



CARICOOS: Un Sistema Caribeño para la Observación Costera

Julio M. Morell Rodriguez

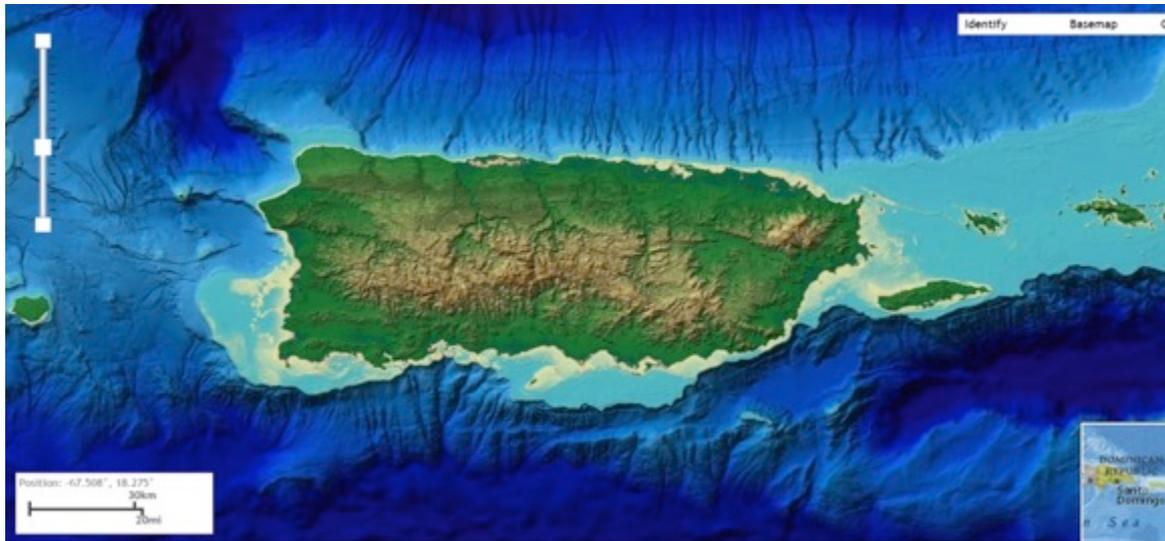




CARICOOS

La región CariCOOS:

- Elevación max. 1.2 km
- Z promedio oceánica: 4 km
- Z promedio plataforma: 25m
- Pendientes marcadas

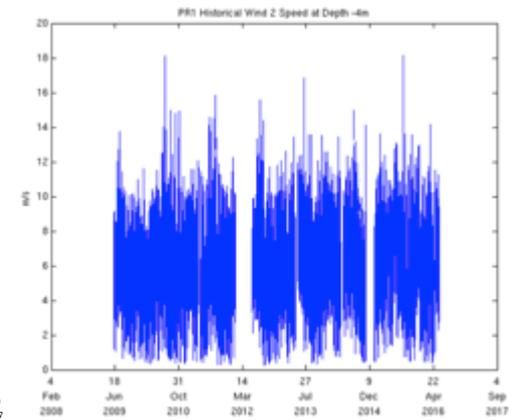
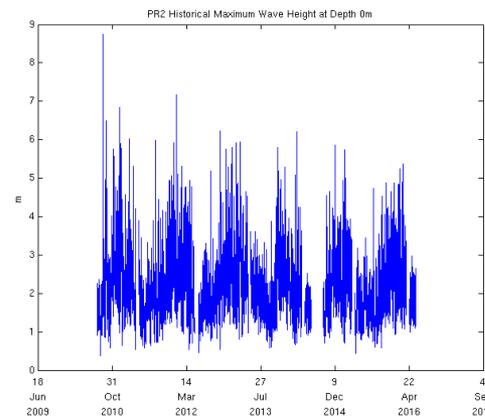
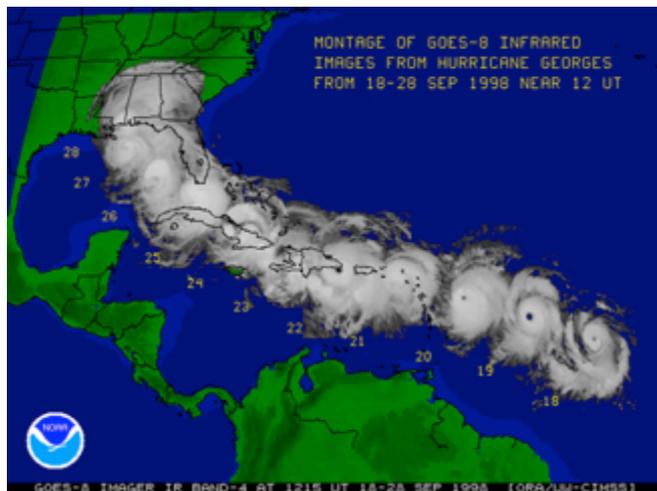
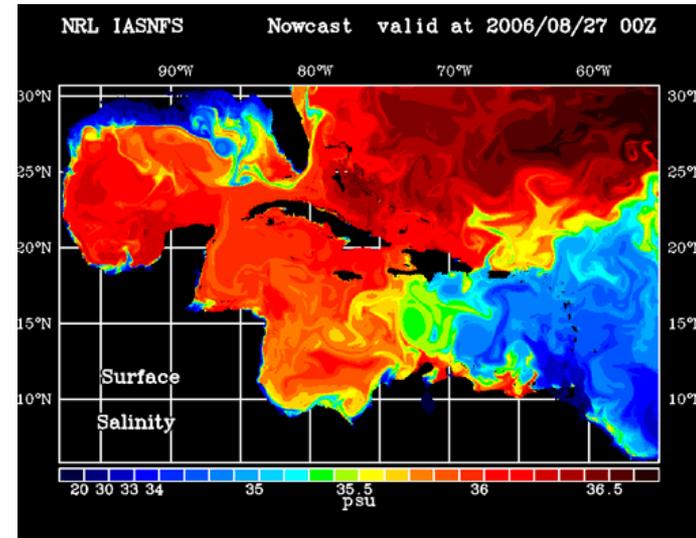




CARICOOS

La región CariCOOS:

- “Eddies” (meso/submeso)
- Huracanes
- Marejadas del Atlántico
- Vientos alisios





