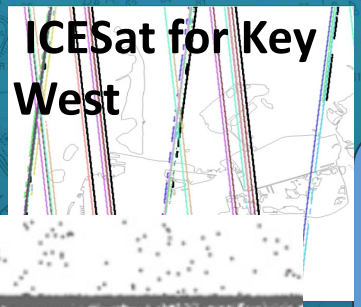
SDB Accuracy Assessment and Improvement Talking Points

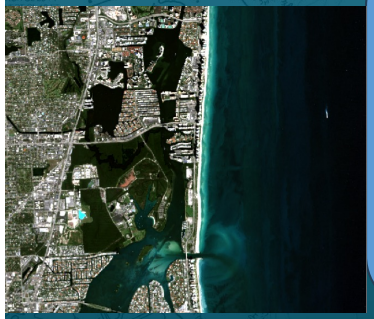
Kim Lowell – Geospatial Data Scientist

Centre for Coastal and Ocean Mapping/Joint Hydrographic Centre, University of New Hampshire

SDB Principles/Techniques



Spatially Incomplete "True" Depth



Spatially Complete (Multi-band) Imagery

"Magic" SDB Model

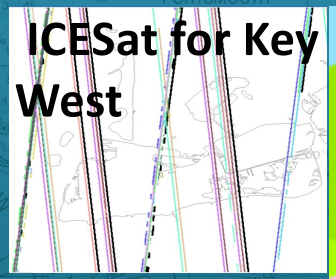
Apply to Imagery

Wall-to-Wall Depth

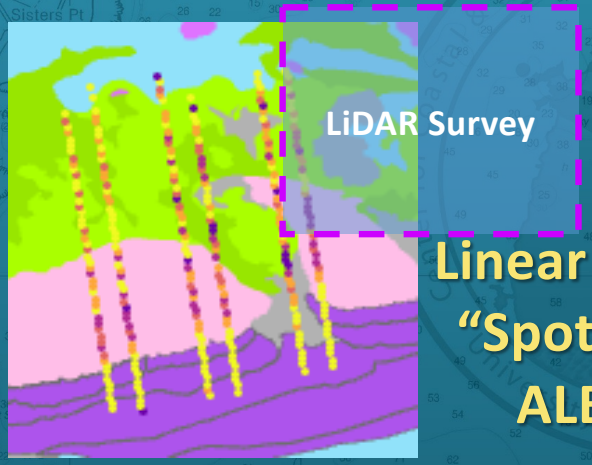
Accuracy Assess-ment

"True"/Reference data

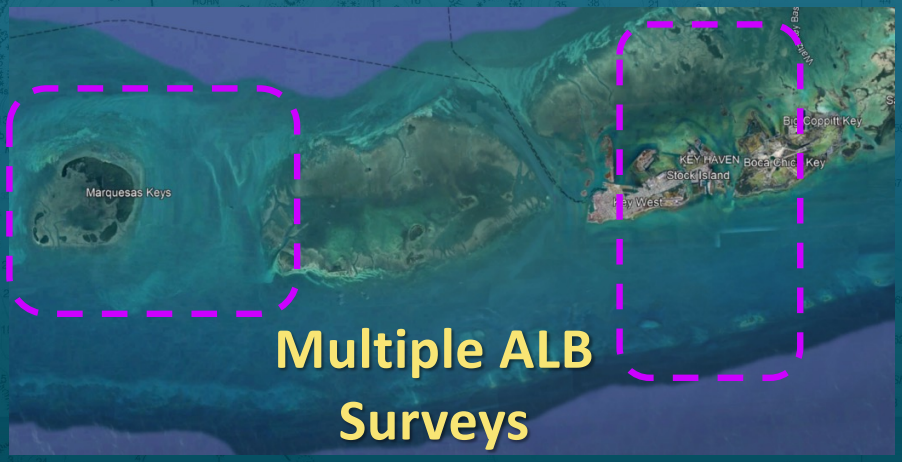
SDB Reference Depth Data



Linear ("ICESat-2") Only



Linear and "Spotty" ALB

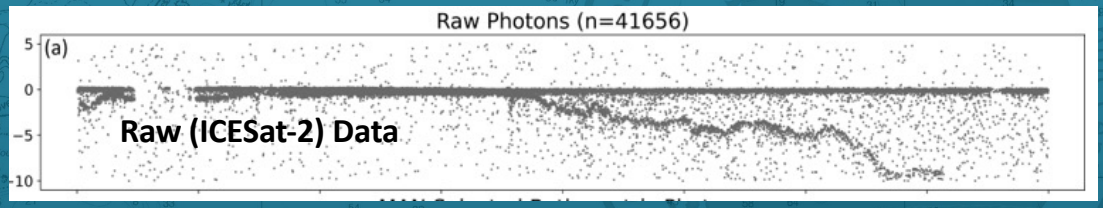


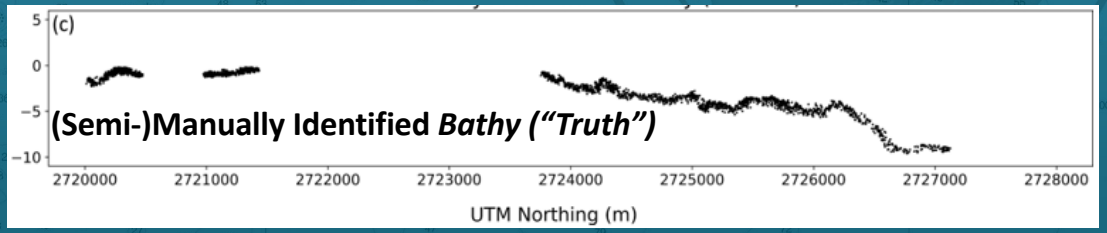
Multiple ALB Surveys

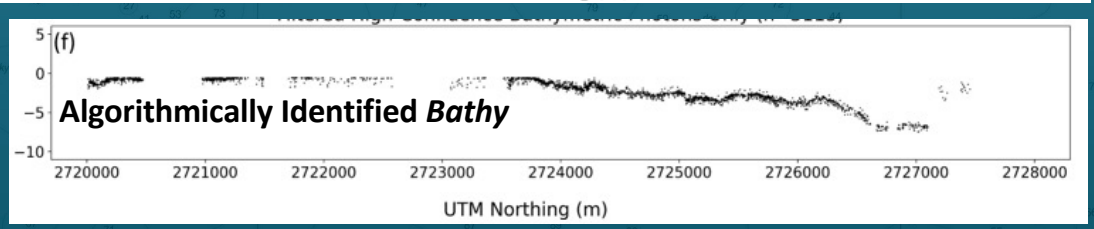
Sampling scheme is critical to meaningful accuracy information

