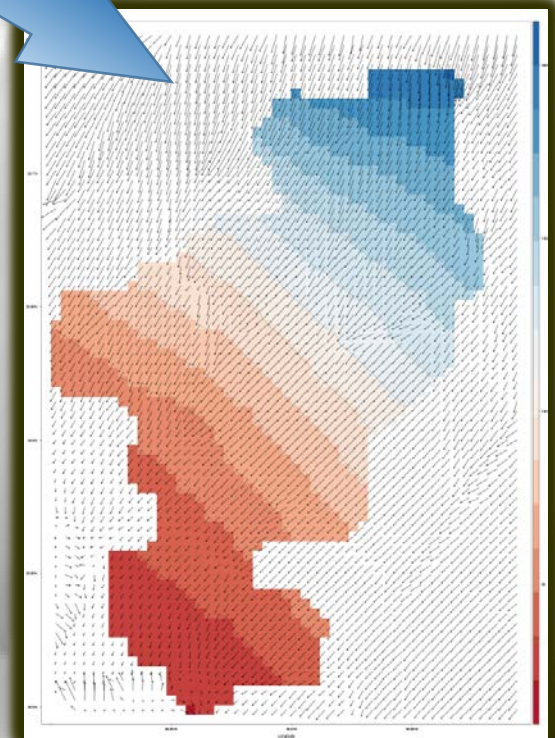
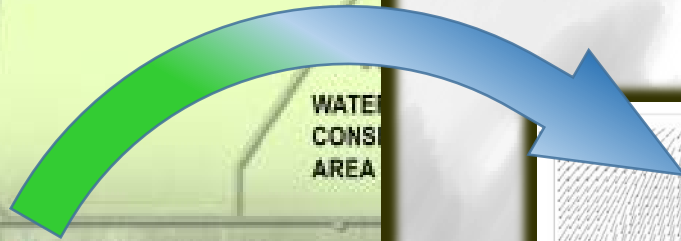
2 USGS St Petersburg Coastal and Marine Science Center

3 USGS Caribbean-Florida Water Science Center

Presentation Outline

- Background – Where we left off (GEER 2015)
- Water Level Gradient Vectors (WLGV) visualization tools
- Confirmation with Dye Studies
- Example Application
- Conclusion

Use the EDEN model to compute water-level slopes and direction between model cells.



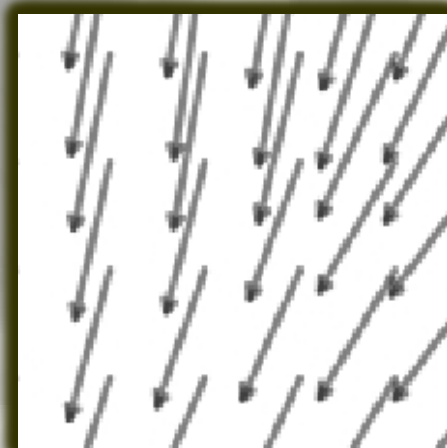
Water Level Vector Gradient Map

0.70	0.72	0.72	0.70
0.62	0.66	0.69	0.67
0.49	0.53	0.59	0.61
0.43	0.46	0.51	0.53

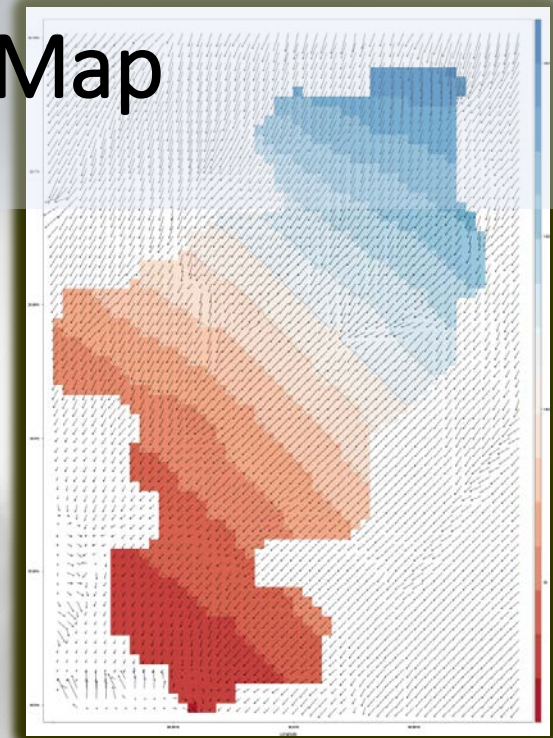
Slope

195.3	200.9	207.0	209.9
195.5	204.3	212.1	214.0
200.0	211.7	218.8	218.2
207.5	217.4	223.4	222.8

Direction



Vector Map



Vector Map
with/ water level color ramp

Use vector map to
evaluate sheetflow and
direction.

Water Level Gradient Vectors (WLGV) Visualization Tools

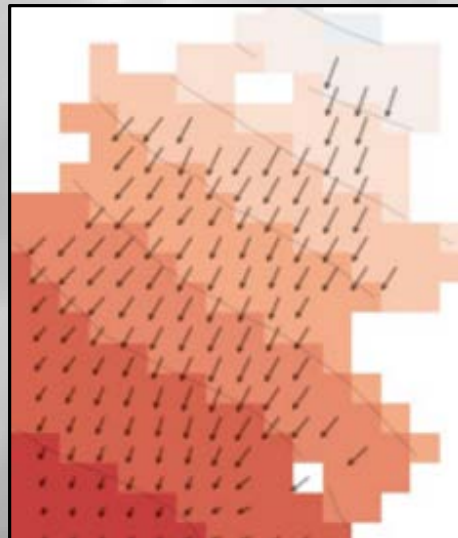
- Vectors for any EDEN cell and date
 - 57,000 cells, 9,200 days
- Maps – plan view
 - Difference resolution depending on area of the view
- Daily time series
 - Daily time series of WLGVs
- Rose Diagrams
 - Aggregate larger time scales of WLGVs

Vector Maps

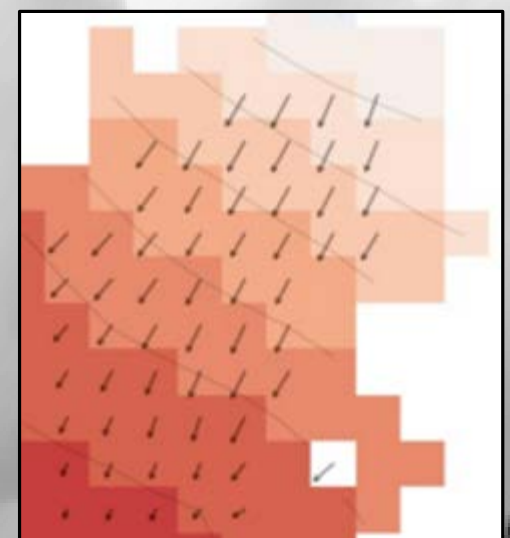
- Daily snap shot
- Use grid averaging for visualizing larger scales
 - 3x3, 5x5, 7x7 grids (or pixels)
- Good for evaluating sheetflow patterns over large areas