CARICOOS

MISIÓN: OBSERVACIONES Y PREDICIONES DEL OCÉANO – 24/7 – PARA APOYAR SUS ACTIVIDADES MARINAS



OBSERVATION & FORECASTS



WINDS



WAVES



TIDES & CURRENTS



OCEAN COLOR & SST

DECISIONAL SUPPORT TOOLS



MARINE OPERATIONS



COASTAL HAZARDS

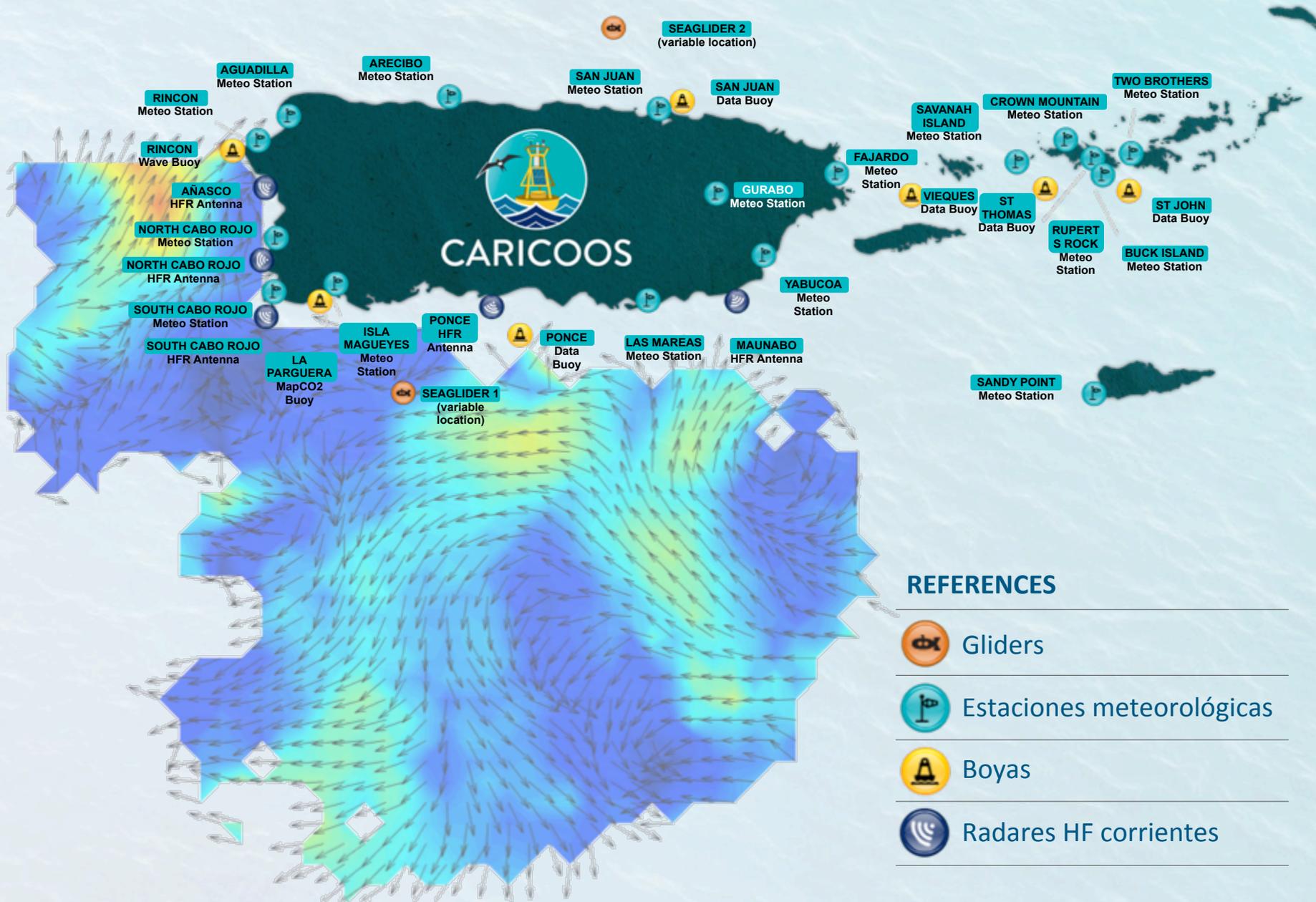


CLIMATE VARIABILITY



ECOSYSTEMS & WATER
QUALITY

OBSERVACIONES



REFERENCES

 Gliders

 Estaciones meteorológicas

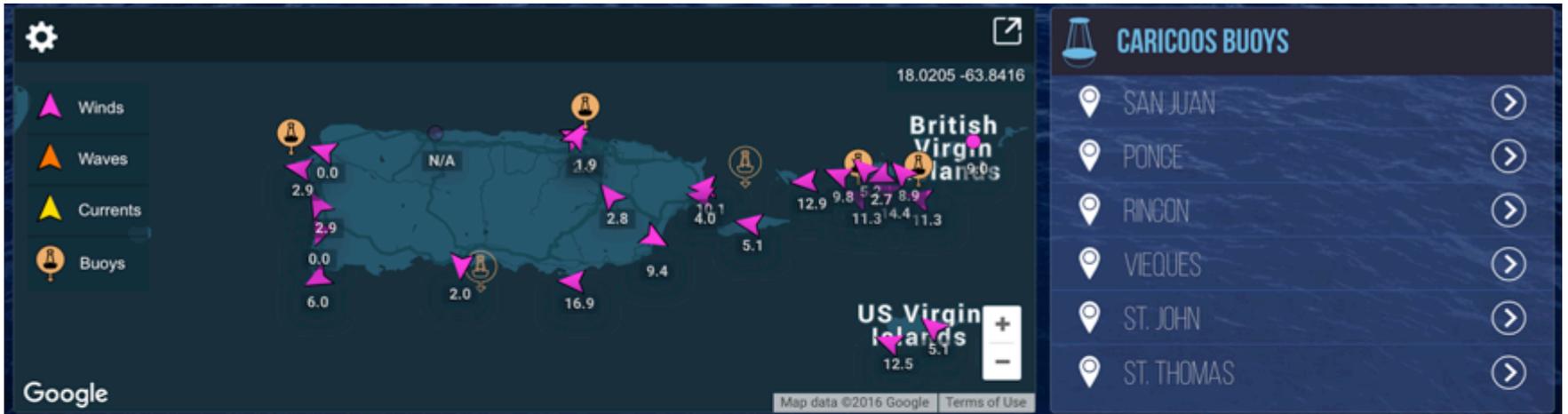
 Boyas

 Radares HF corrientes



CARICOOS

VIENTO



OBSERVATION & FORECASTS

WINDS	WAVES
TIDES & CURRENTS	OCEAN COLOR & SST

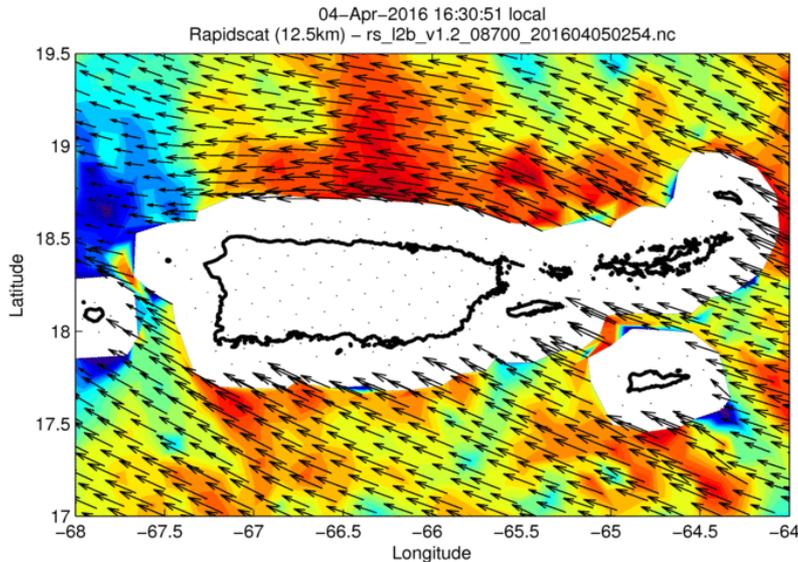
DECISIONAL SUPPORT TOOLS

MARINE OPERATIONS	COASTAL HAZARDS
CLIMATE VARIABILITY	ECOSYSTEMS & WATER QUALITY

PRONOSTICOS DE VIENTO: CARICOOS WRF

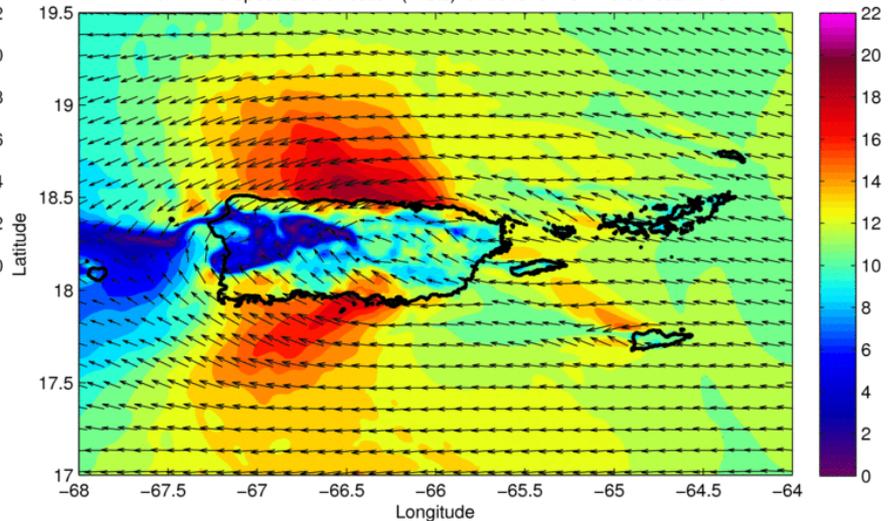