Bathymetry Extraction Uncertainty

- How good is *Bathy/NotBathy* identification?
  - Can use confusion matrix + statistics







"True":

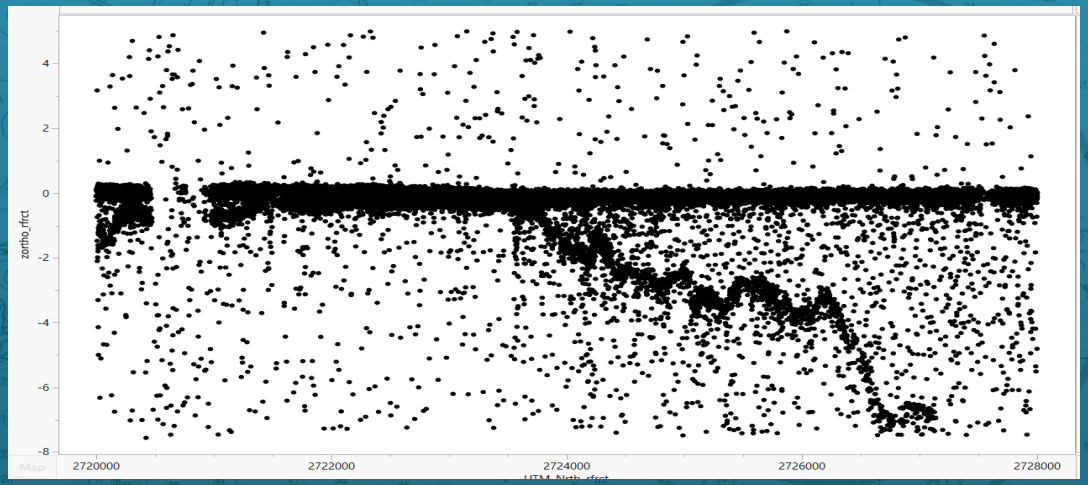
Algorithm:	NotBathy	Bathy	TOTAL
NotBathy	4562949	10826	4573775
Bathy	428000	1468412	1896412
TOTAL	4990949	1479238	6470187

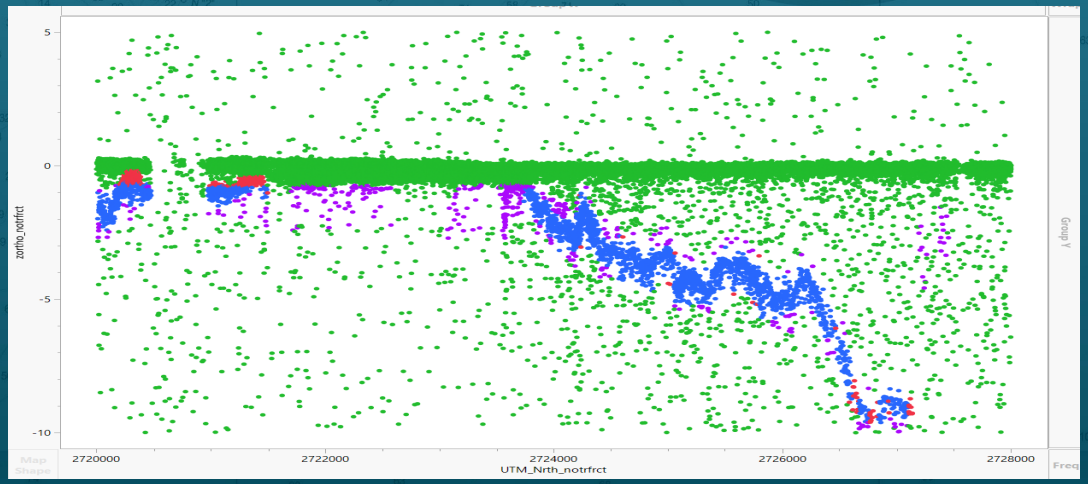
Global Accuracy: 0.932

	True	False	User's	Producer's	F1
NotBathy	0.914	0.086	0.998	0.914	0.954
Bathy	0.993	0.007	0.774	0.993	0.87

Accuracy Assessment: Soundings Level

		"True" Bathy	"True" NotBathy	Total
	Bathy	2620	495	3115
Algori	NotBathy	532	38009	38541
	Total	3152	38504	41656
		Global	0.975	





What about depth?

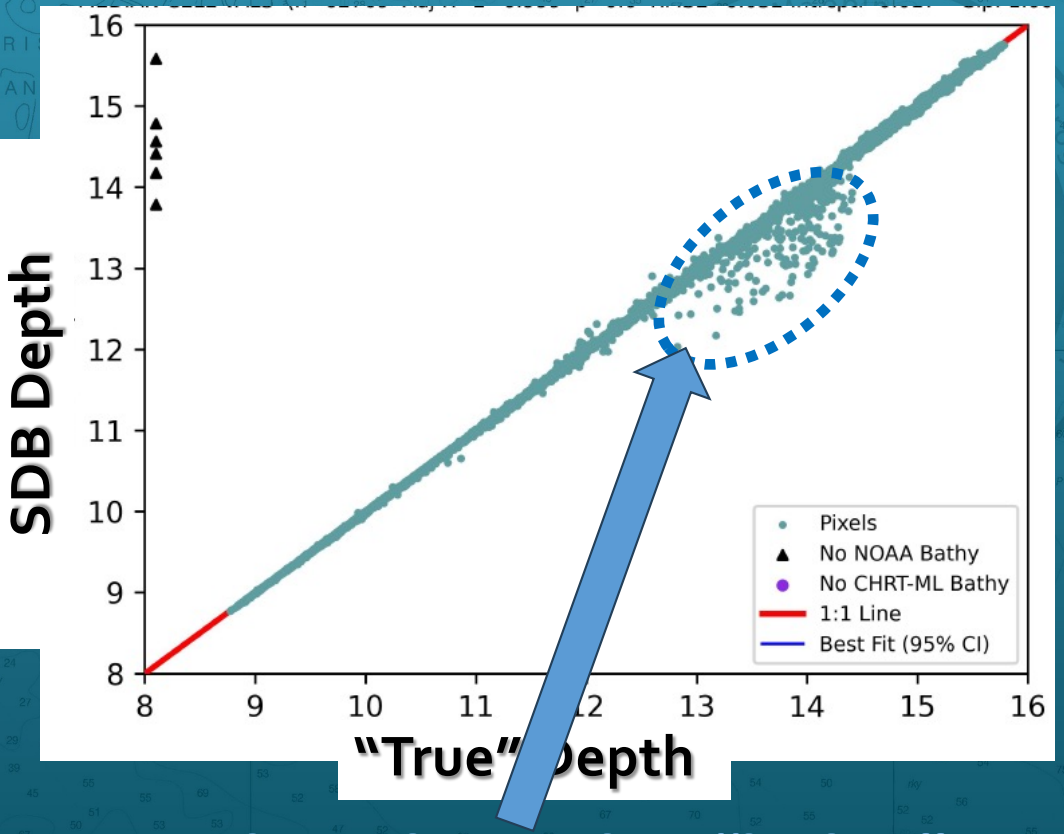
More useful….