3X3



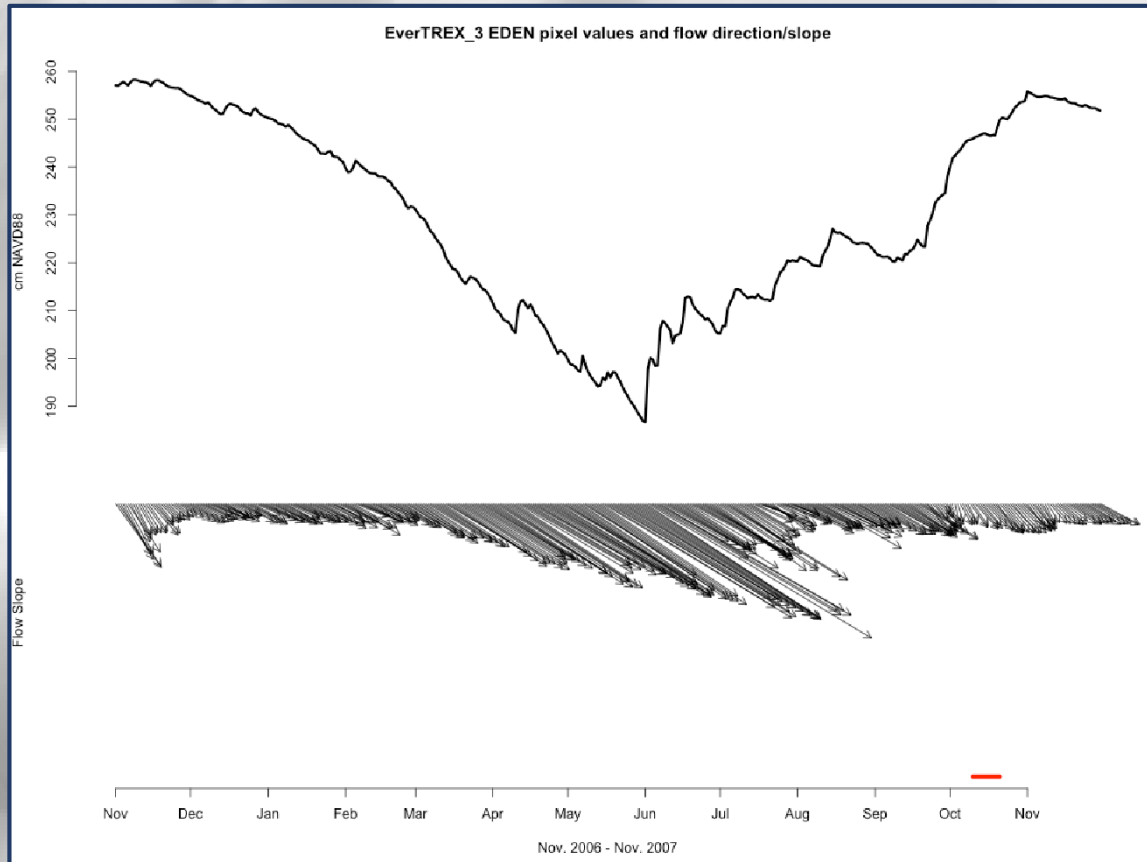
5X5



7X7

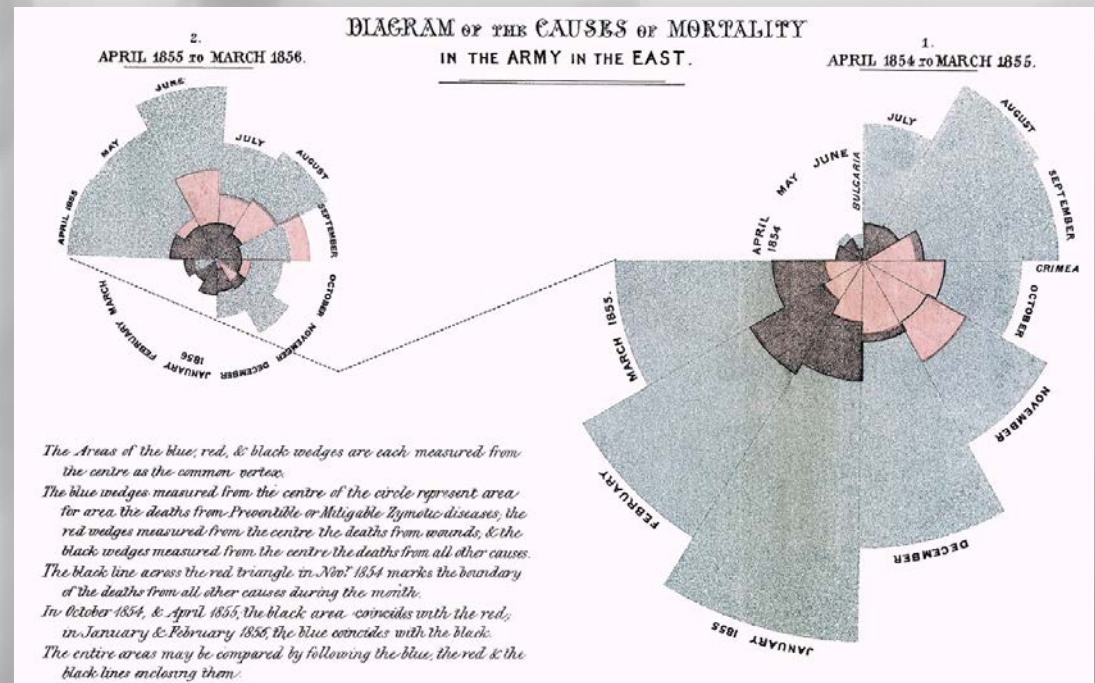
Daily WLGV Time Series

- WLGVs and water levels for one EDEN cell (pixel) over a year.
- Good for analyzing individual pixels



Rose Diagrams

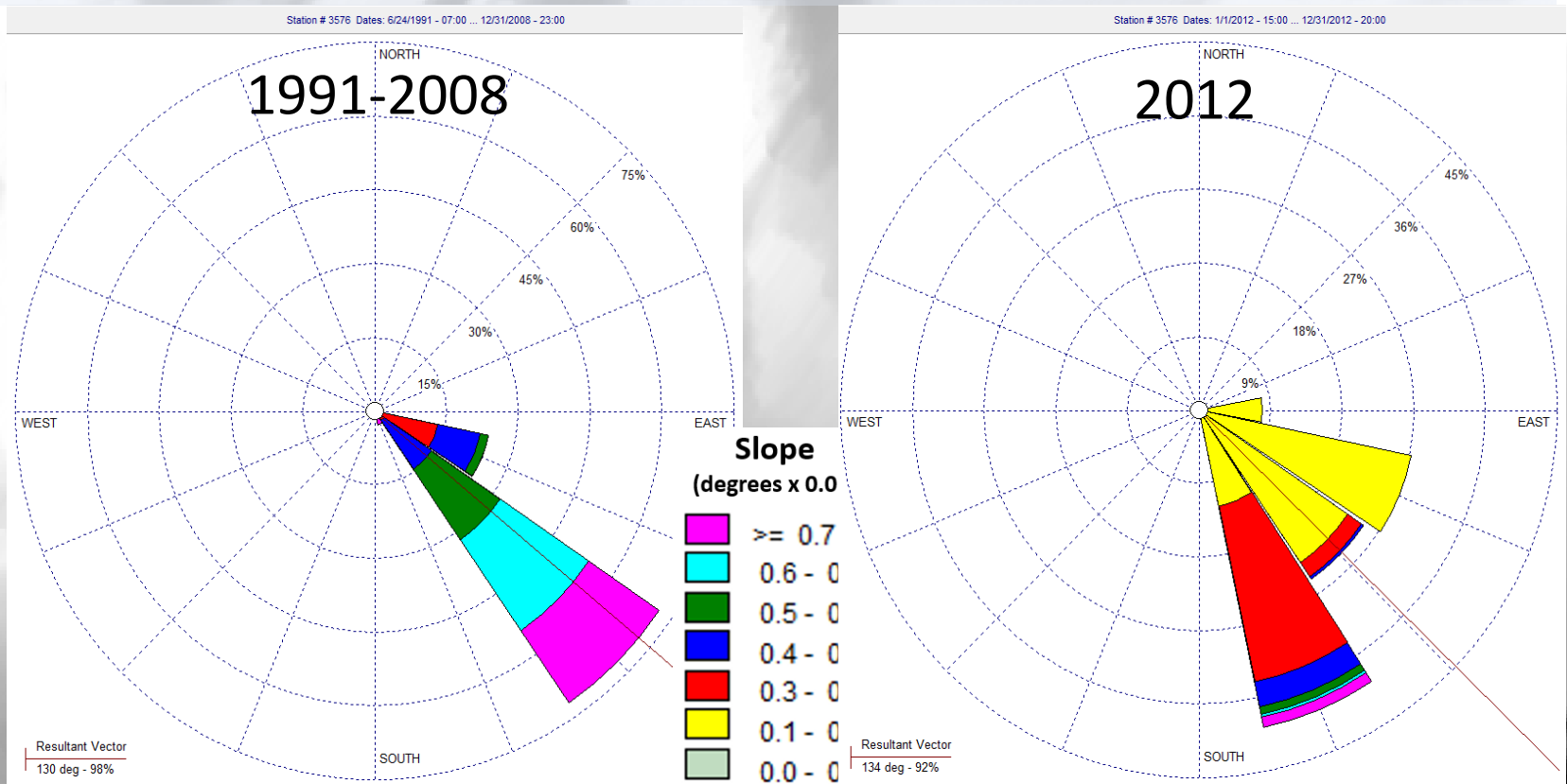
- Often used to summarize wind speed and direction
- Plot data in a circle:
 - Segmented by direction or time (months)
- Generate rose diagrams to summarize vectors over time
- Rose diagrams can be used to compare time periods or locations



Florence Nightingale's rose diagrams for evaluating mortality during the Crimea War

Detecting Changes in Flow Direction & Magnitude

- Displays distribution of vector over specified period – month, season, year

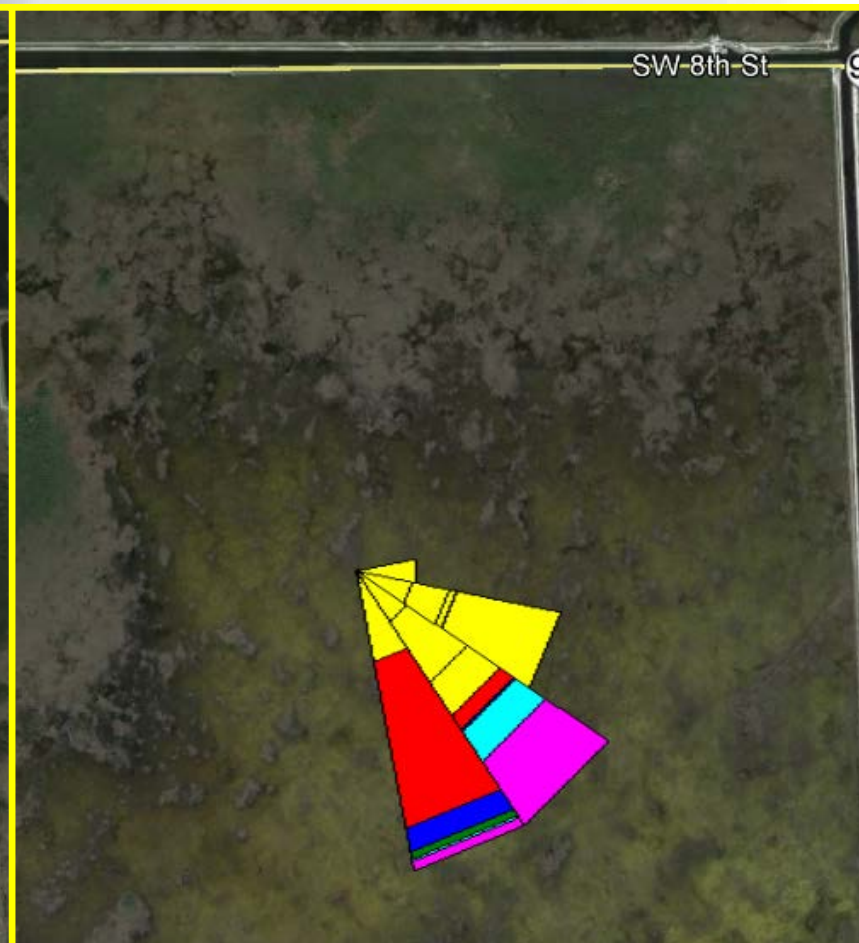


Detecting Changes in Flow Direction & Magnitude

- Displays distribution of vector over specified period
– month, season, year



1991-2008



G-3576

2012

Dye Studies

- EverTREN Field Tracer Tests
 - 3 Sites in WCA3A & B
 - 2006 and 2007
 - Michael Sukop 2008 Report
- S-356 Pump Test Dye Studies
 - Four releases
 - Fall 2015

Final Report

GEW Hydrodynamic Analysis

For CERP MAP Activity

Determination of Sheetflow Hydrodynamic Properties

Prepared for:

South Florida Water Management District

Purchase Order 4500023614

Prepared by:

