# Coastal ocean response to Hurricanes Ian and Idalia as revealed through coordinated observations and models

Y. Liu, R.H. Weisberg, J.A. Law, L. Zheng, J. Chen, S. John, K. Qiao, H. Xu
College of Marine Science, University of South Florida, St. Petersburg, Florida, USA

1. Coastal ocean observing & modeling

Sustained 26+ years of coastal ocean observing system on the West Florida Shelf: surface buoys (real-time) and subsurface moorings with ADCPs measuring current velocity, water temperature and salinity. Buoys also measure full set of meteorological variables.
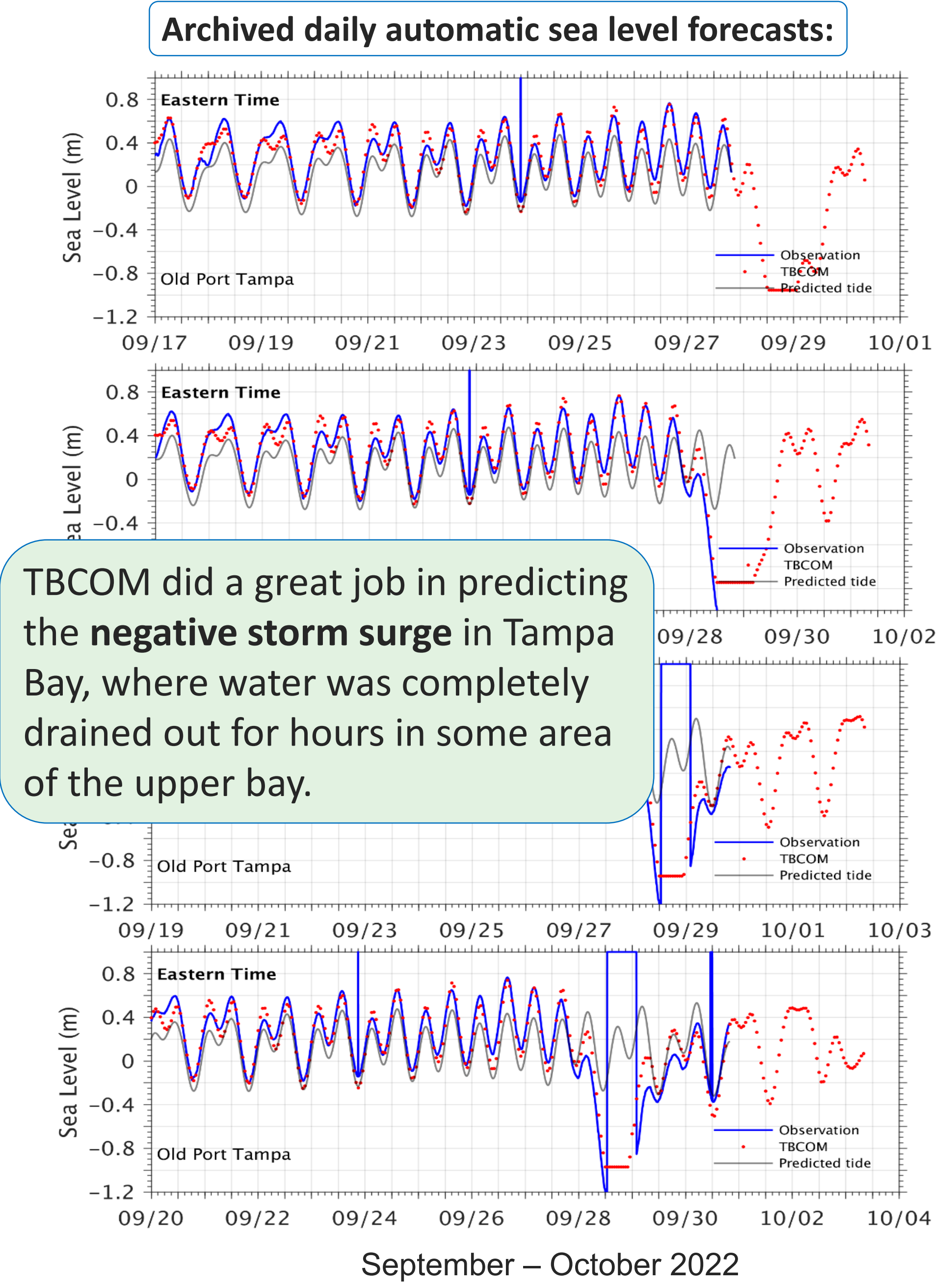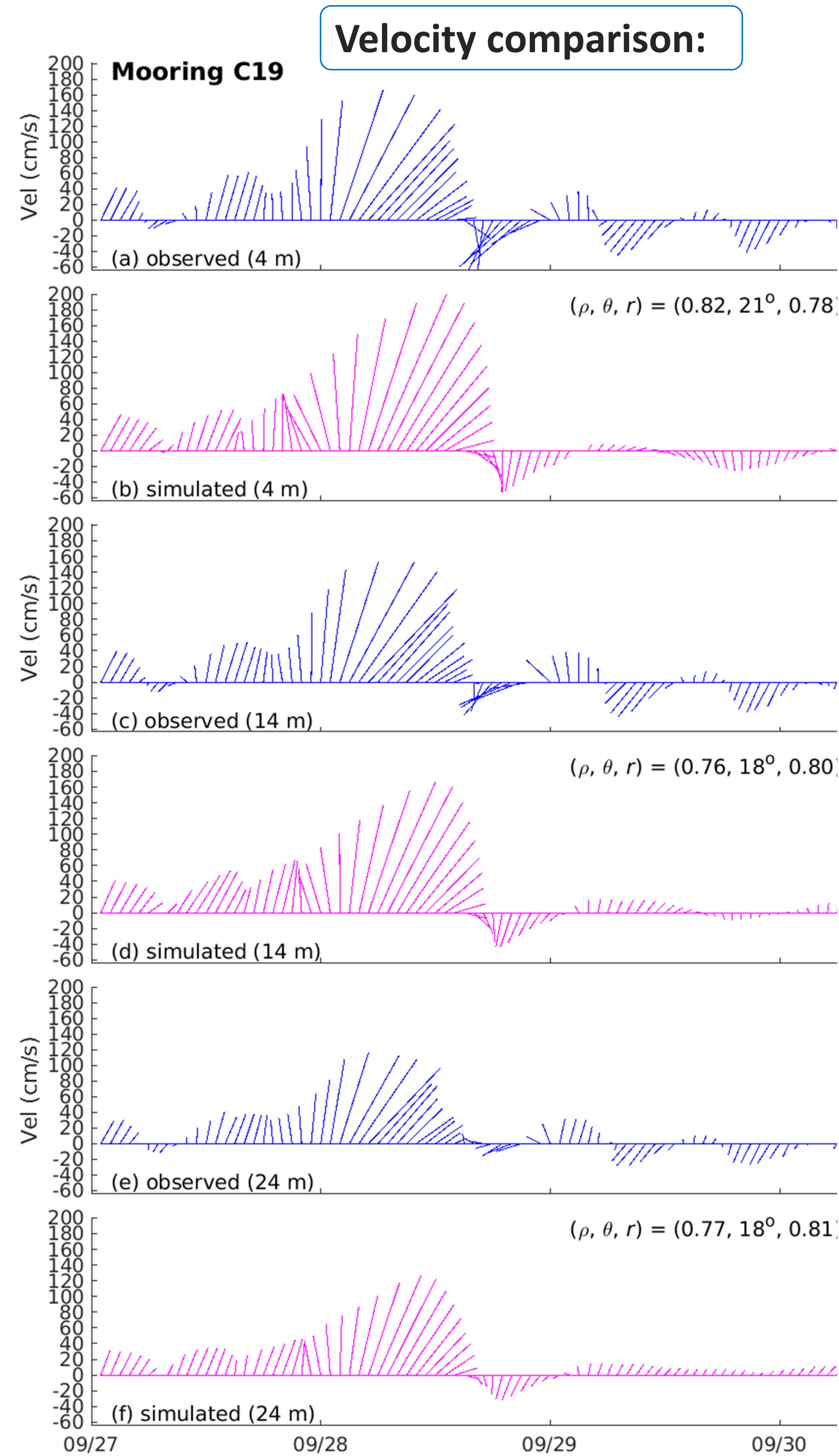
Nowcast/forecast models: West Florida Coastal Ocean Model (WFCOM), and very high-resolution Tampa Bay Coastal Ocean Model (TBCOM). By nesting in HYCOM, WFCOM downscales from the deep