Statistics

- RMSE: 3 cm
- R^2: 0.999

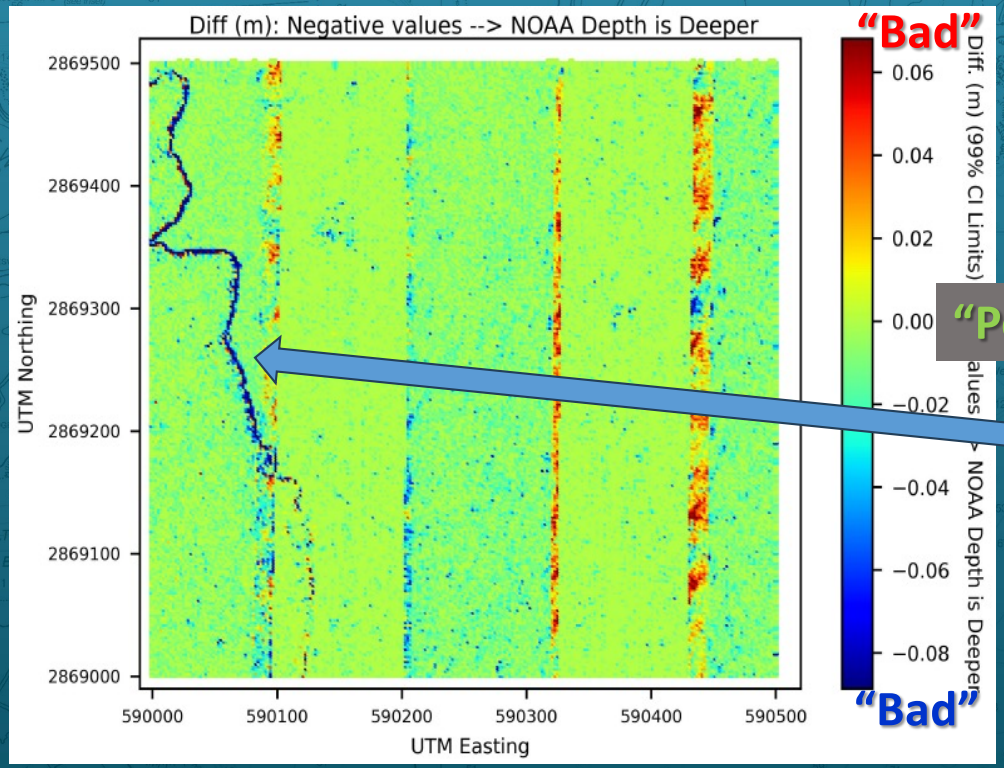
But there's more….

- Line of best fit almost perfect:
  - Slope: 1.0
  - Intercept: -2 cm

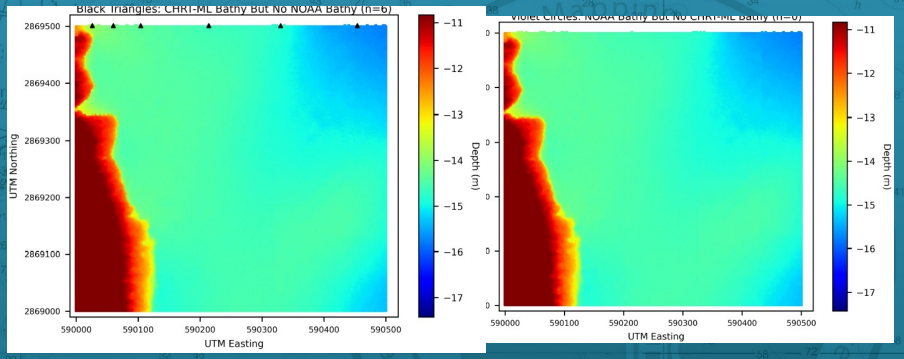


But what about this "bulge" at 13 m?