Rapidscat

Vientos (12.5km) – April 4, 2016 ~ 4:30 PM



WRF-ARW-2.5KM

CariCOOS WRF-ARW-v10e 2.5 km Grid Model – PRVI (Model Run 20160404_00Z)
10m Wind Speed and Direction (knots) for 2016-04-04-16:00 local time

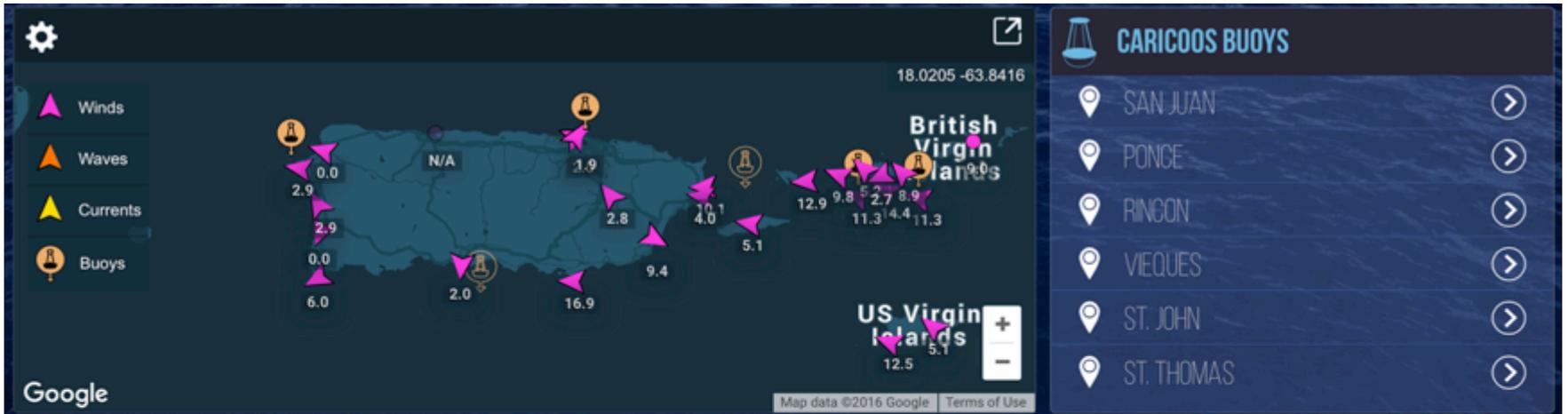


- Resoluciones horizontales desde 6km hasta 500 metros
Condiciones iniciales y frontera de GFS



CARICOOS

OLAS



OBSERVATION & FORECASTS



WINDS



WAVES



TIDES & CURRENTS



OCEAN COLOR & SST

DECISIONAL SUPPORT TOOLS



MARINE OPERATIONS



COASTAL HAZARDS



CLIMATE VARIABILITY



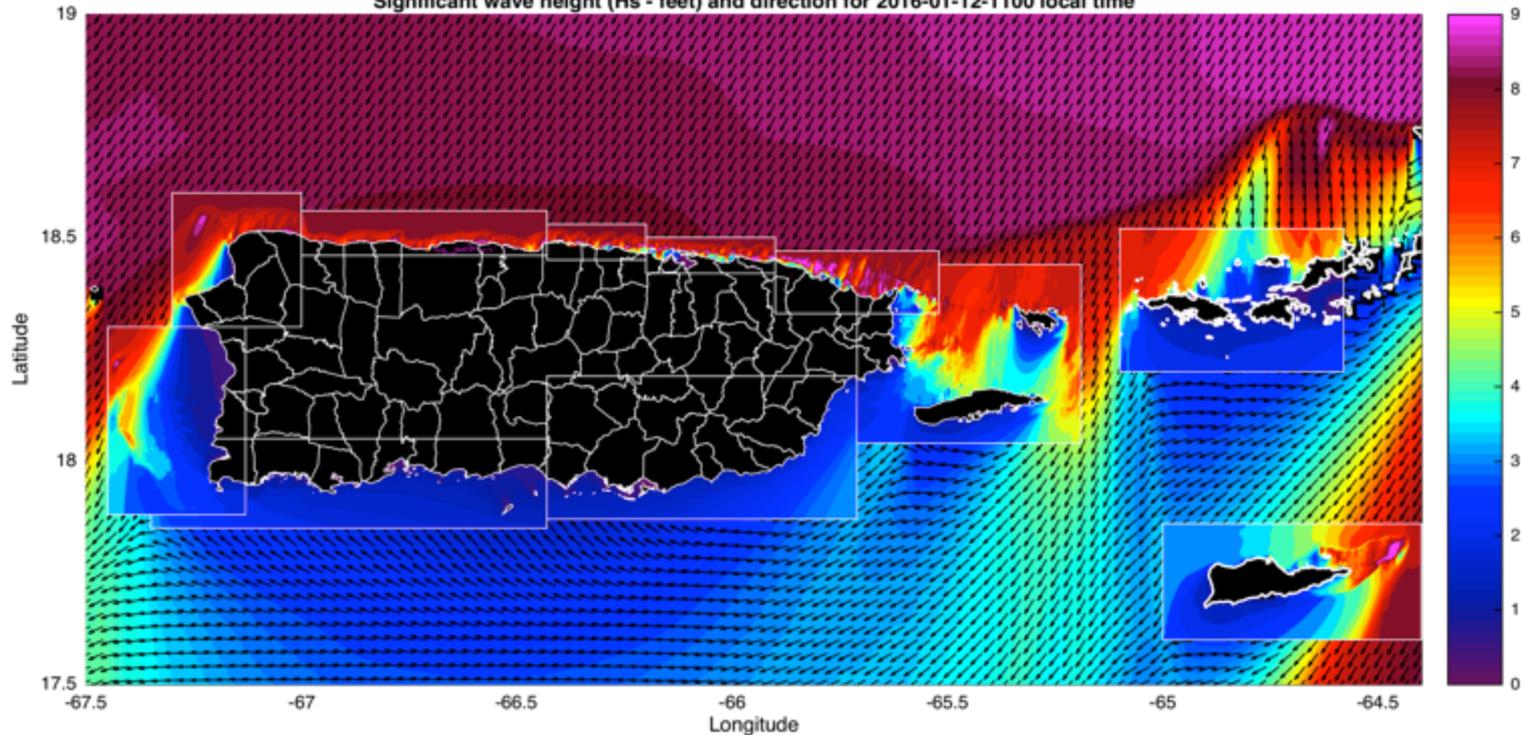
ECOSYSTEMS & WATER QUALITY



CARICOOS

PRONÓSTICOS DE OLAS: CARICOOS-SWAN

CariCOOS Nearshore Wave Model v7.0 (run: 20160112.1200 machine:swanwrf)
Significant wave height (Hs - feet) and direction for 2016-01-12-1100 local time