Dr. Michael C. Sukop

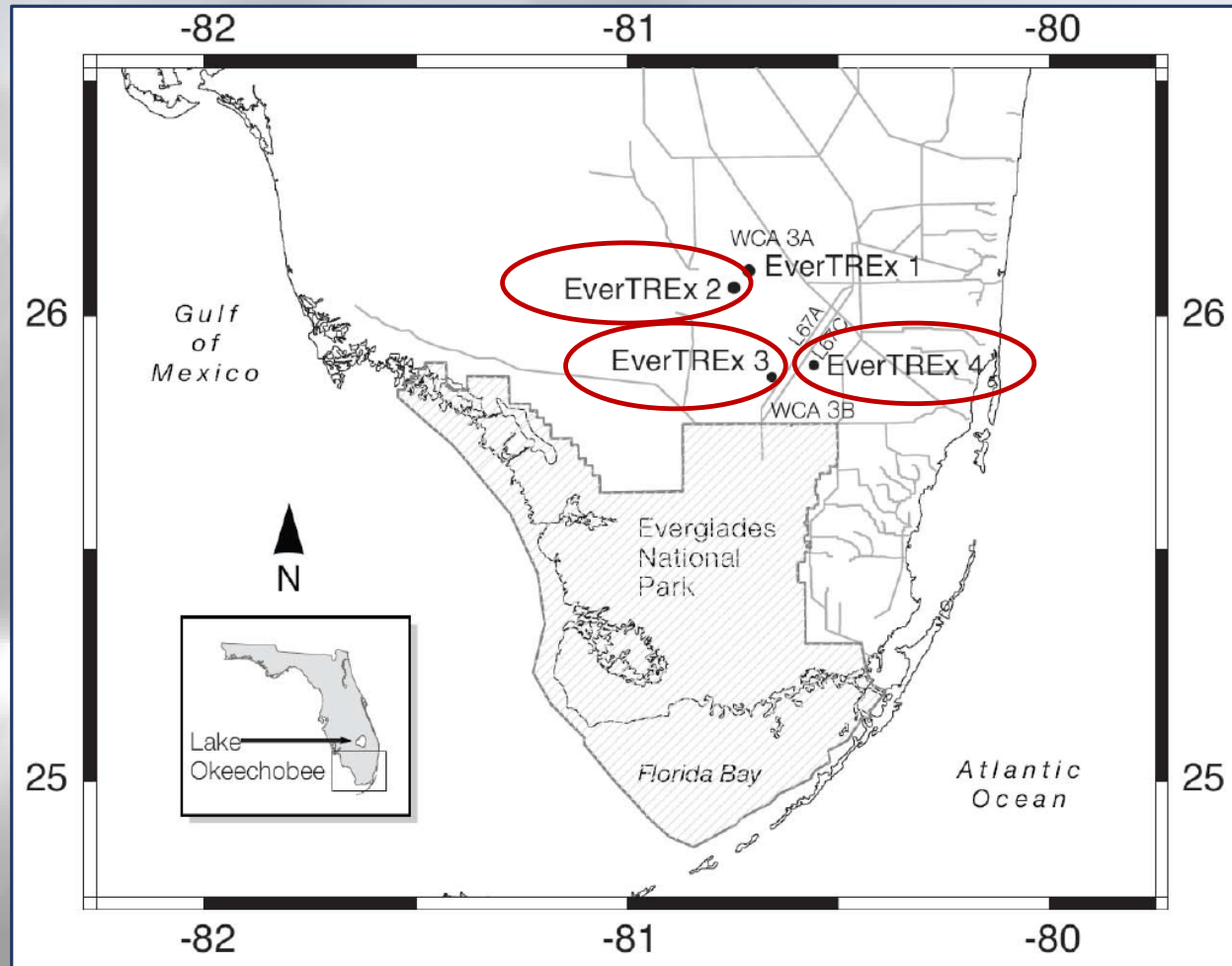
Department of Earth Sciences

Florida International University

Miami FL

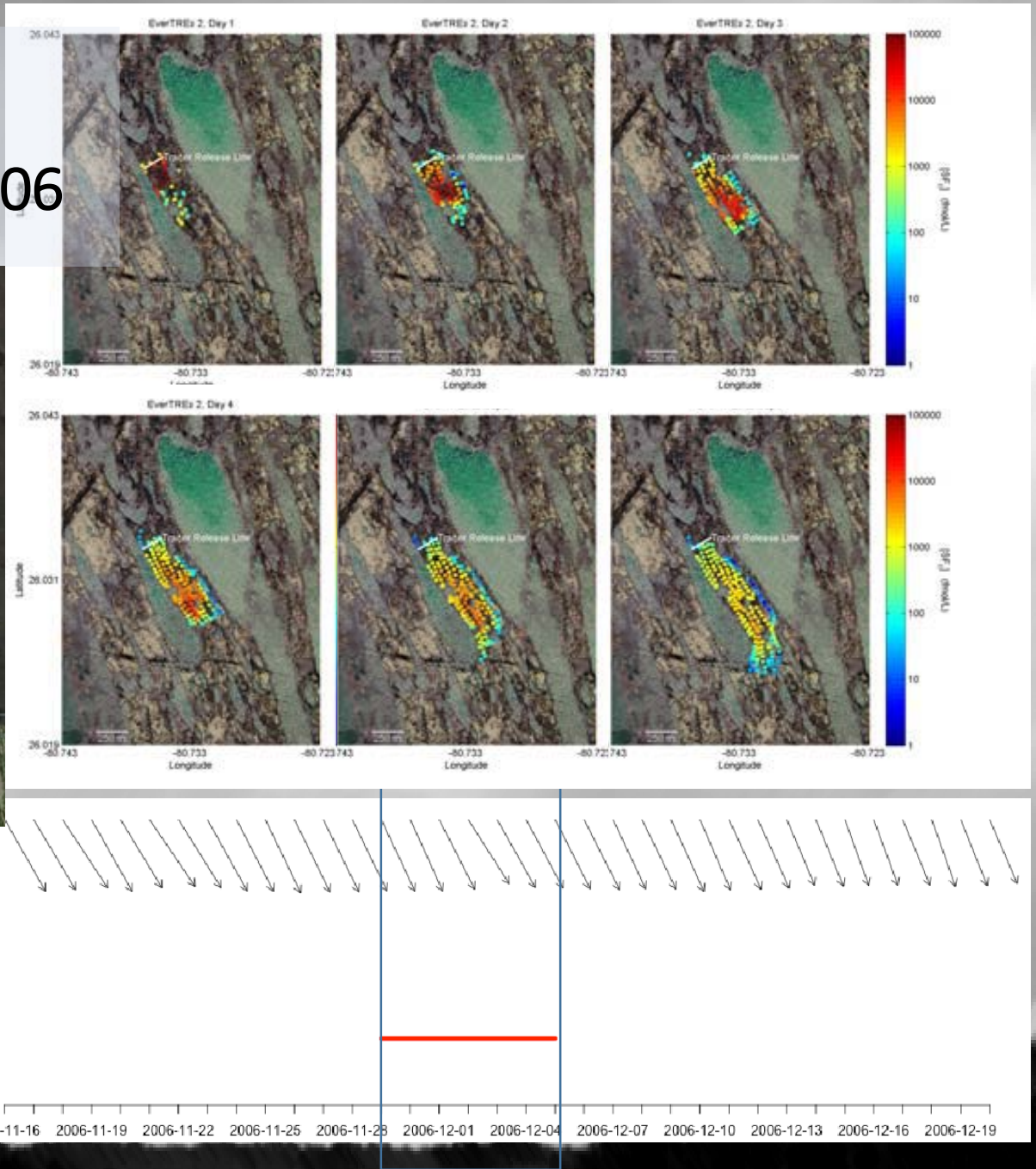
September 30, 2008

The EverTREK Releases

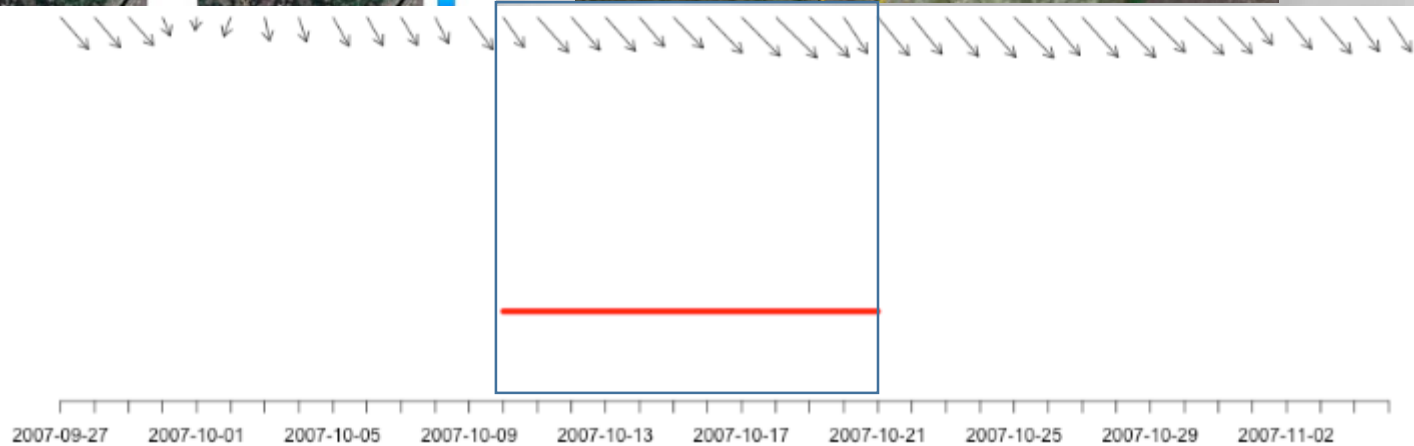
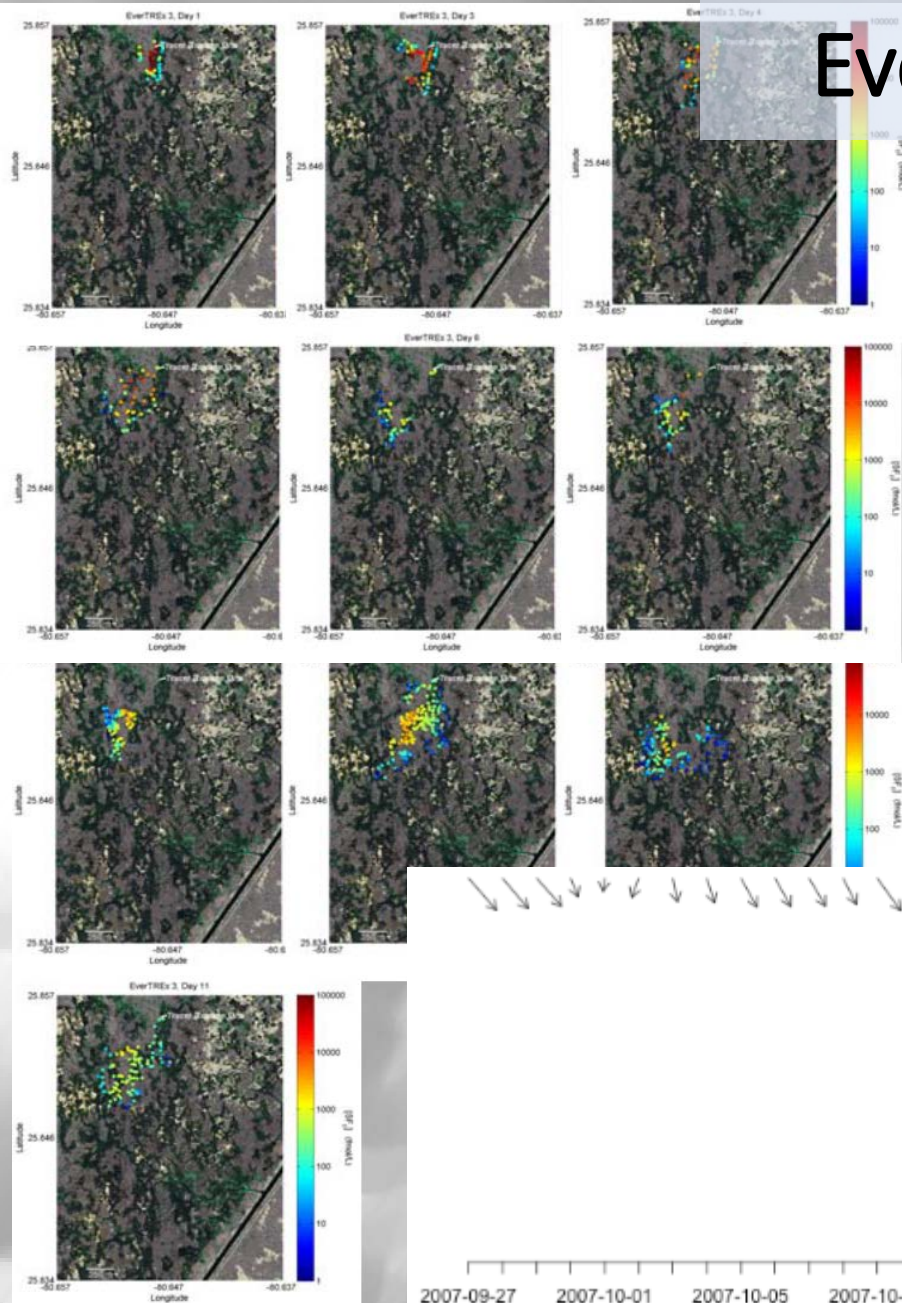


EverTREK 2