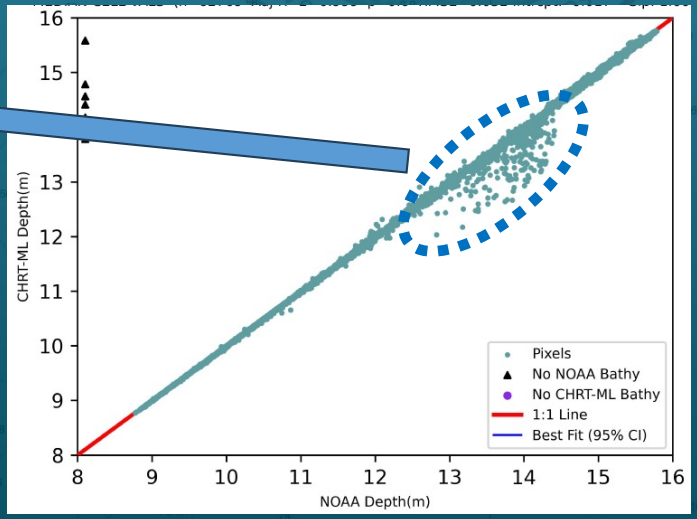
SDB Depth Difference Map



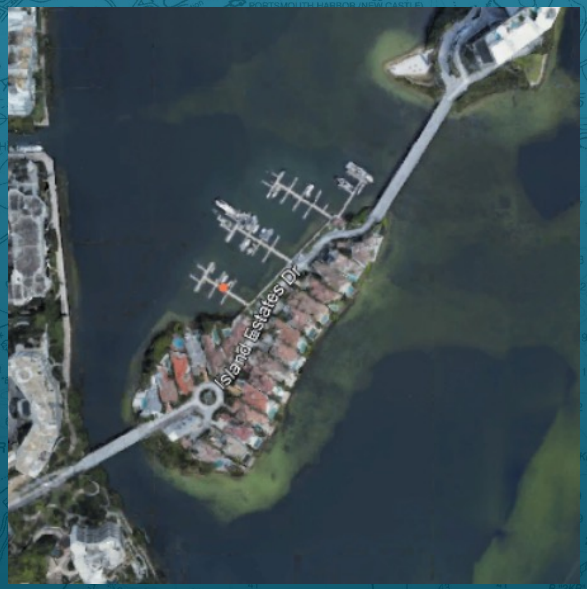
"Perfect"