- 12 mallas computacionales a resoluciones desde 240 hasta 10 metros
- Condiciones de frontera de WaveWatch III



CARICOOS

CORRIENTES Y MAREAS



OBSERVATION & FORECASTS

WINDS	WAVES
TIDES & CURRENTS	OCEAN COLOR & SST

DECISIONAL SUPPORT TOOLS

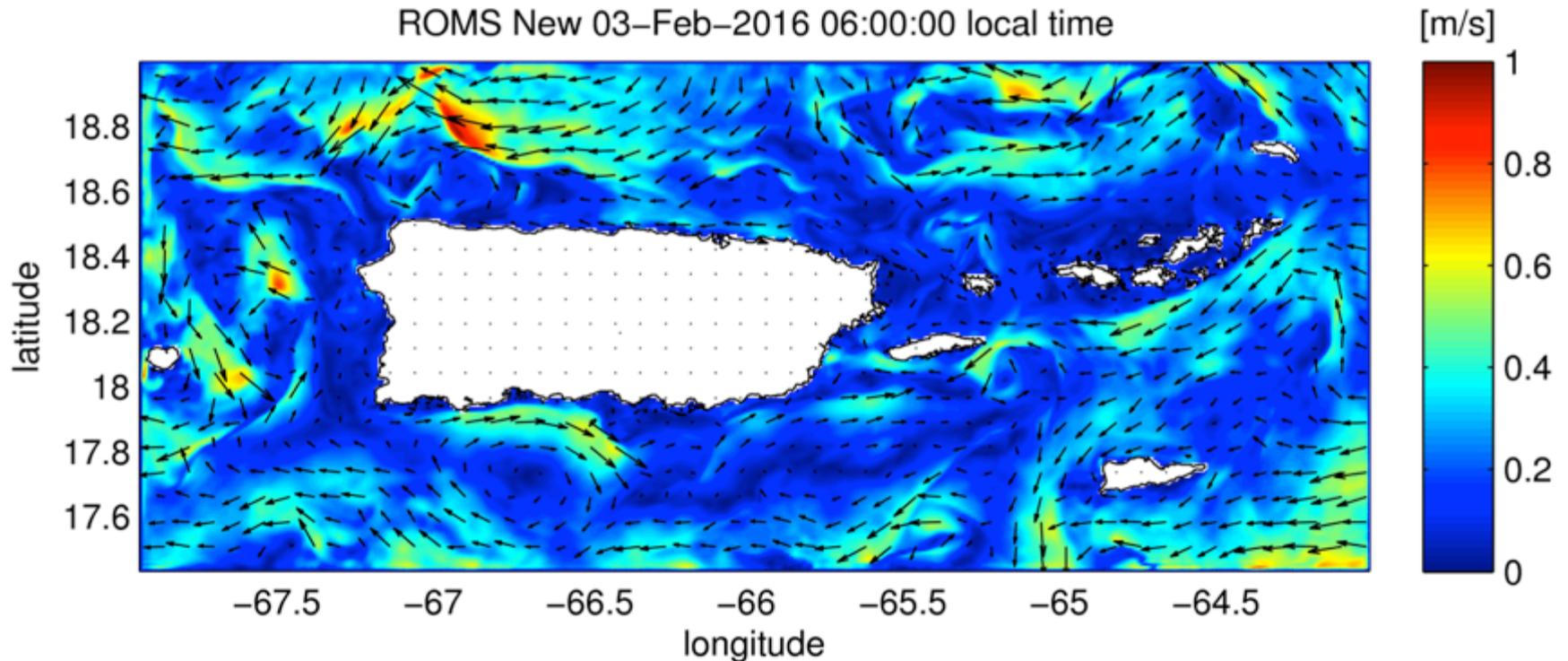
MARINE OPERATIONS	COASTAL HAZARDS
CLIMATE VARIABILITY	ECOSYSTEMS & WATER QUALITY



CARICOOS

CORRIENTES OCEÁNICAS: ROMS

ROMS New 03-Feb-2016 06:00:00 local time

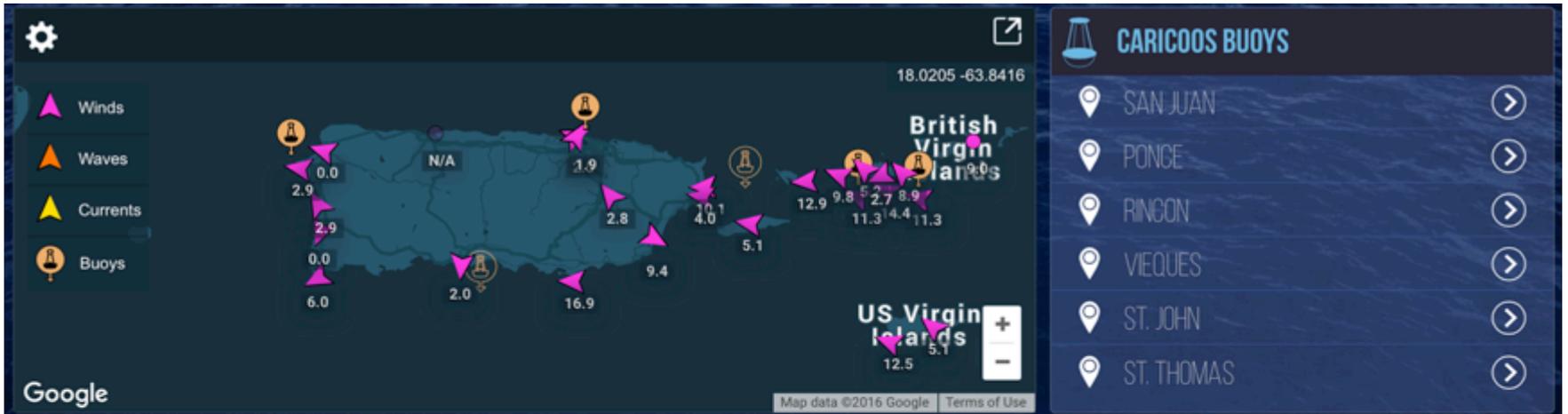


- Resolución horizontal de 1 kilómetro
- Condiciones iniciales y frontera de AMSEAS