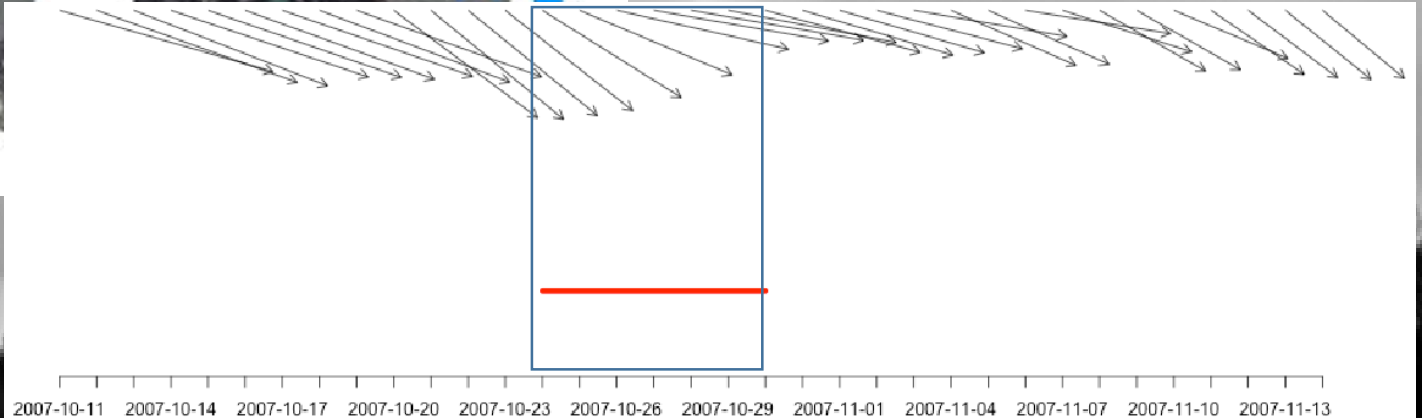
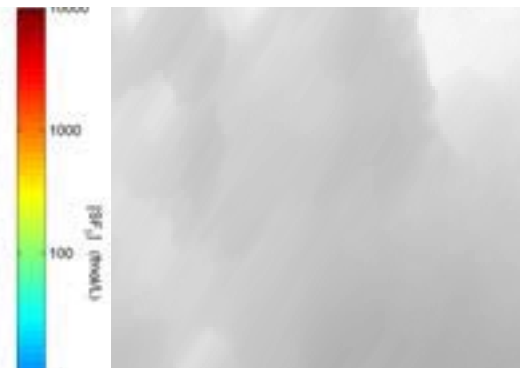
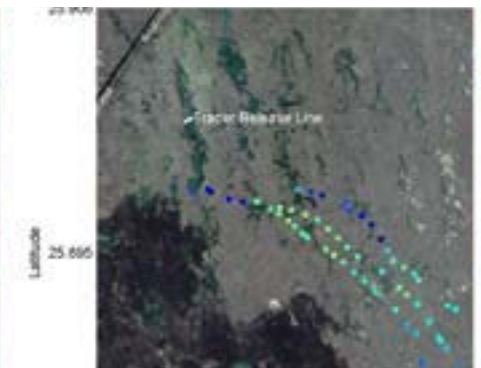
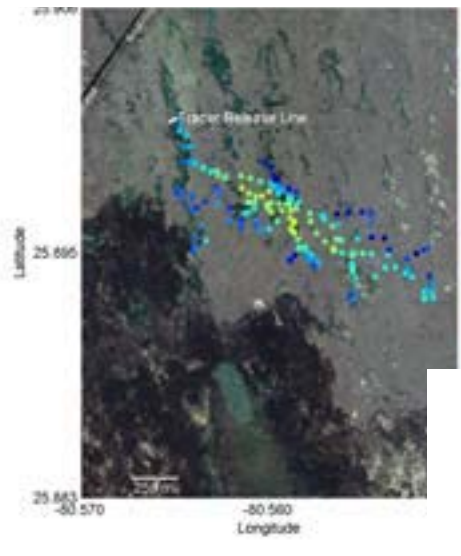
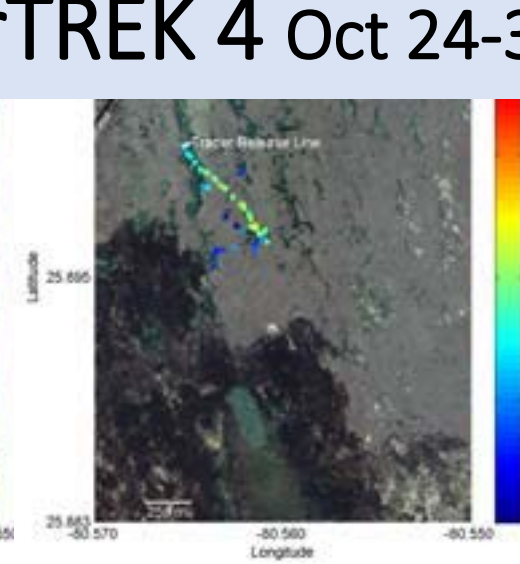
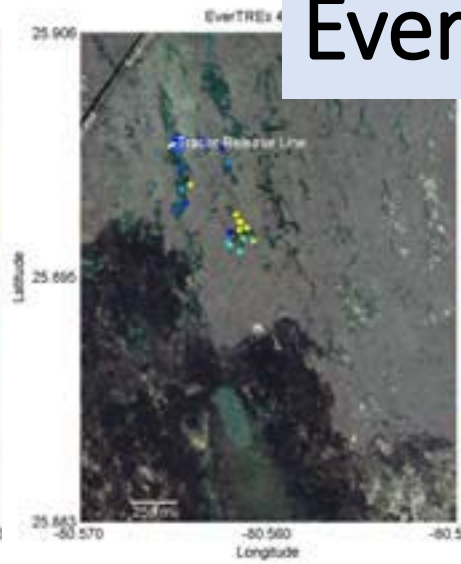
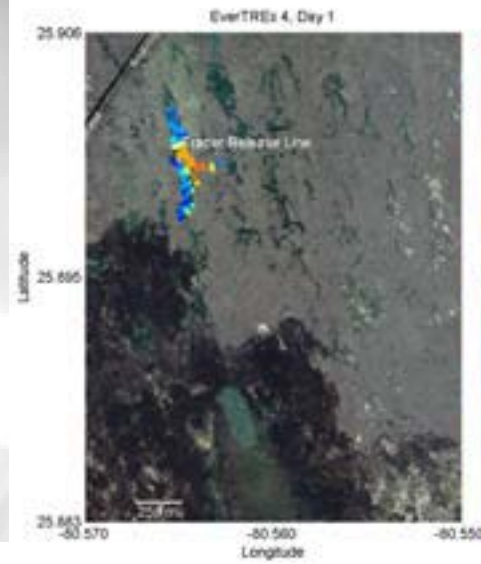
Nov 29-Dec 5, 2006