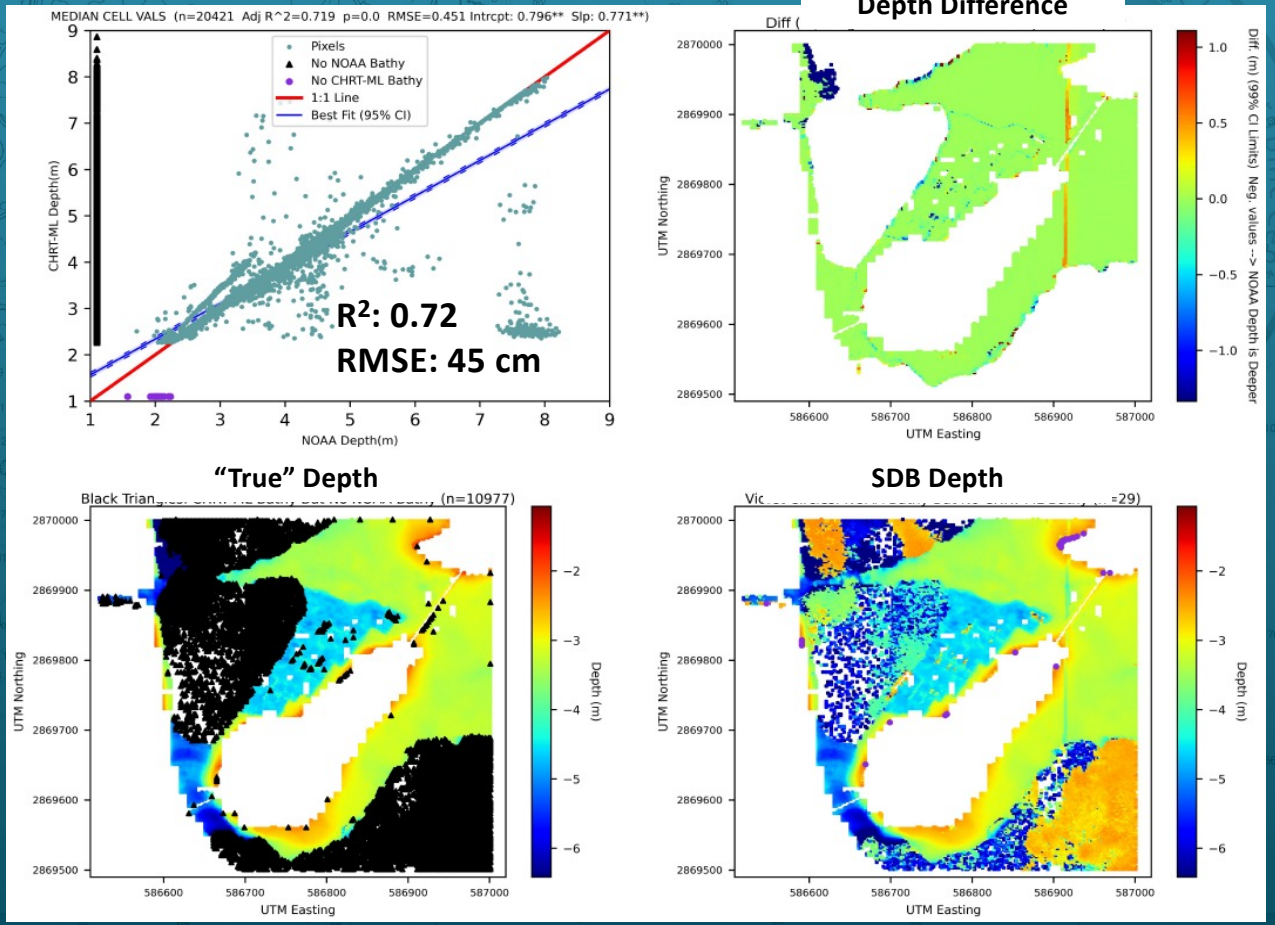


"True" SDB

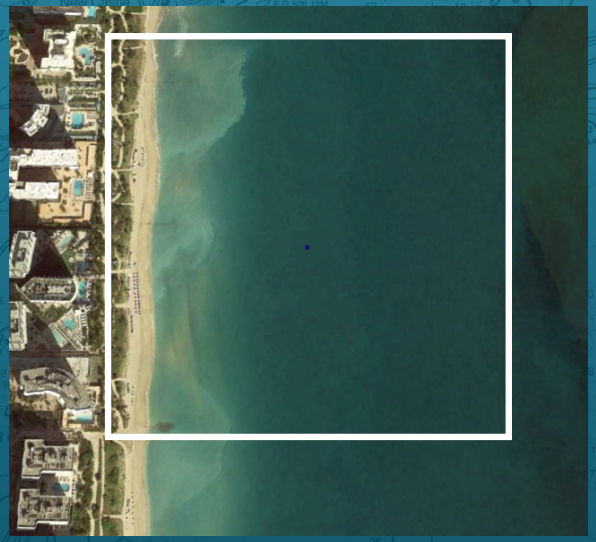


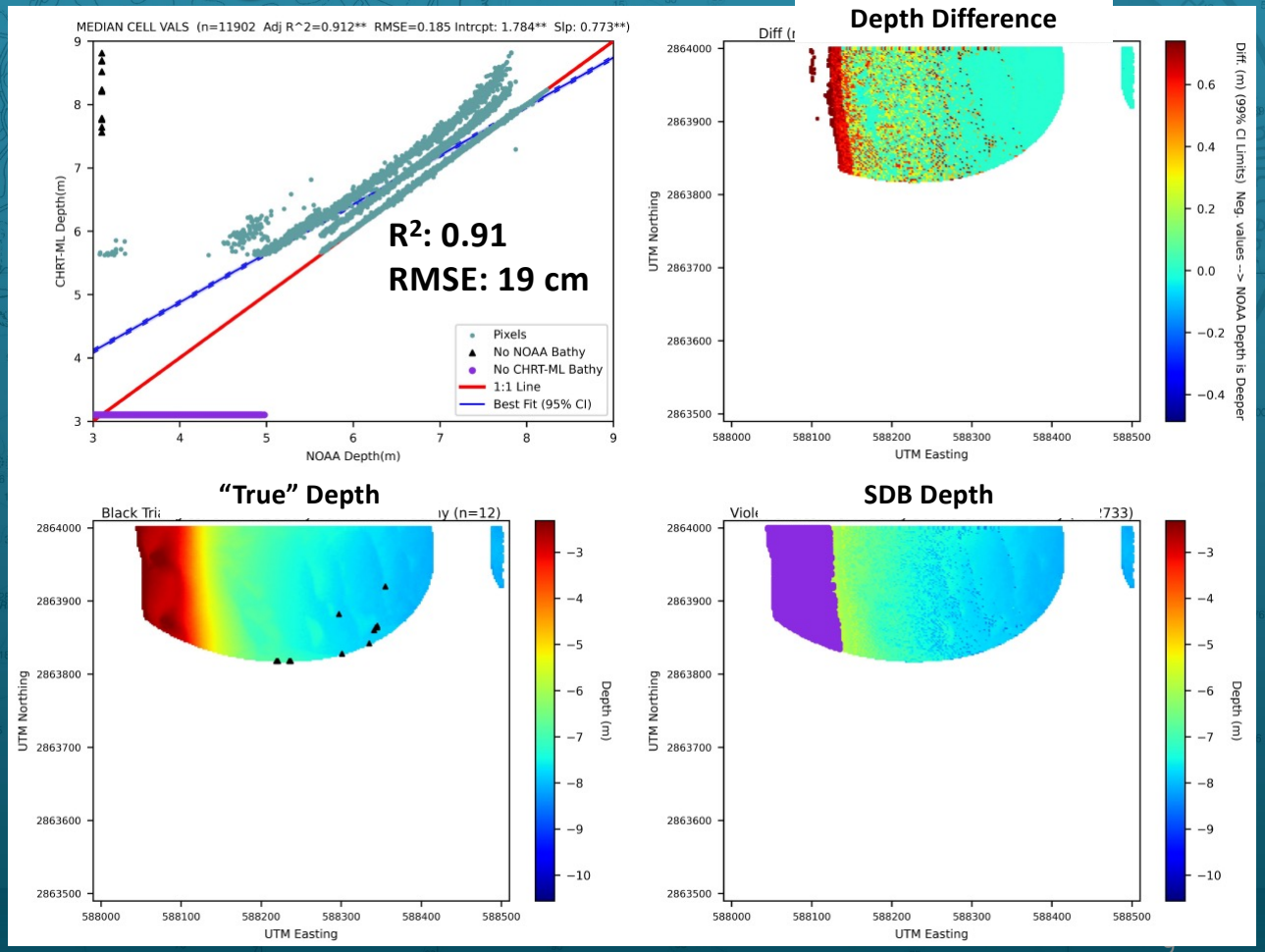
More comprehensive ….