CARICOOS

OPERACIONES MARINAS



OBSERVATION & FORECASTS

DECISIONAL SUPPORT TOOLS

WINDS	WAVES
TIDES & CURRENTS	OCEAN COLOR & SST

MARINE OPERATIONS	COASTAL HAZARDS
CLIMATE VARIABILITY	ECOSYSTEMS & WATER QUALITY



CARICOOS

OPERACIONES MARINAS: PRONÓSTICOS PUNTUALES

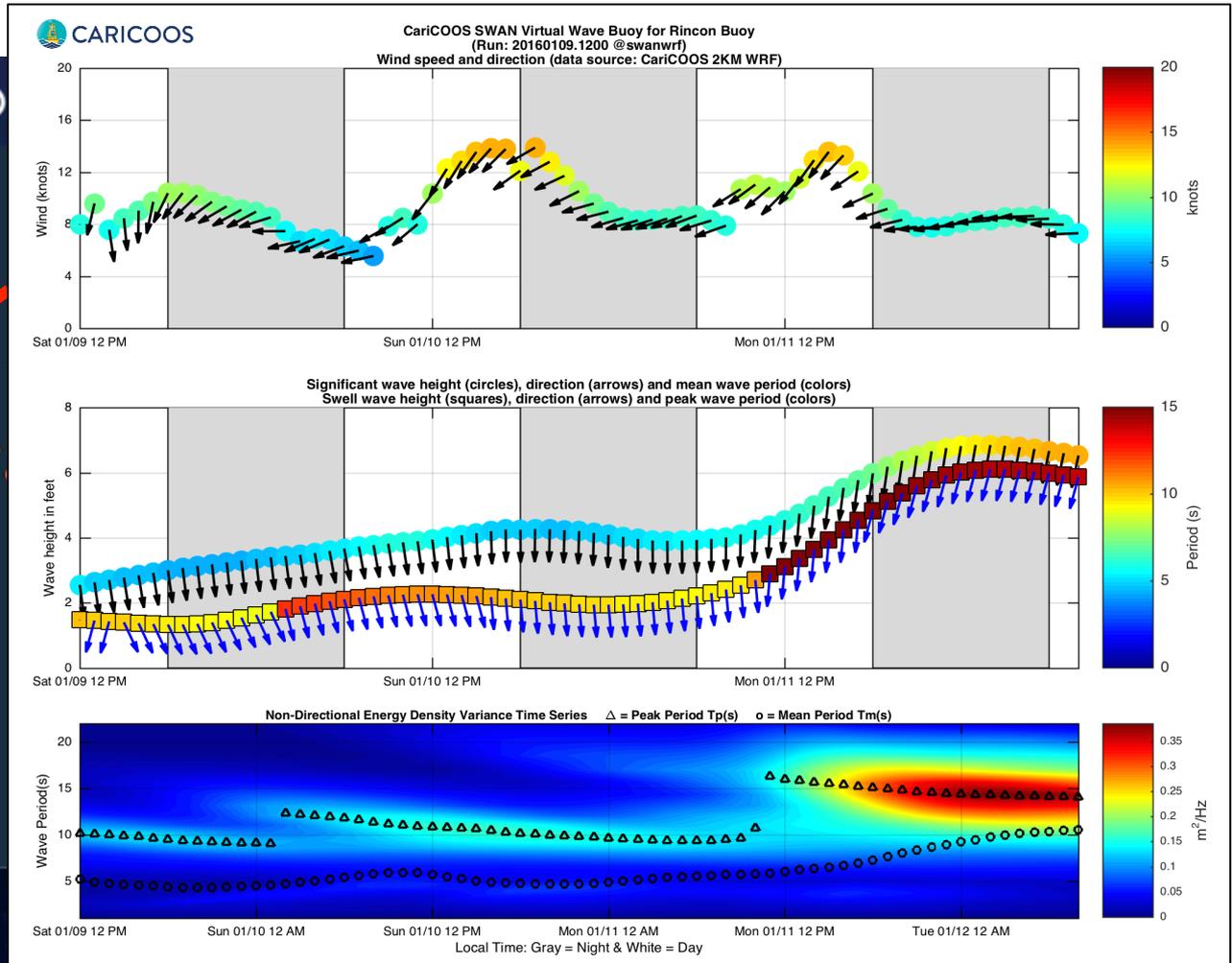
CARICOOS

Isla de Nima

Google

Regional Coastal Observing Systems
National Observing System Partners

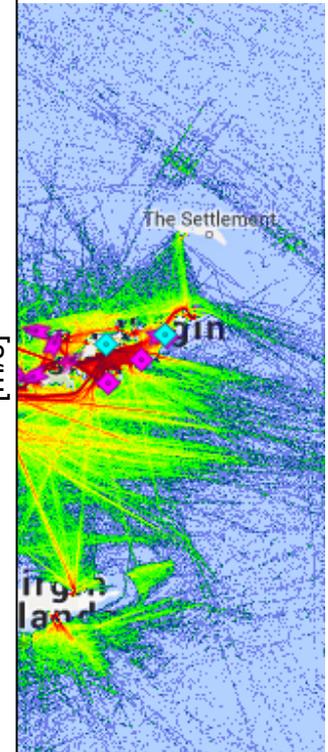
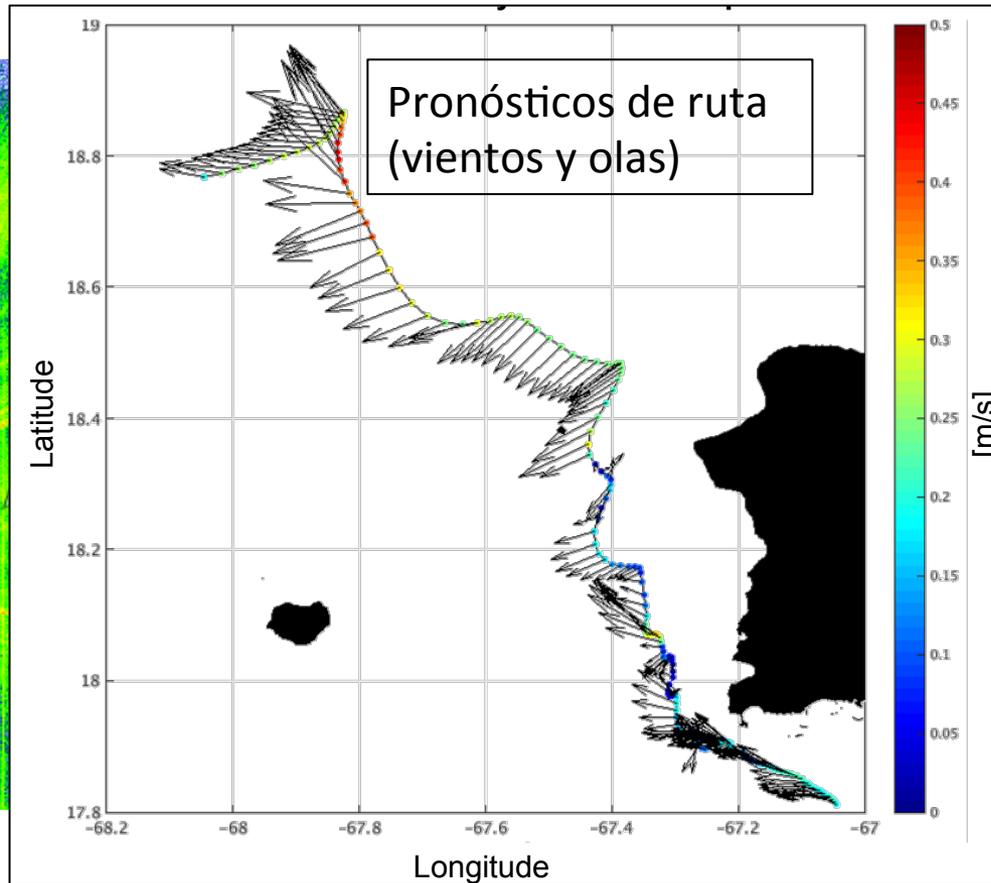
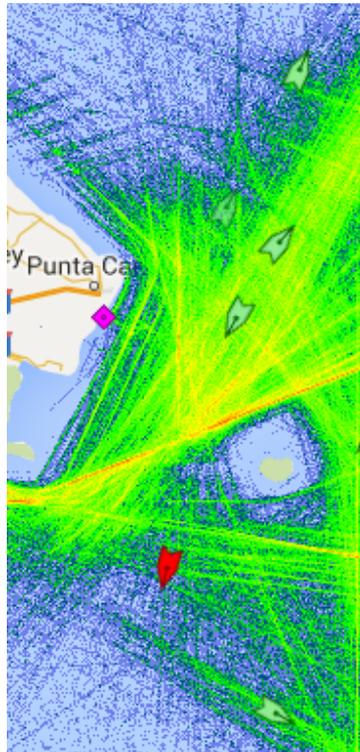
IOOS