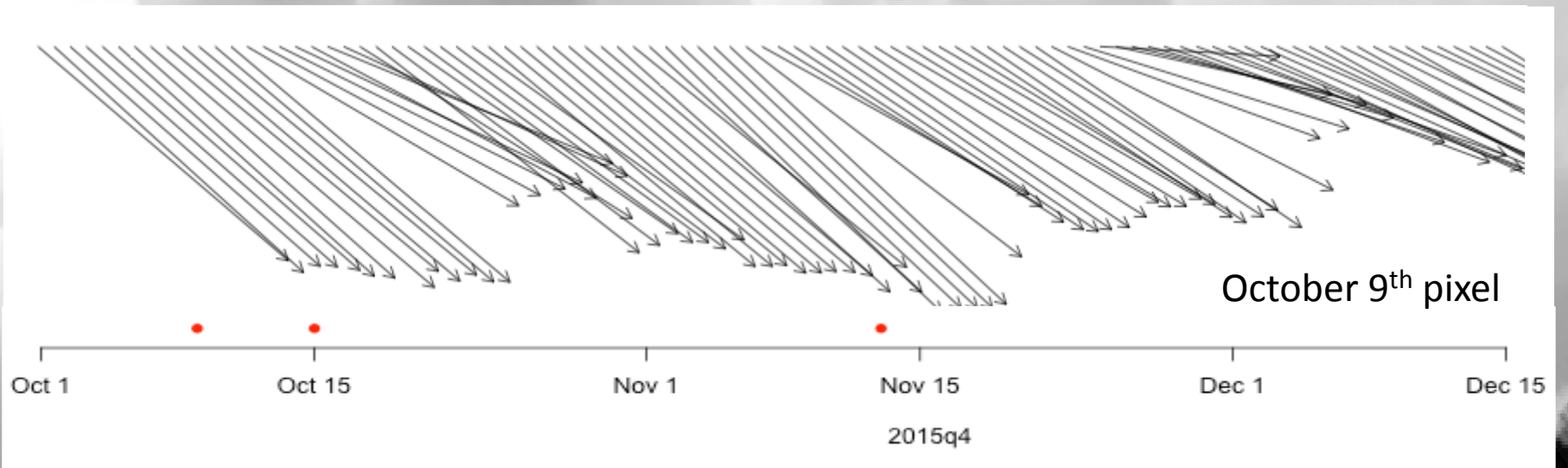
EverTREK 3 Oct. 10-21, 2007



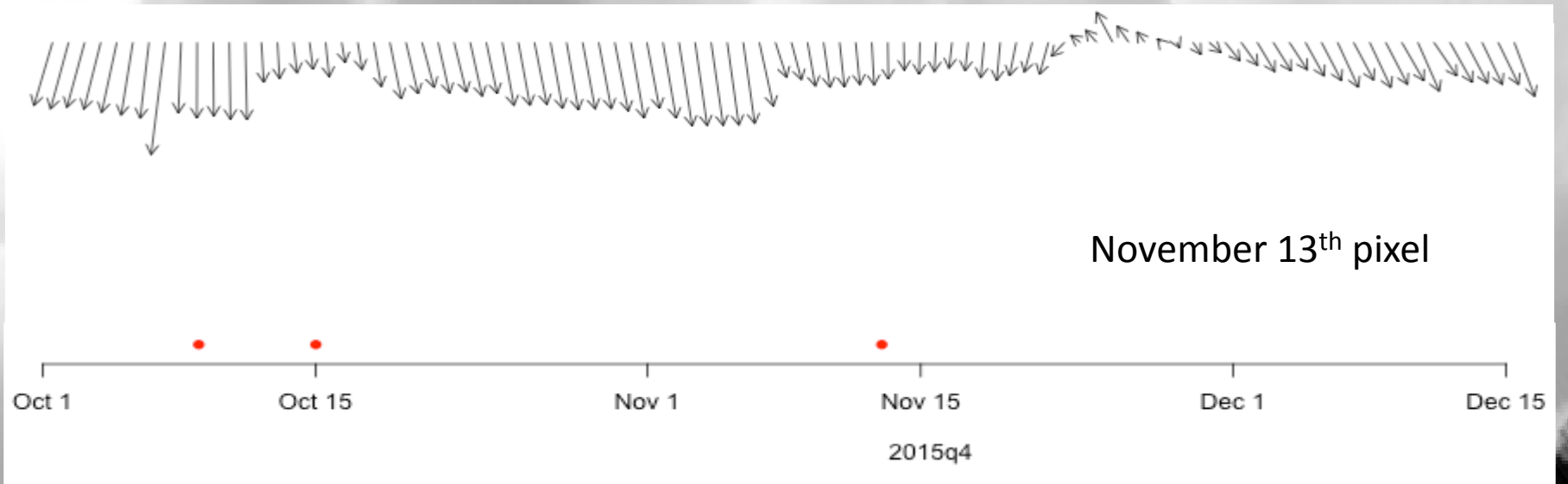
EverTREK 4 Oct 24-30, 2007



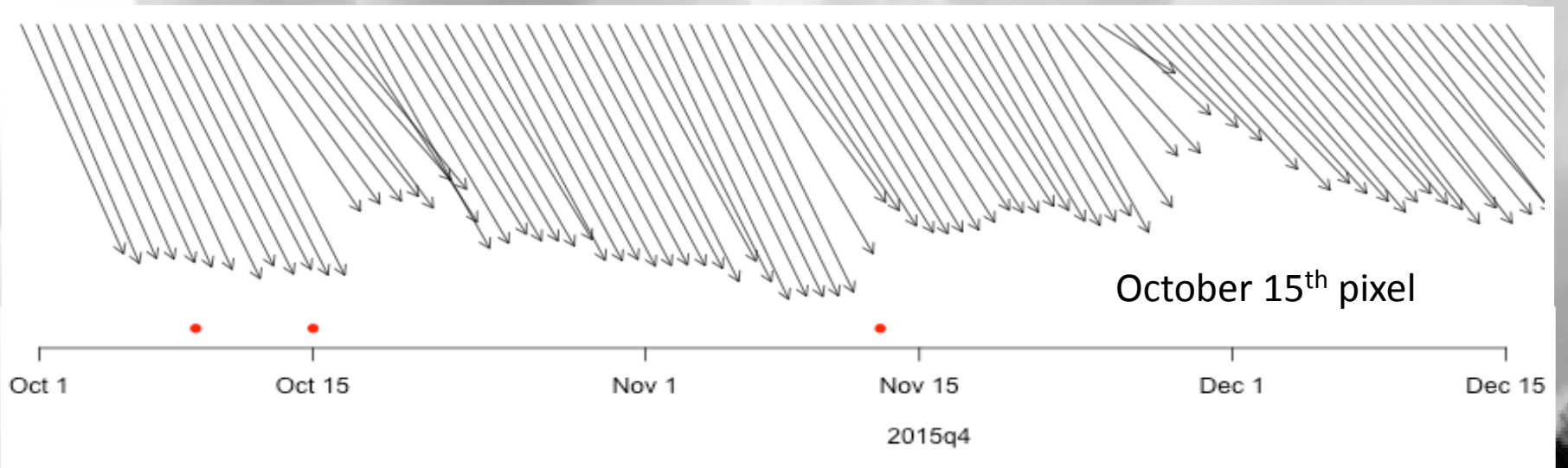
S-356 Pump Test Dye Studies



S-356 Pump Test Dye Studies



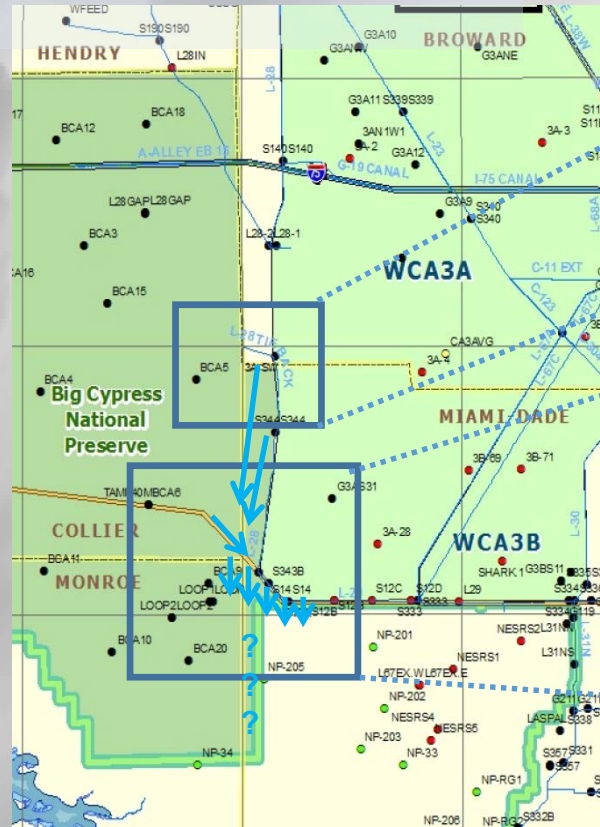
S-356 Pump Test Dye Studies



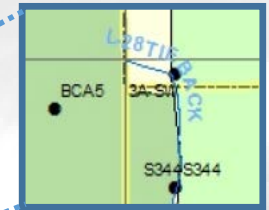
Application Example

L28 Canal

- Endangered Cape Sable seaside sparrow, subpopulation A (CSSS-A)
- Western flows on CSSS-A