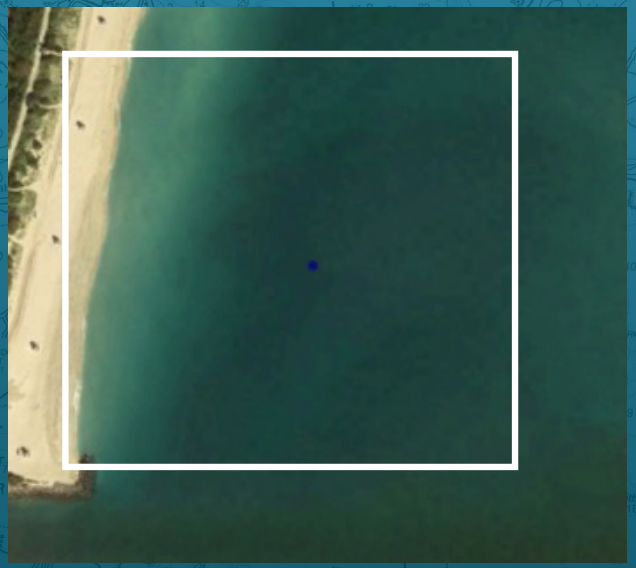


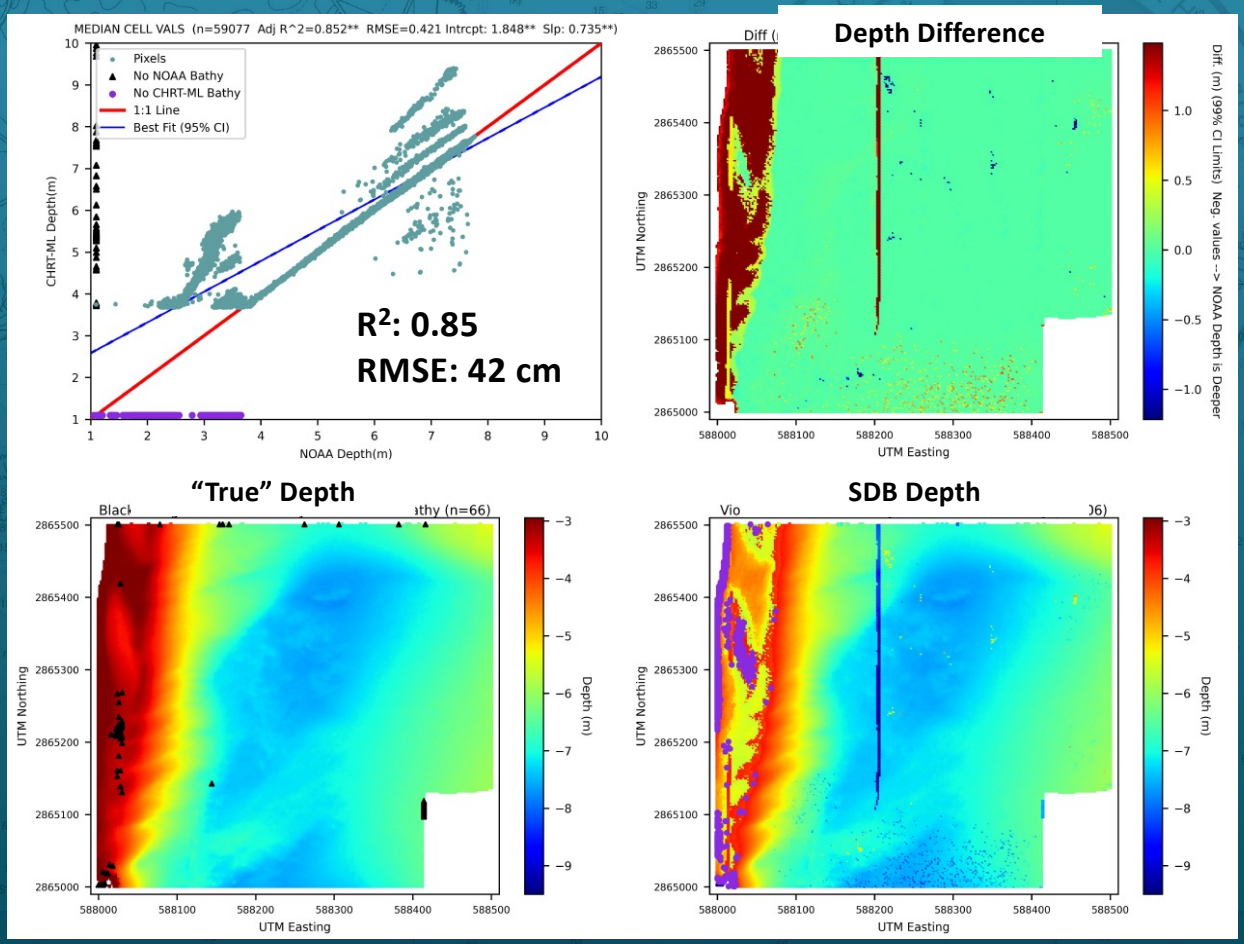
Example: Edge of Flight Path





Example: Shallow Area Problems. Tides?





"Meta Analysis" of Uncertainty

- How does SDB uncertainty relate to:
  - Depth (esp. shallow)
  - Geomorphology
  - Distance from a harbor
  - Turbidity
  - Shipping lanes
  - Substrate…
  - Distance from land
  - Spatial clustering

Channels

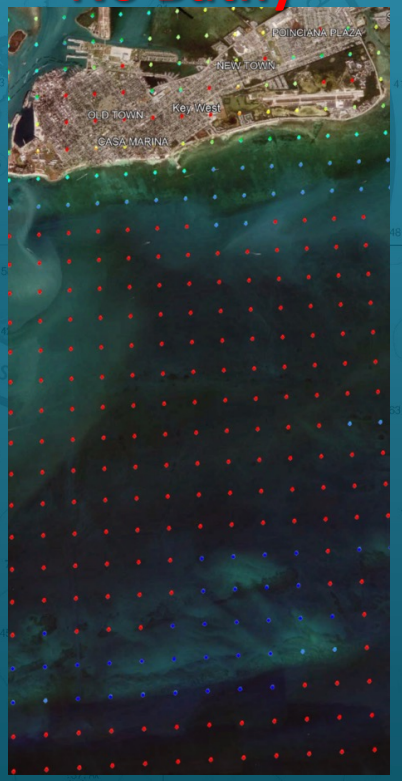
Sea Grass

Shipping/ Infrastructure

Dredging

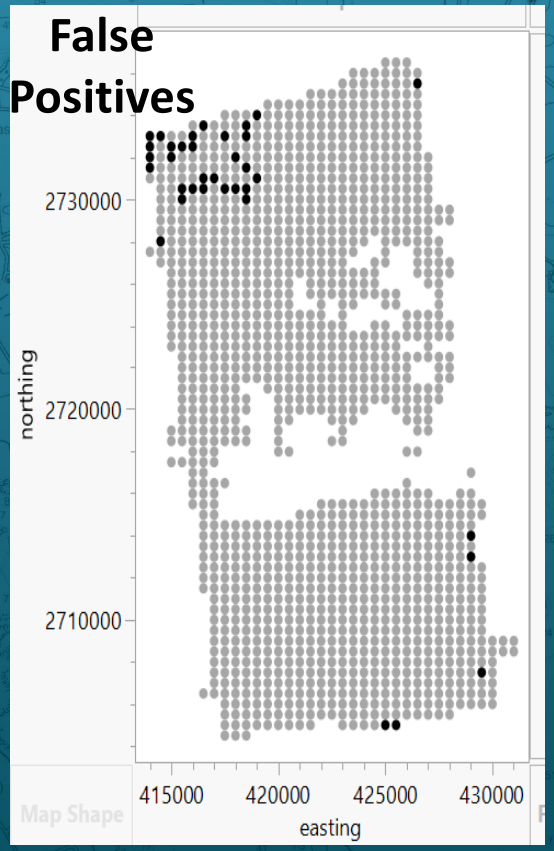
ALB Tile Centres

No Bathy

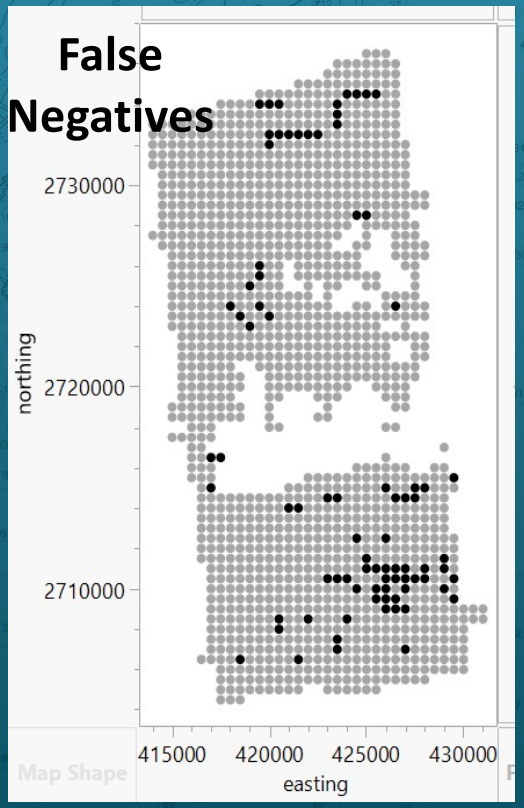


Model-based *p*(Bathy Present)