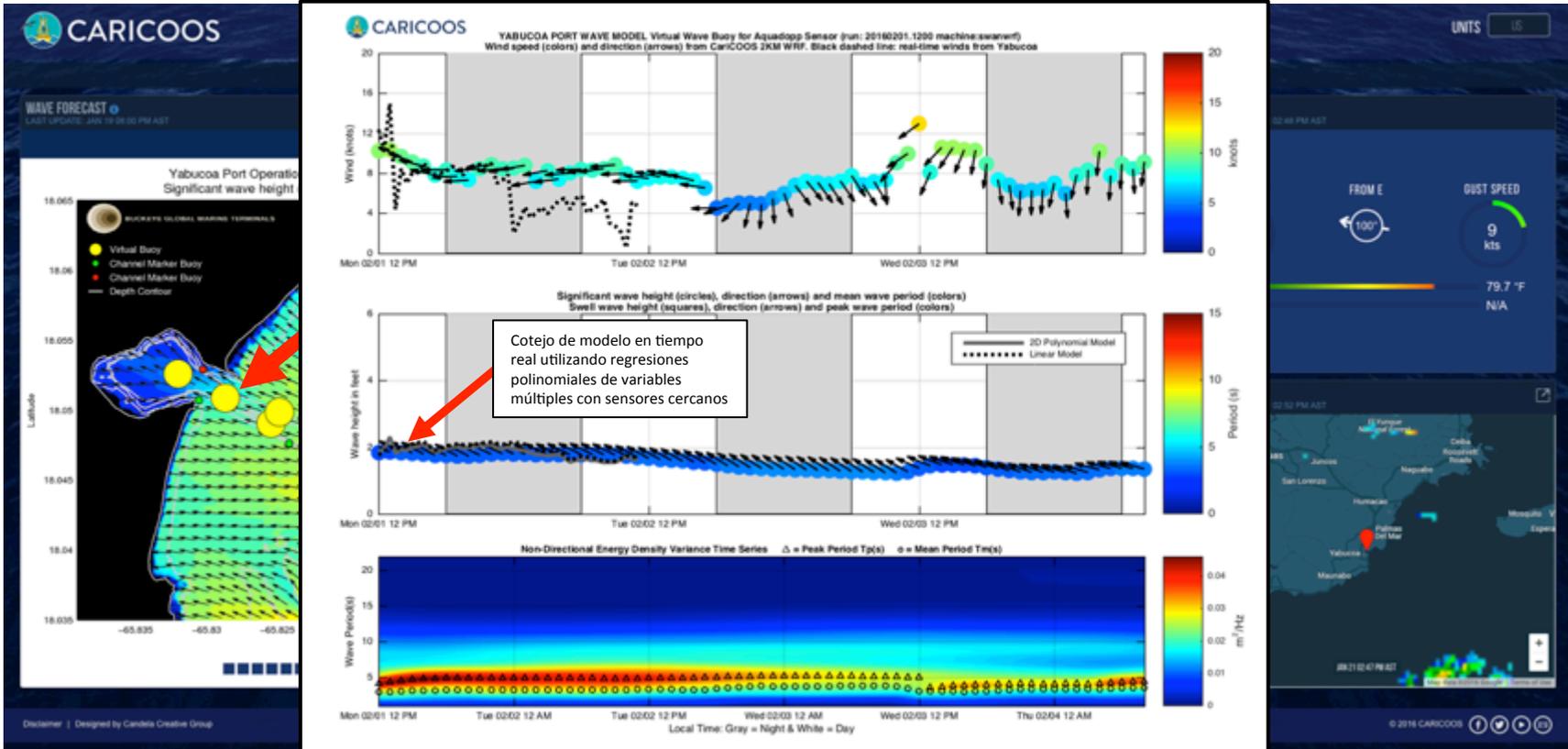


CARICOOS

OPERACIONES MARINAS



OPERACIONES EN PUERTOS



<http://www.caricoos.org/ports/yabucoa/us>



CARICOOS

RIESGOS COSTEROS



OBSERVATION & FORECASTS



WINDS



WAVES



TIDES & CURRENTS



OCEAN COLOR & SST

DECISIONAL SUPPORT TOOLS



MARINE OPERATIONS



COASTAL HAZARDS



CLIMATE VARIABILITY



ECOSYSTEMS & WATER QUALITY



CARICOOS



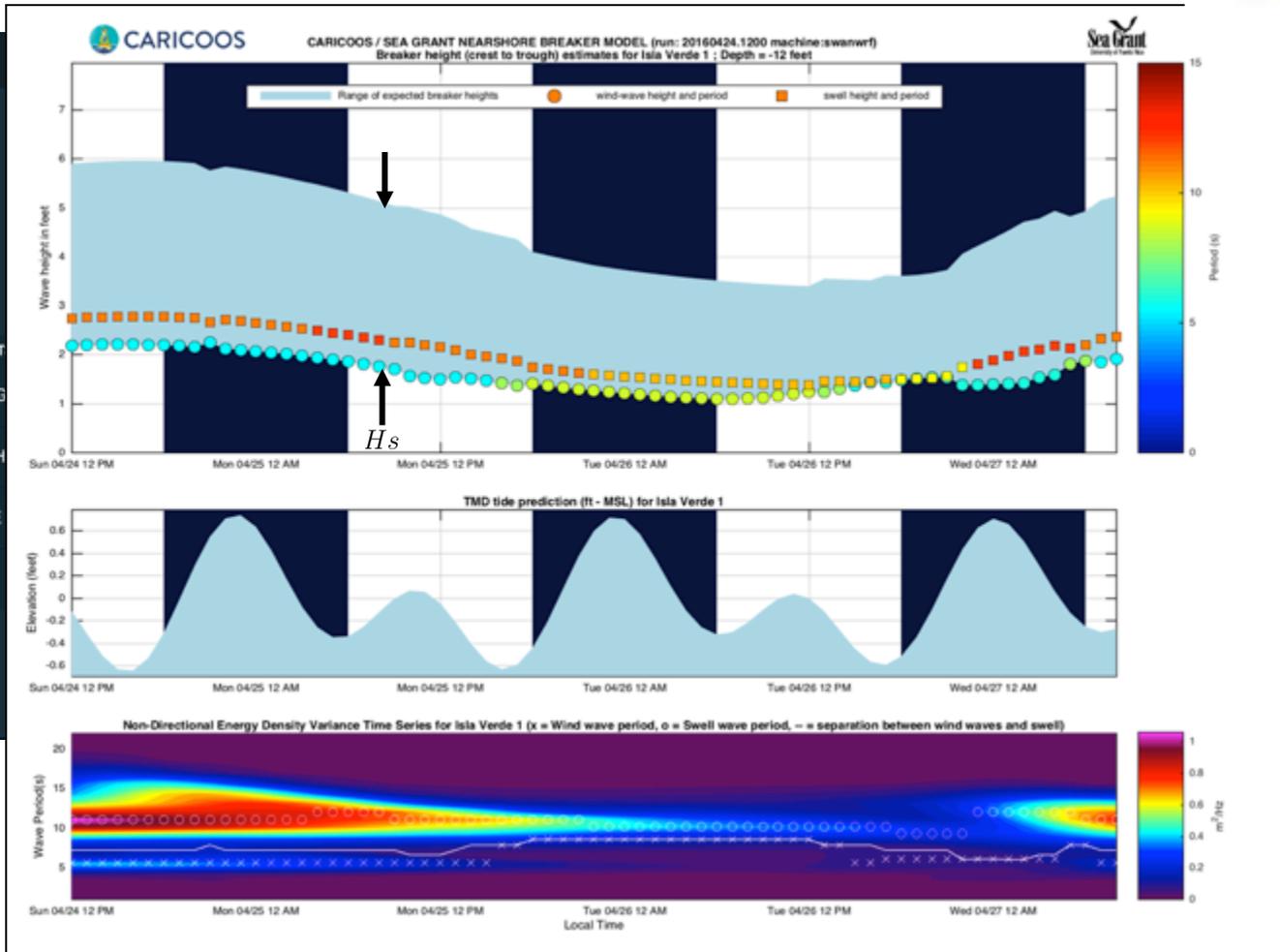
RIESGOS COSTEROS: OLAS ROMPIENTES



EXPECTED BREAKER HEIGHT

-  HIGH TO VERY LARGE
-  MODERATE TO HIGH
-  LOW TO MODERATE
-  LOW

Google



18.2476 -67.2281



US Virgin Islands



2016 Google Terms of Use

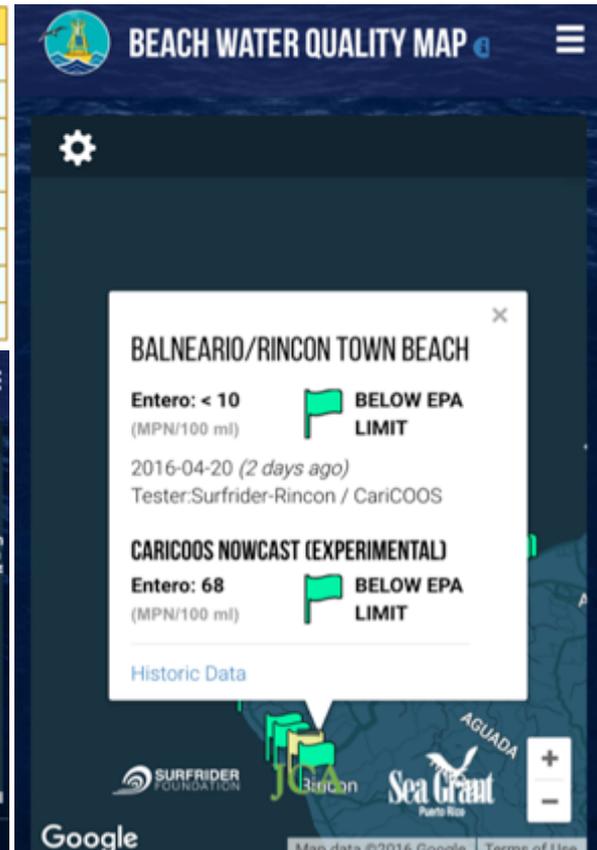


CARICOOS

RIESGOS COSTEROS: PATÓGENOS EN PLAYAS

$$\log_{10} Ent = \beta_0 + \Delta\beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \beta_6x_6$$