L-28 Tieback Levee



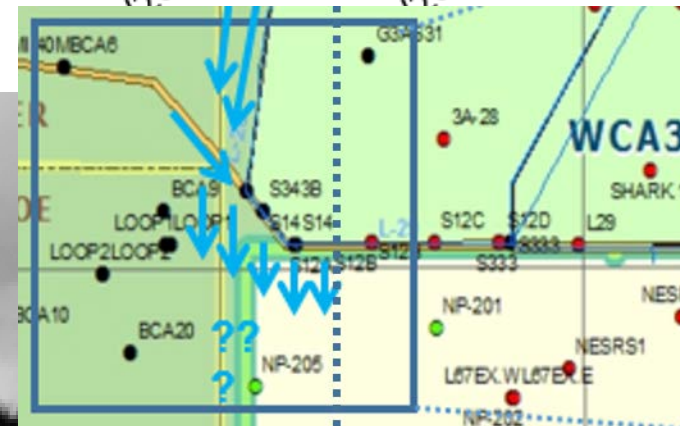
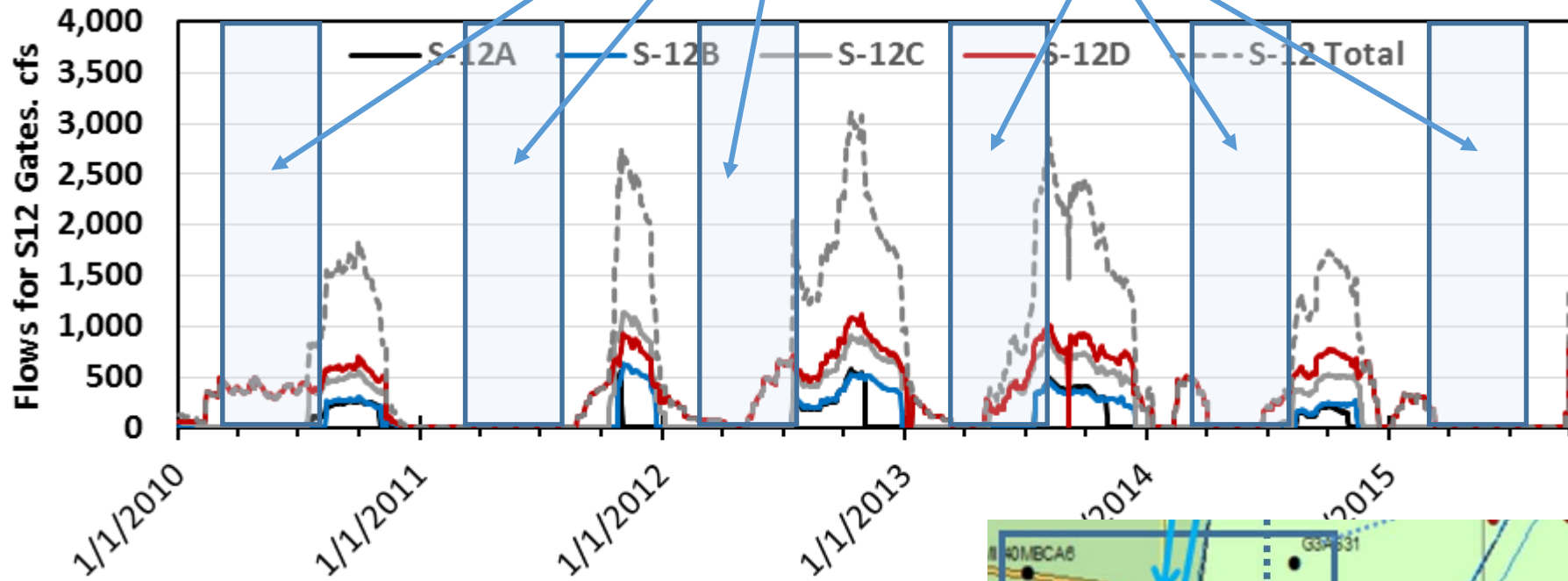
L-28 Levee; Tamiami Trail
40-mile and 50-mile be

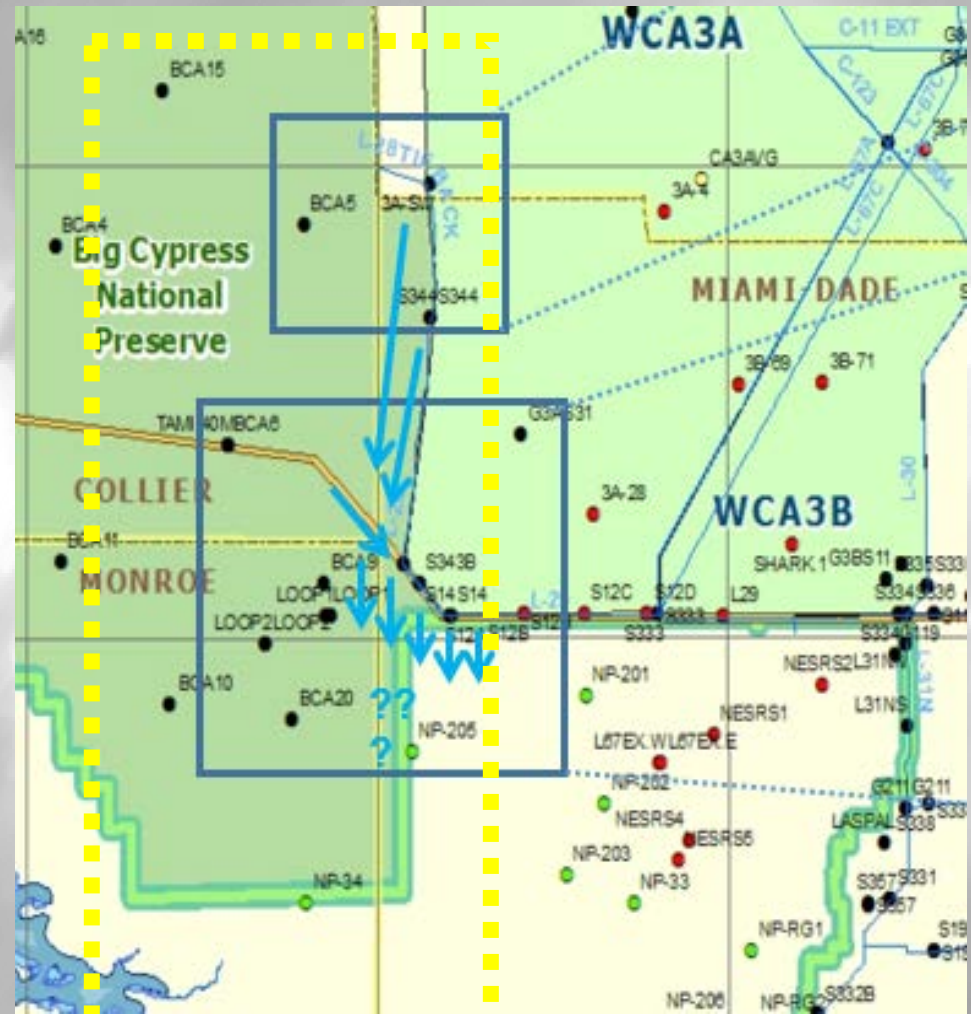
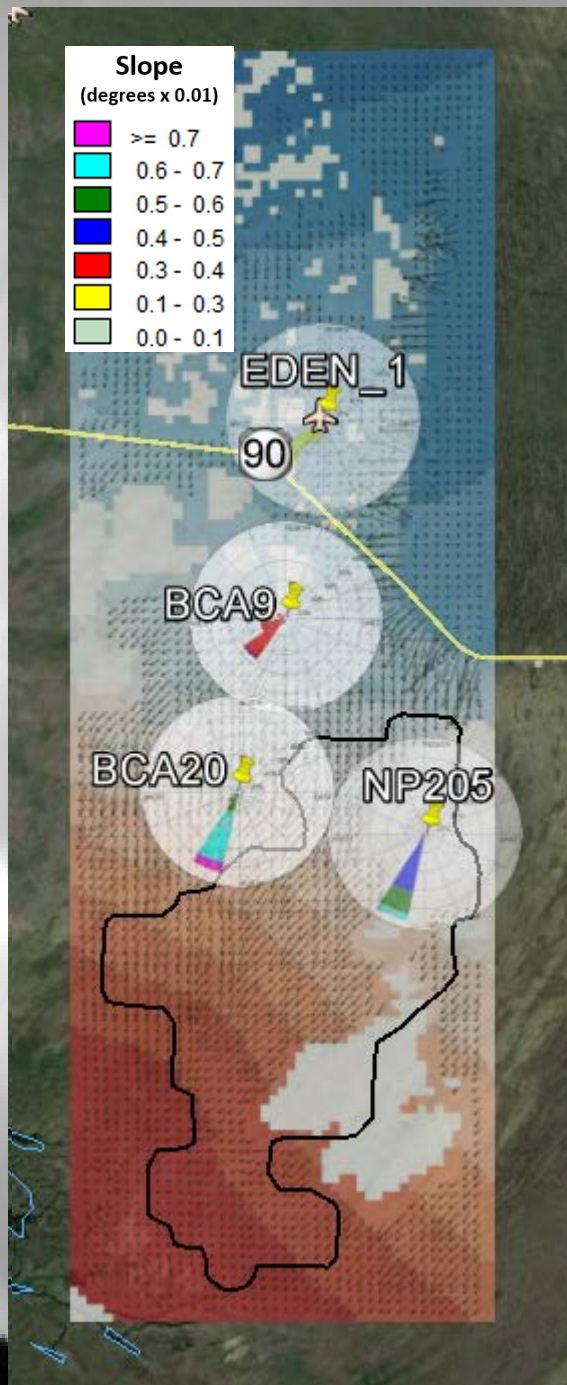