ocean, across the continental shelf and into the estuaries, TBCOM further downscales into Tampa Bay by nesting in WFCOM, providing realistic simulation of ocean circulation.
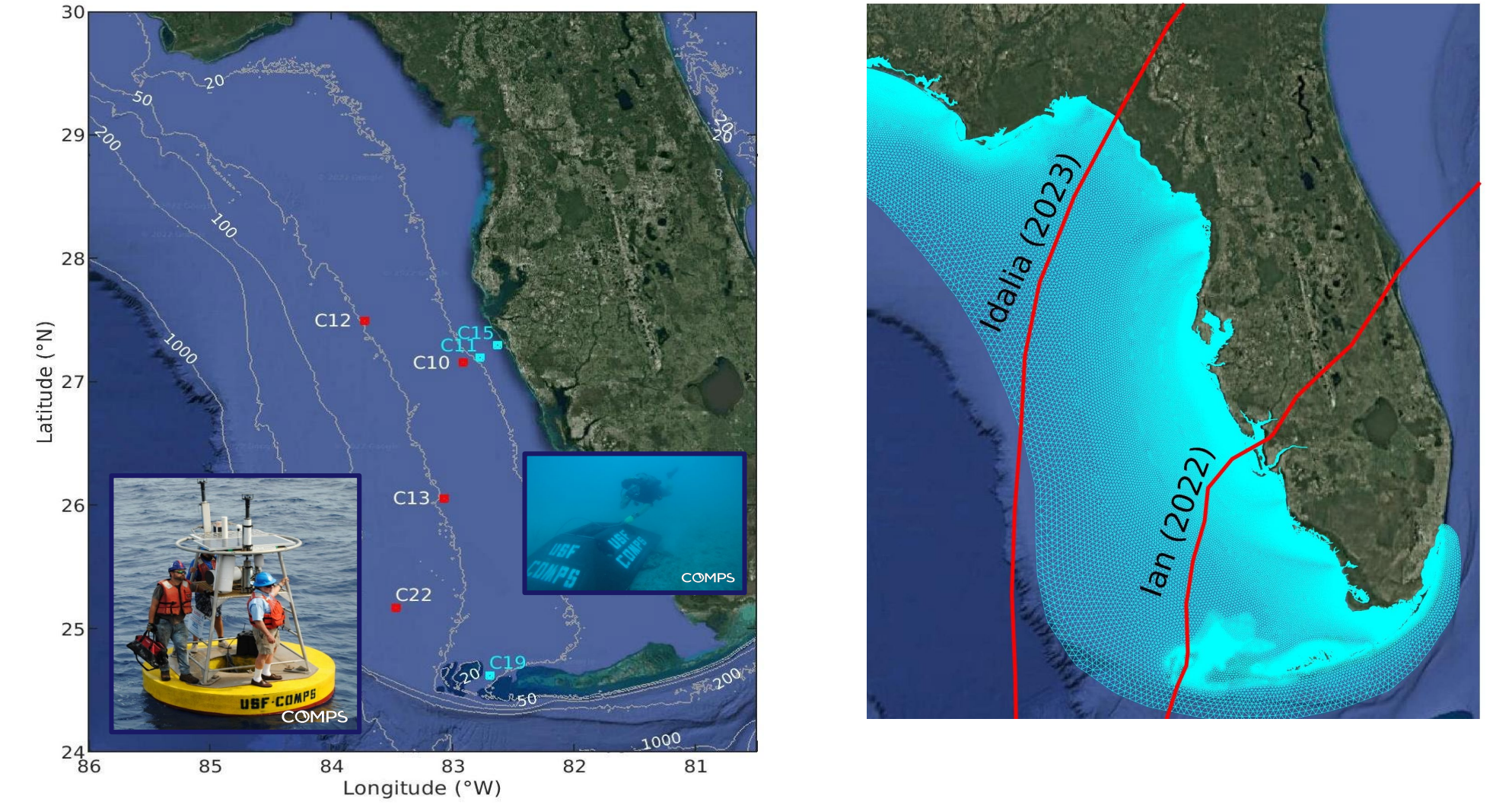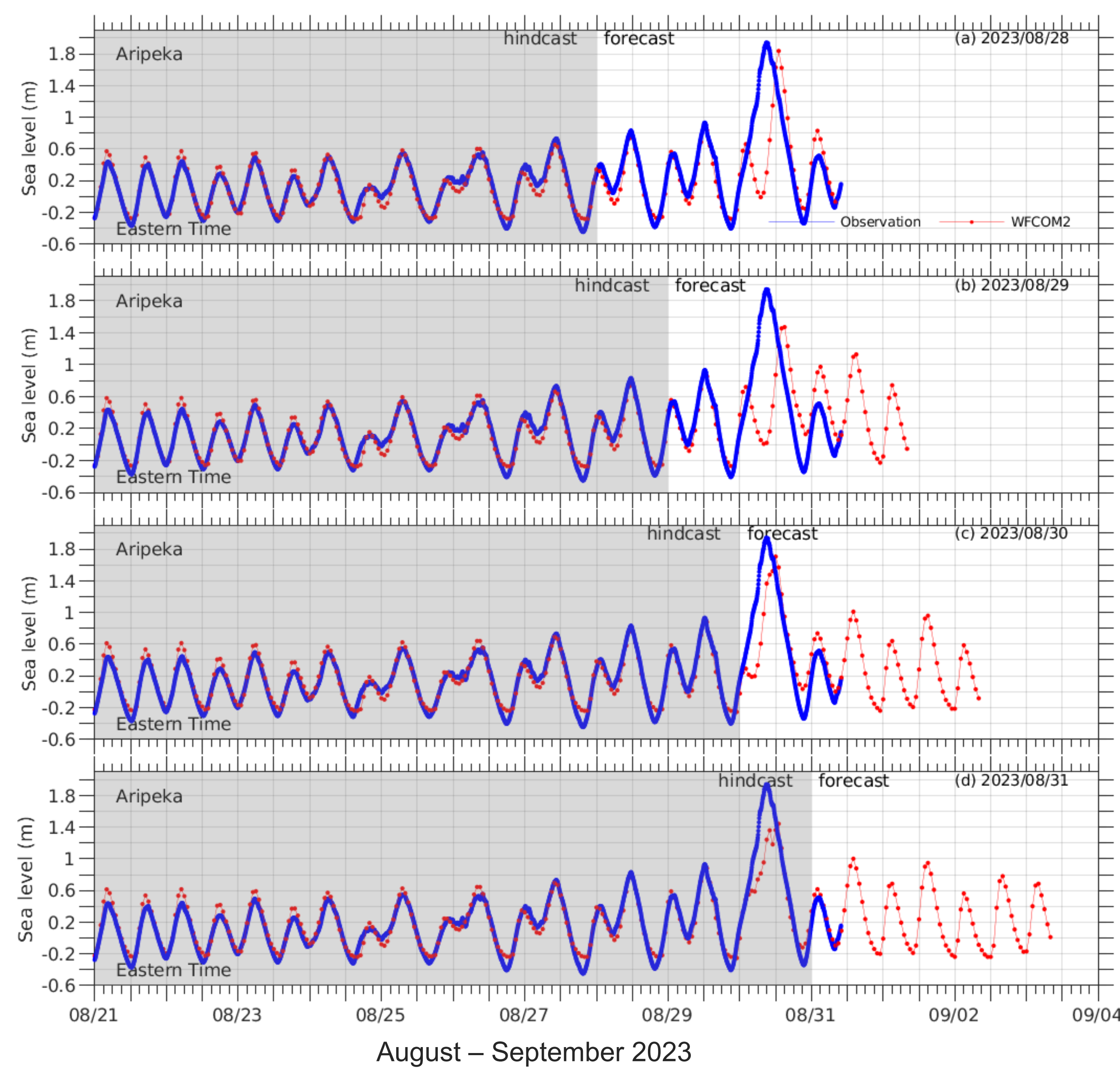
2. Hurricane Ian (Category 5)