Variable	$\beta \pm \epsilon$	Transformation	P-value
β_0 Intercept	-7.30 ± 2.28	-	0.0021
$\Delta\beta_0$ Offset	$-\log_{10}(1.12)$	-	-
x_1 Accumulated Precipitation	$0.68 \pm .08$	$x^{1/4}$	$2.06 \cdot 10^{-13}$
x_2 Wind Speed	$-0.12 \pm .06$	$1/x$	0.0284
x_3 Wind Direction	1.43 ± 0.55	$1.642 + 0.002x - 3.314 \cdot 10^{-6}x^2$	0.0108
x_4 Wave Height	2.66 ± 1.67	$1.820 - 0.261x - 0.114x^2$	0.0148
x_5 Wave Direction	$0.22 \pm .06$	$1/x$	0.0005
x_6 Tides	$1.18 \pm .40$	$1.682 - 1.728x + 12.767x^2$	0.0042





CARICOOS

ECOSISTEMAS /RECURSOS COSTEROS/CALIDAD DE AGUA



- ### CARICOOS BUOYS
- SAN JUAN
 - PONGE
 - RINGTON
 - VIEQUES
 - ST. JOHN
 - ST. THOMAS

OBSERVATION & FORECASTS

WINDS	WAVES
TIDES & CURRENTS	OCEAN COLOR & SST

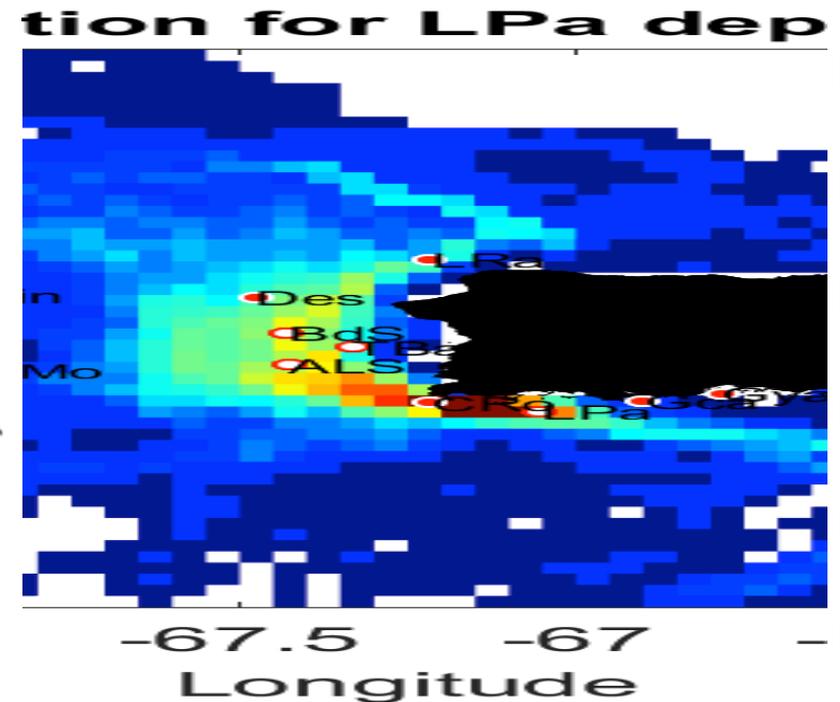
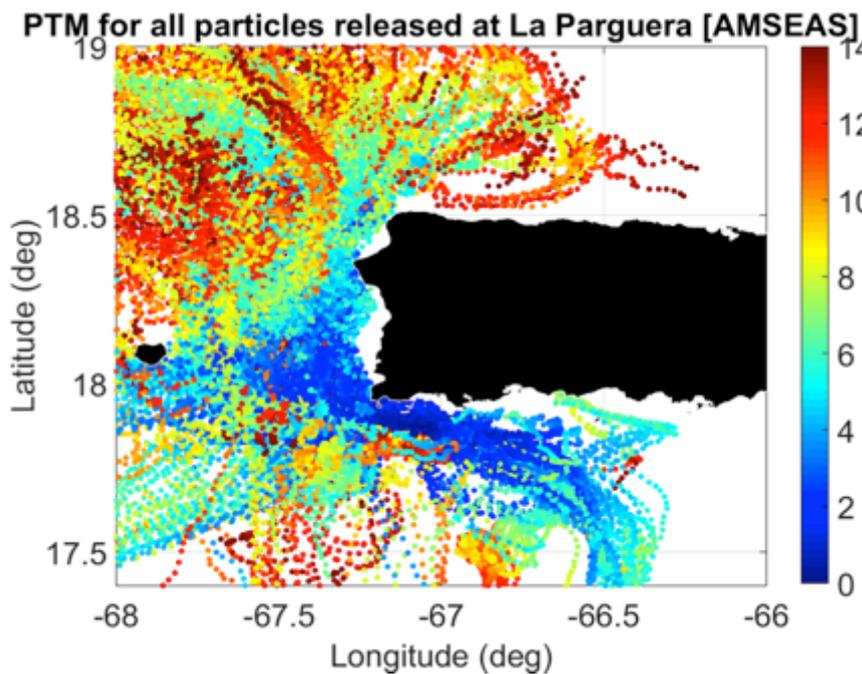
DECISIONAL SUPPORT TOOLS