↓ Potential Western Flow Paths

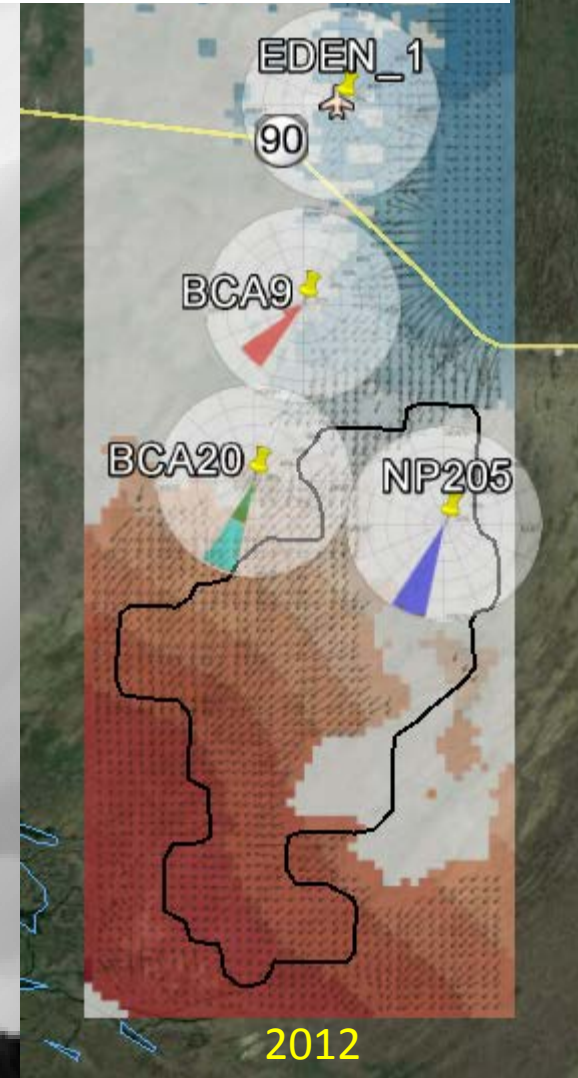
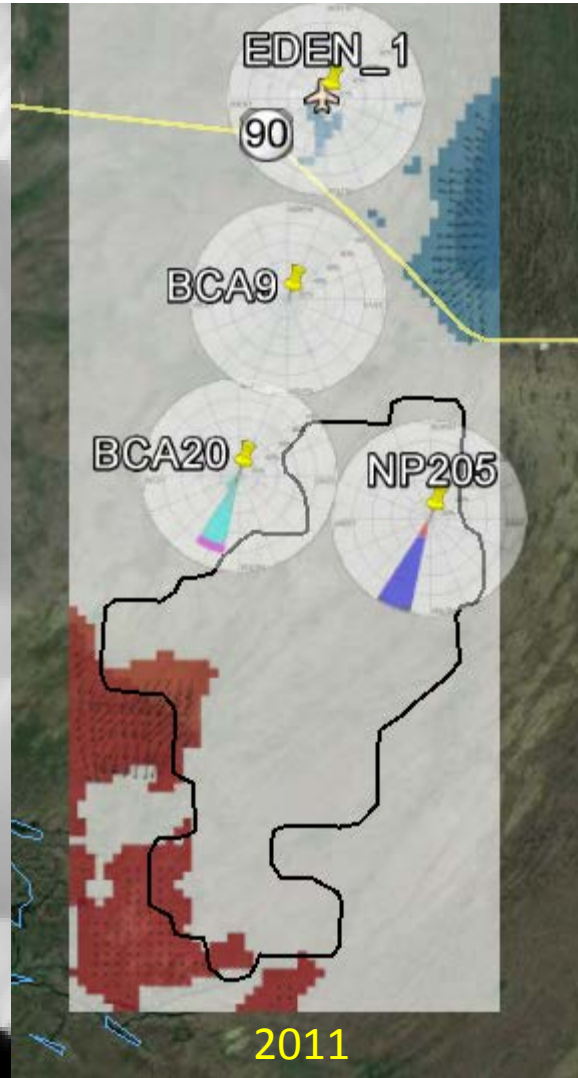
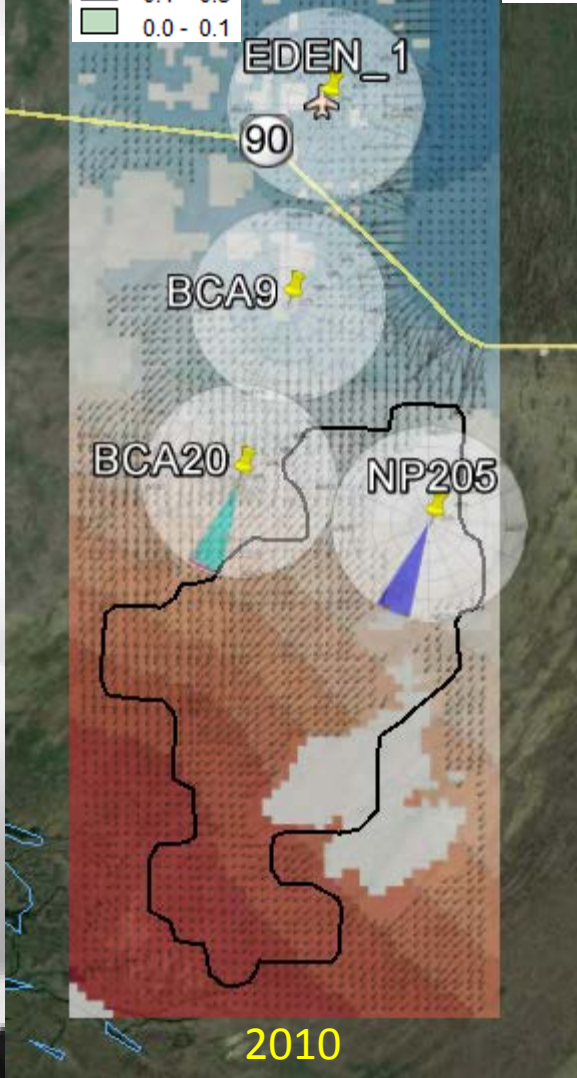
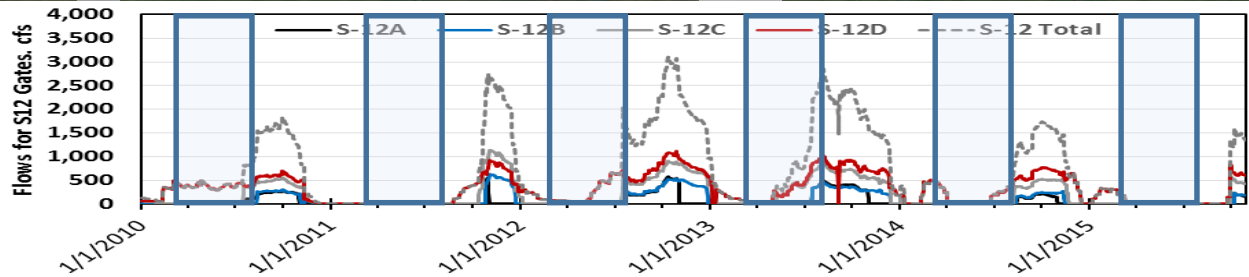
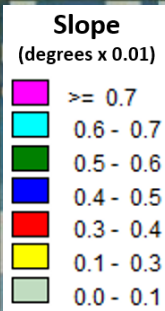
S12s Flows

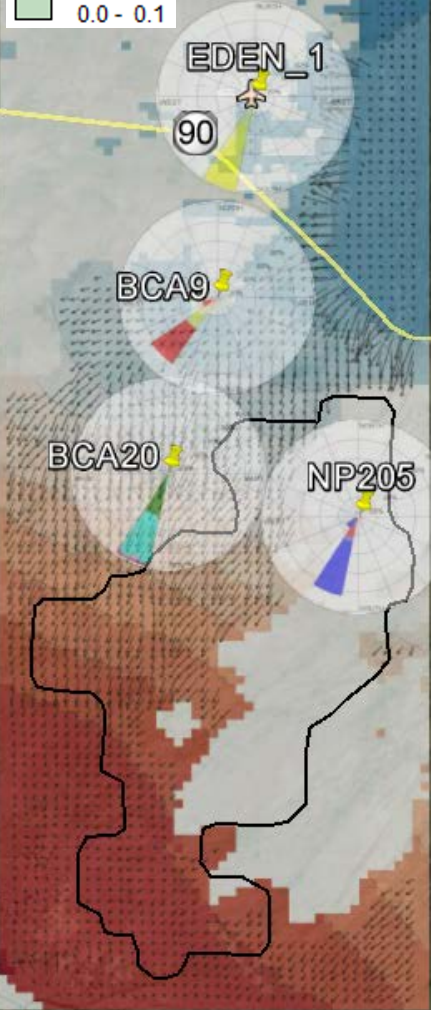
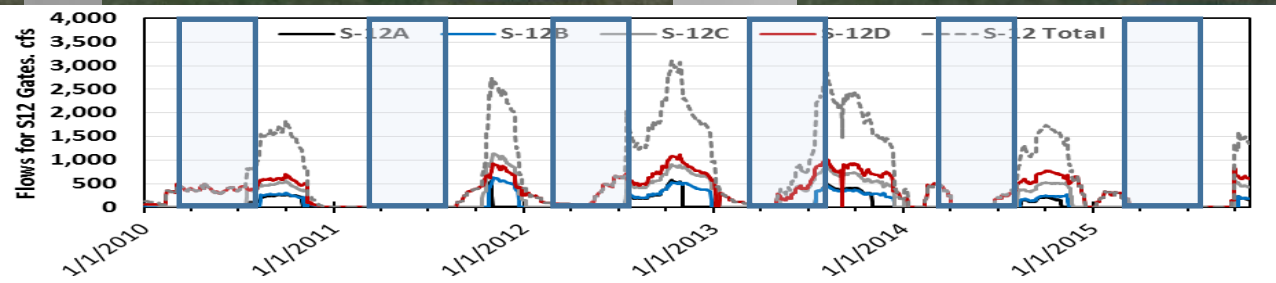
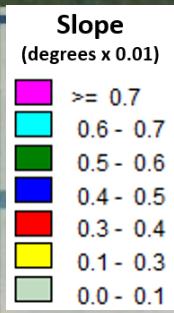
Nesting season
March 1 – July 15