WFCOM surface current and salinity at hour 15 on 09/28/2022

NASA Satellite Imagery (10/1/2022)
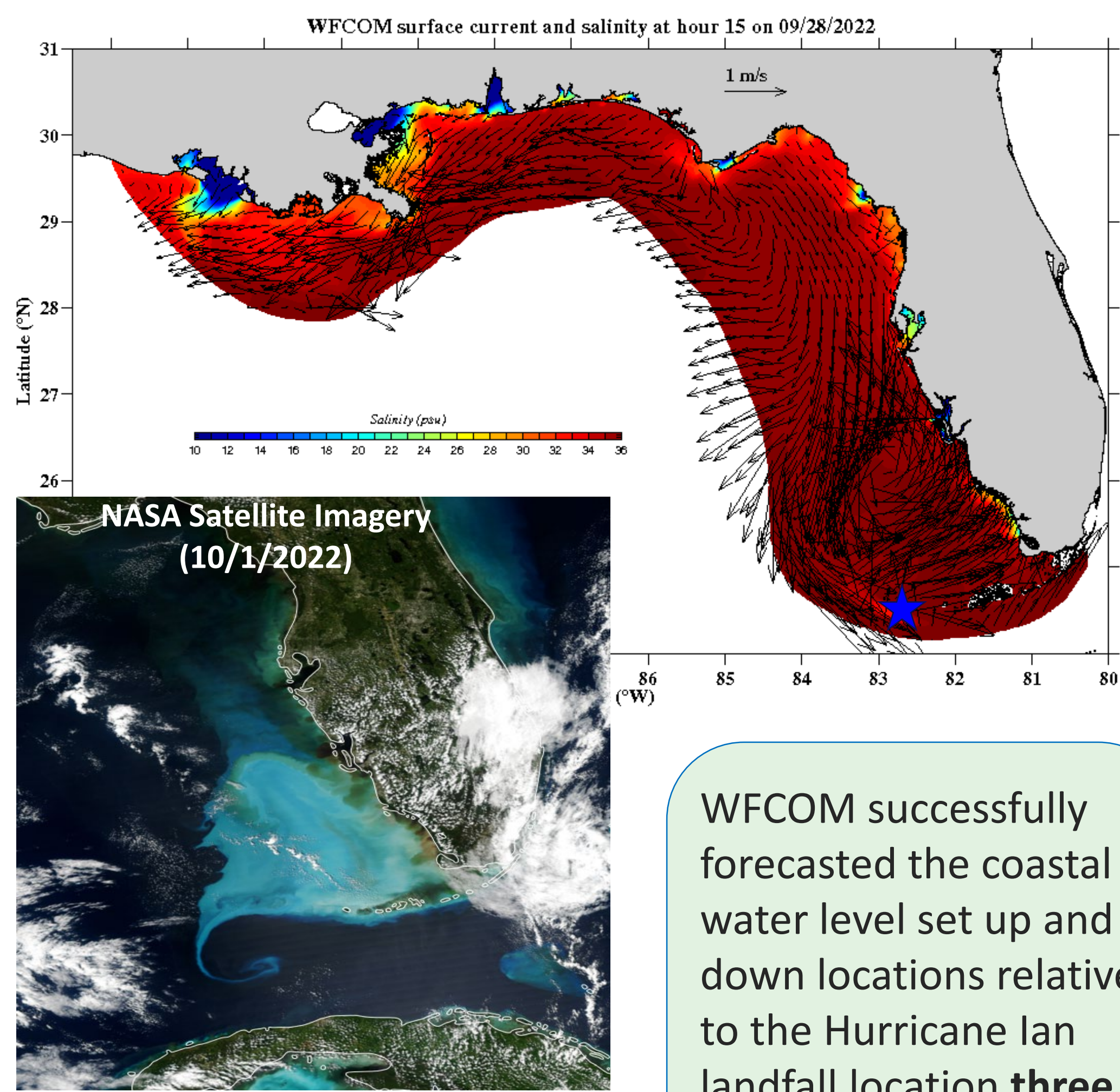
WFCOM successfully forecasted the coastal water level set up and down locations relative to the Hurricane Ian landfall location **three days in advance**.

Velocity comparison:

Mooring C19

(a) observed (4 m)

$(\rho, \theta, r) = (0.82, 21^\circ, 0.78)$

(b) simulated (4 m)

(c) observed (14 m)

$(\rho, \theta, r) = (0.76, 18^\circ, 0.80)$

(d) simulated (14 m)

(e) observed (24 m)

$(\rho, \theta, r) = (0.77, 18^\circ, 0.81)$

(f) simulated (24 m)

Archived daily automatic sea level forecasts:

Eastern Time — Old Port Tampa — Observation / TBCOM / Predicted tide

TBCOM did a great job in predicting the **negative storm surge** in Tampa Bay, where water was completely drained out for hours in some area of the upper bay.

September – October 2022

3. Hurricane Idalia (Category 4)

Aripeka — hindcast / forecast — (a) 2023/08/28 — Observation / WFCOM2

Aripeka — hindcast / forecast — (b) 2023/08/29

Aripeka — hindcast / forecast — (c) 2023/08/30

Aripeka — hindcast / forecast — (d) 2023/08/31

August – September 2023

Both models were generally successful in predicting the coastal ocean responses three days in advance during the major hurricanes that made landfall on the west coast of Florida in recent years. However, the water level set-ups/set-downs were slightly underestimated, which were largely due to the weaker winds that were used in the ocean models. For better storm surge forecasts, **it is important to sustain more met/ocean observations within coastal ocean regions** for assimilation in atmospheric models and to make such improved wind field forecasts more broadly available to the oceanographic community.

Cedar Key — NOAA NAM winds: 6-hr time lag between **forecast** (on 8/28/2023) & observation.

Clearwater Beach — **Hindcast** winds are weaker than the observed.