MARINE OPERATIONS	COASTAL HAZARDS
CLIMATE VARIABILITY	ECOSYSTEMS & WATER QUALITY



CARICOOS

MANEJO DE RECURSOS: CONECTIVIDAD HIDRODINÁMICA

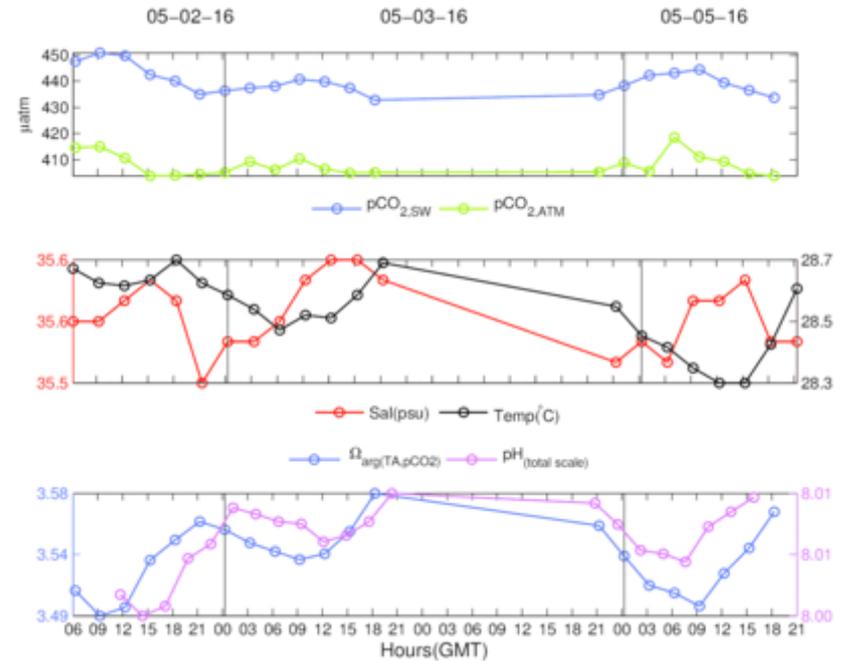
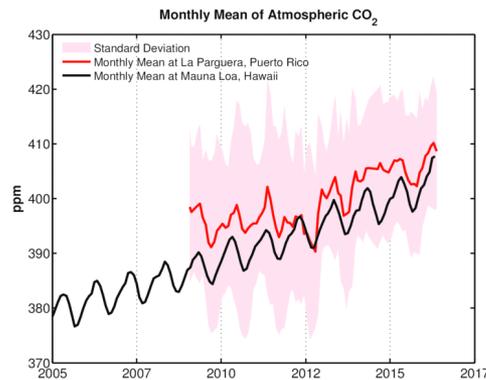


Generación de matrices de conectividad, utilizando modelos y observaciones de radares HF para evaluar la efectividad de áreas protegidas como fuentes de huevos y larvas de peces



CARICOOS

CALIDAD DE AGUA: ACIDIFICACIÓN EN ARRECIFES



Monitoreo de pCO₂ aire y agua, pH y alcalinidad—saturación aragonita



CARICOOS

VARIABILIDAD DEL CLIMA



OBSERVATION & FORECASTS

DECISIONAL SUPPORT TOOLS

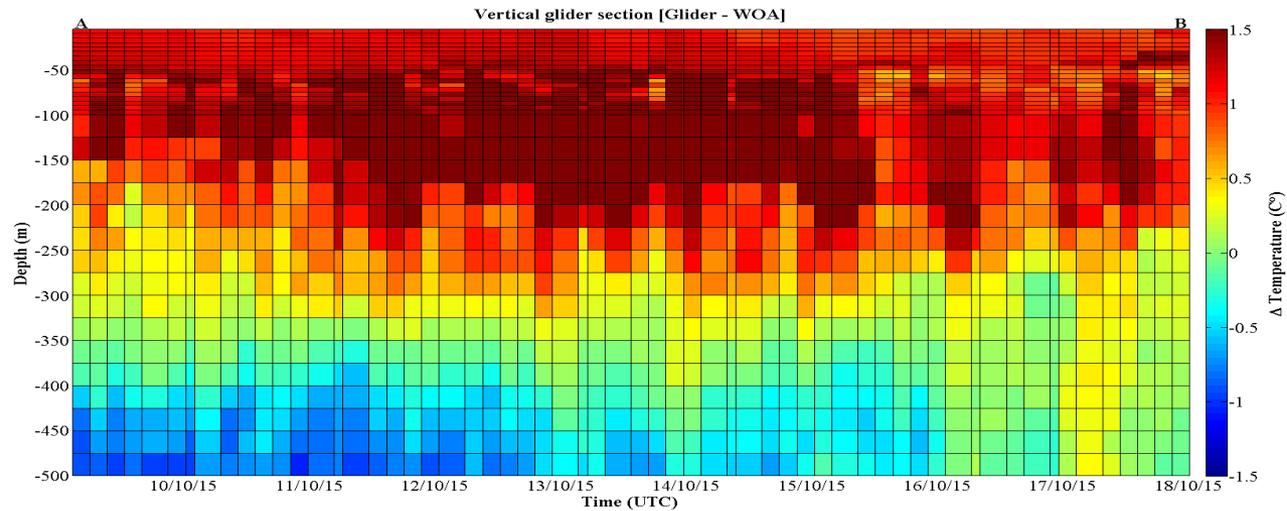
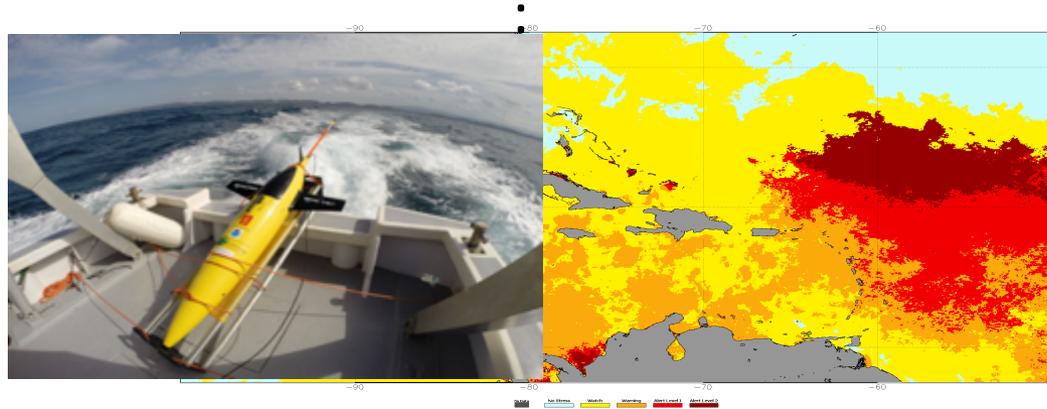
WINDS	WAVES
TIDES & CURRENTS	OCEAN COLOR & SST

MARINE OPERATIONS	COASTAL HAZARDS
CLIMATE VARIABILITY	ECOSYSTEMS & WATER QUALITY



CARICOOS

VARIABILIDAD DEL CLIMA: CALENTAMIENTO DEL OCÉANO



GLIDERS: 5 perfiles hasta 1000 metros por dia



CARICOOS

EL FUTURO: COLABORACIÓN REGIONAL

- Iniciativas en desarrollo para colaboración en observación oceánica:
 - Republica Dominicana
 - Antillas Holandesas
 - I. Vírgenes Británicas
 - Cuba?

Speeds for drifter trackers 3 to 18