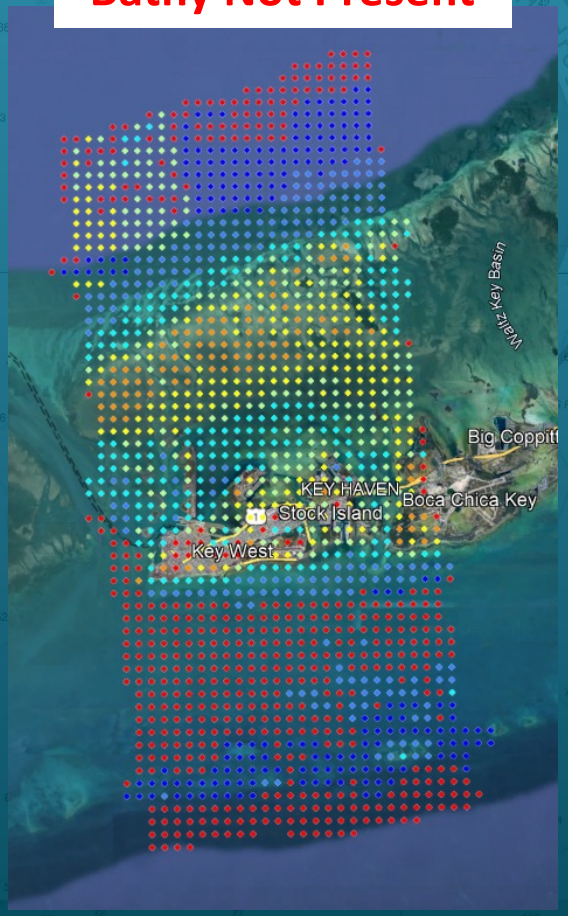
False Positives



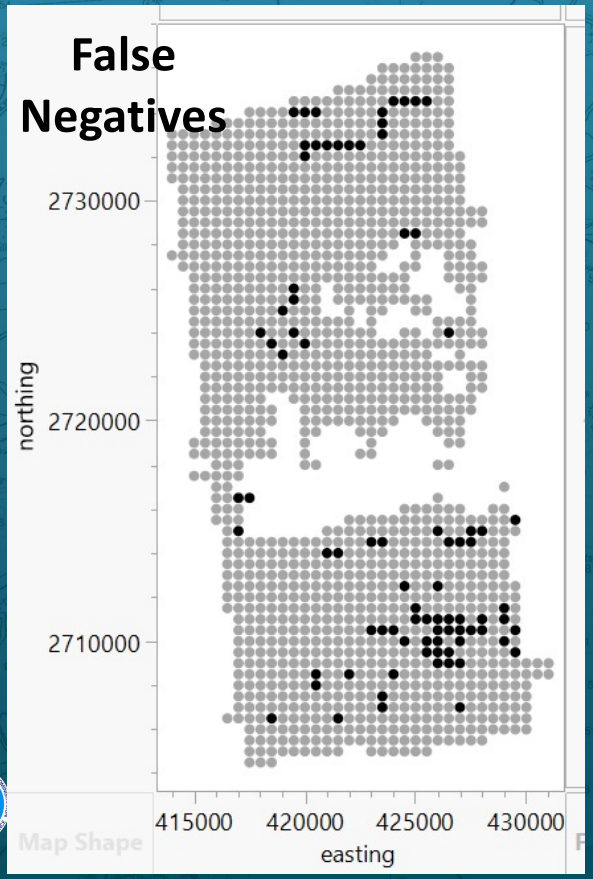
False Negatives

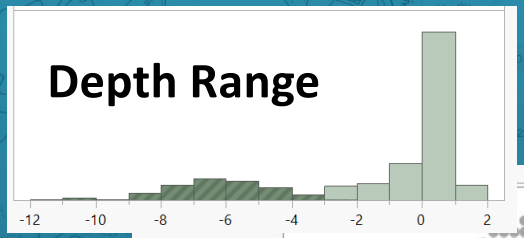


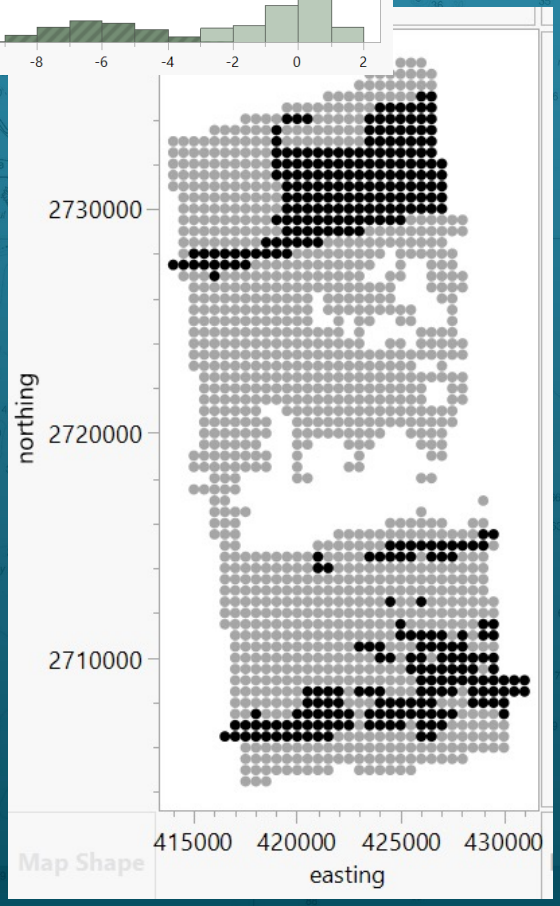
Bathy Not Present



FNs vs Depth


False Negatives
2730000
2720000
2710000
northing
415000
420000
425000
430000
easting
Map Shape