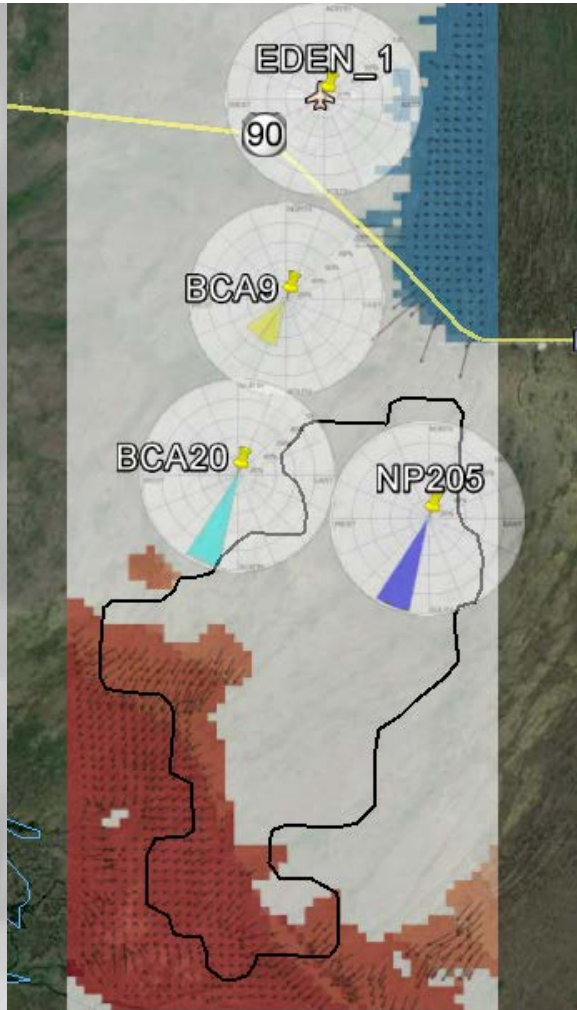


Rose Diagram – POR-NS
WLGV map 2010

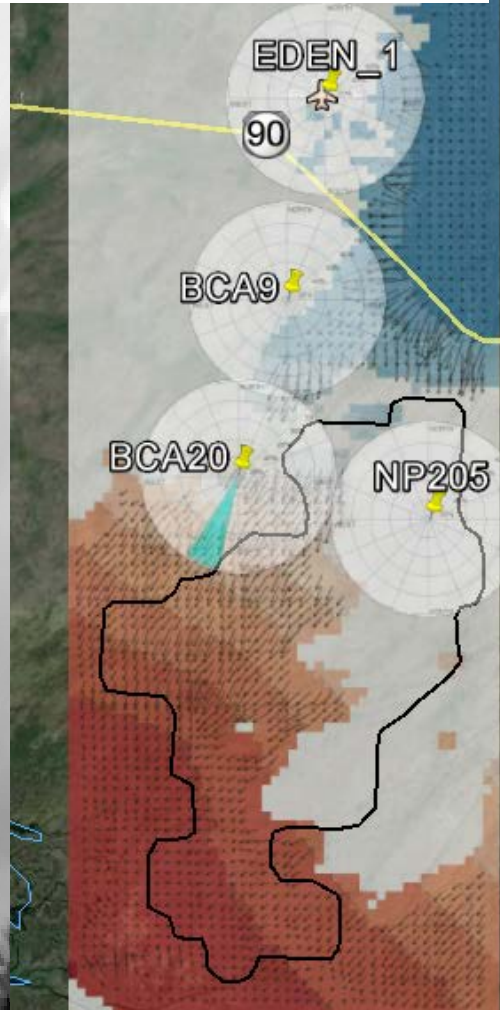




2013

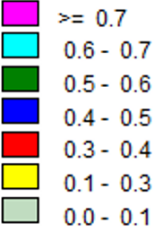


2014



2015

Slope (degrees x 0.01)



EDEN_1

90

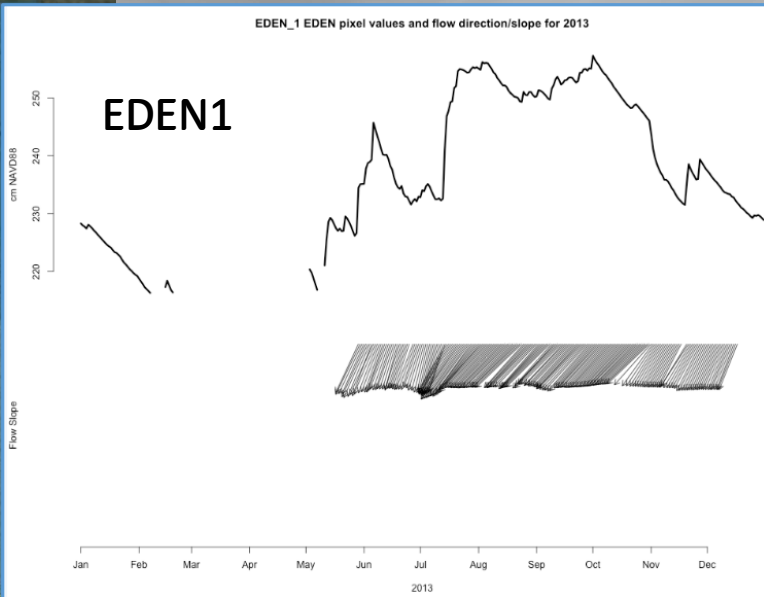
BCA9

BCA20

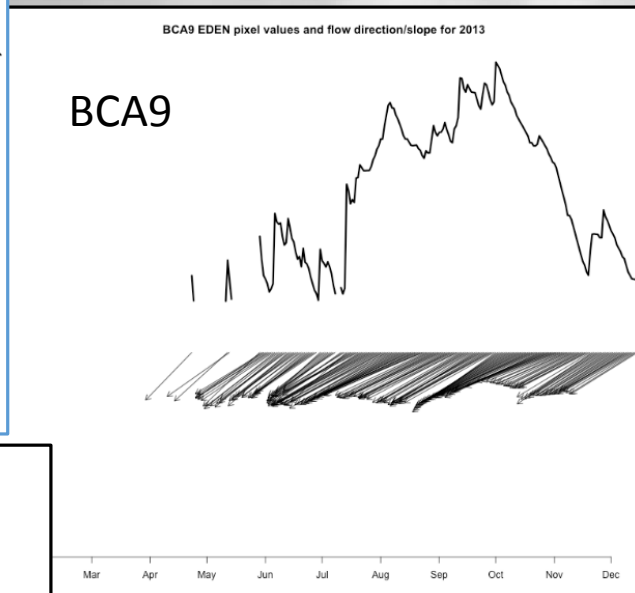
NP205

2013

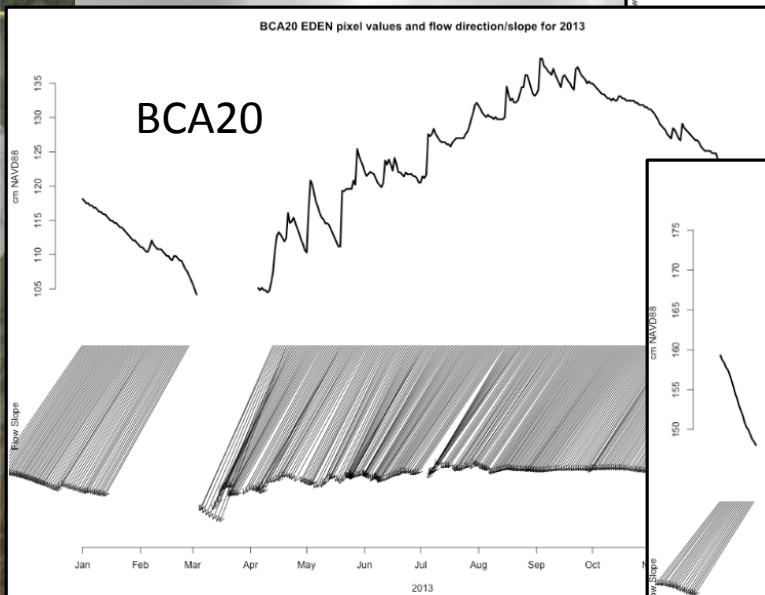
EDEN_1 EDEN pixel values and flow direction/slope for 2013



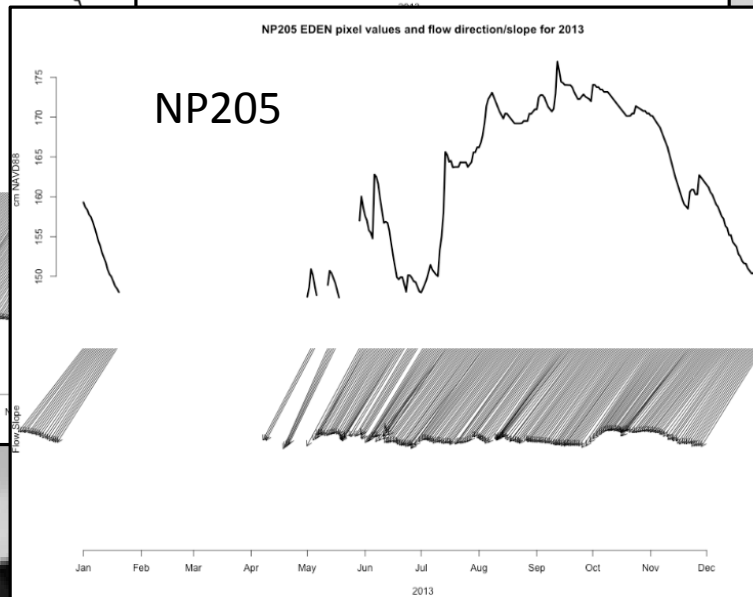
BCA9 EDEN pixel values and flow direction/slope for 2013



BCA20 EDEN pixel values and flow direction/slope for 2013



NP205 EDEN pixel values and flow direction/slope for 2013



Summary

- Water-level gradient vector (WLGV) visualization tools leverages EDEN model to provides insight to the magnitude and direction of sheet flow.
- Visual comparisons with dye studies shows approach is a good approximation of sheetflow.
- Tools able to look at large spatial areas to the grid/pixel level.
- Can use the approach to evaluate the interaction of hydrologic forcing/restrictions on sheetflow.

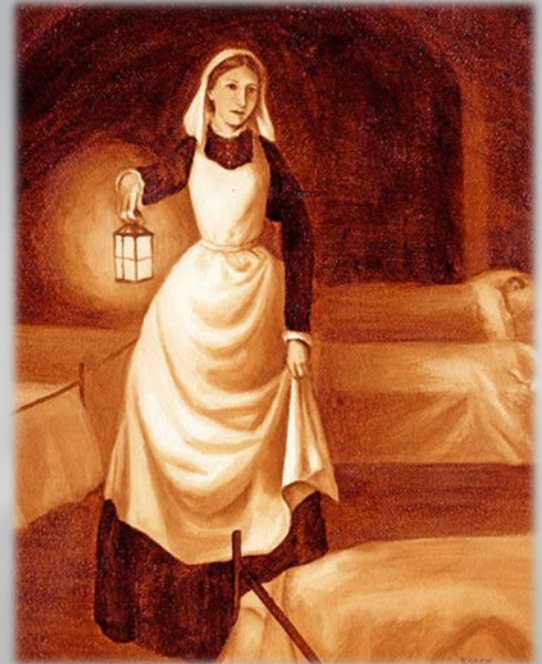
Thanks!

Contact Information:

Paul Conrads

803 750 6140

pconrads@usgs.gov



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