Depth Range
-12
-10
-8
-6
-4
-2
0
2


2730000
2720000
2710000
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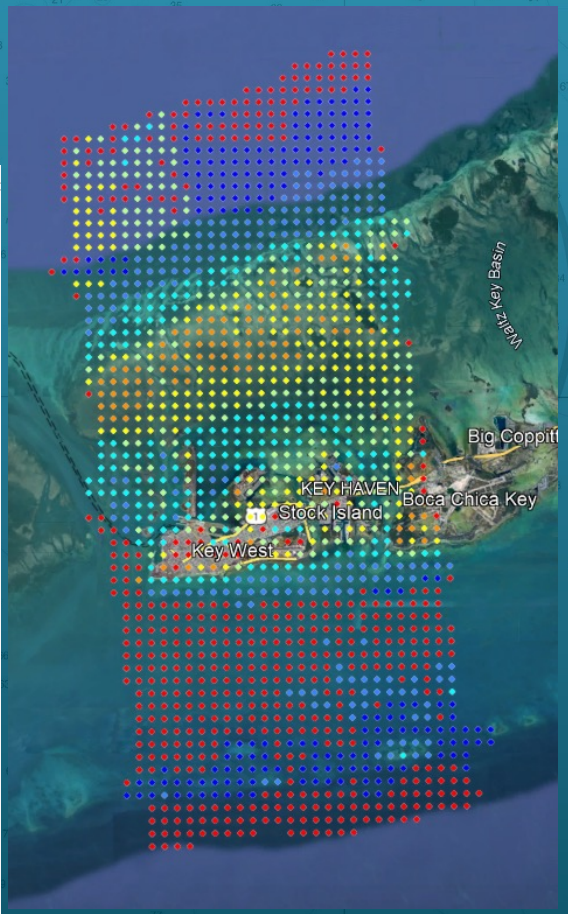
415000
420000
425000
430000
easting
Map Shape

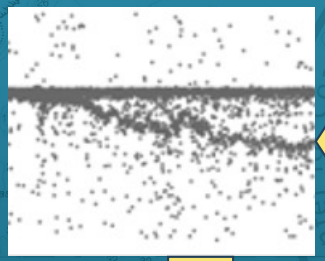

West Key Basin
Big Coppitt
KEY HAVEN
Stock Island
Boca Chica Key
Key West

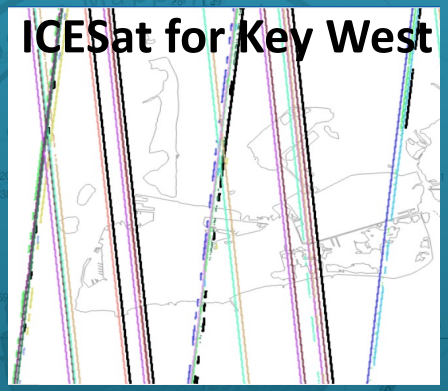
Broader Context: Quality Assurance & Continuous Improvement

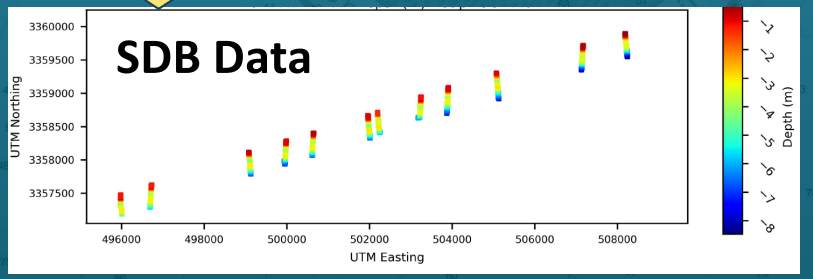
- For ALB Tiles – i.e., wall-to-wall coverage
  - Sample "20%" of tiles (probably not random?)
  - Bathymetric Extractions:
    1. SOPs
    2. Independent: (Nearly) 100% automated classification (CHRT-ML)
  - Spatial and Statistical Comparison
  - "Meta-analysis" on uncertainty. Accuracy relative to:
    - Depth, distance from land/extinction depth, presence of channels….

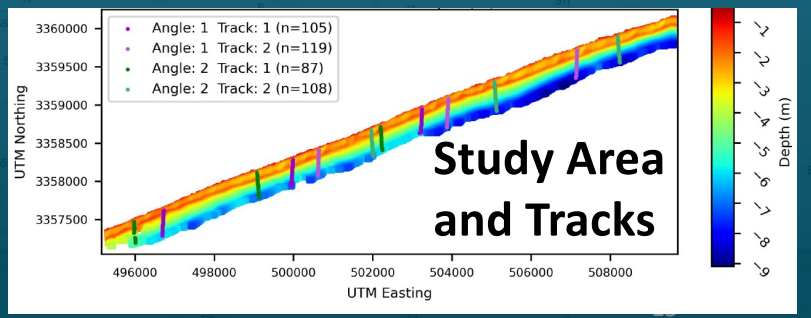
Broader Context: ICESat-2 SDB (1)

- **Not** wall-to-wall coverage
  - Extract Bathymetric "photon events"
  - Split tracks into Train/Test (randomly?)
  - Fit SDB model on Train; verify on Test
  - Compare statistically and spatially
  - "Meta-analysis" on uncertainty relative to:
    - Depth, distance from land/extinction depth, presence of channels….









Discussion, thoughts, organizational contexts…?

GERRISH
ISLAND
PORTSMOUTH
HARBOR
Kittery
Pepperrell Cove
Gooseberry
Island
Fishing
Sisters Pt
Salamander Pt
Fort Pt
New Castle
NEW CASTLE ISLAND
Boatswain Hill
Stielman Rks
CUPOLA
Wood I
TOWER
Sewards Cove
East Sister
West Sister
White I
White I Reef
Phillips Rk
Kitts Rks
LITTLE
HARBOR
Frost Pt
Odiornes Pt
NEW HAMPSHIRE
MAINE
Center for Coastal & Ocean Mapping Joint Hydrographic Center
University of New Hampshire
CCOM
JHC