

Oceanography and Coastal Engineering Research Group

OCEANICOS

Grupo A1 - Colciencias



groups/oceanicosUN

**Geoscience and Environmental Department, Faculty of Mines
National University of Colombia , Medellín**



<http://minas.medellin.unal.edu.co/gruposdeinvestigacion/oceanicos>



RESEARCH LINES

Oceanography Physics Geological Operational (oil spills)	Marine Ecosystems Estuaries Mangroves Coral Reefs
Mathematical Modeling Hydrodynamics Water quality Modeling estuarine	Coastal Management Risk management
Climate Climate Change Marine climate statistics	Ocean engineering Fluid-Structure interaction Offshore engineering
Coastal Engineering Coastal processes Coastal morphodynamics	Marine Energy Waves and Tides Ocean Thermal Energy Salinity Gradient Energy

RESEARCHERS



.Andrés Fernando Osorio Arias
Coastal engineering
Director - Oceanicos



Gladys Rocío Bernal Franco
Oceanography



Francisco Mauricio Toro Botero
Numerical modelling



Ligia Estela Urrego Giraldo
Coastal ecosystems



Yuley Cardona
Ocean and ecosystems modelling

Collaborators



Veronica Botero
Risk management and GIS



Alejandro Molina
Bioprocess and Reactive flows



Carlos David Hoyos
Ocean and atmosphere interaction



Clara Villegas
Environmental economical value



Santiago Arango
Energy and climate change



Germán Poveda Jaramillo
Climate change



Jaime Ignacio Vélez
Hidroclimatology and management



Andrés Gómez Giraldo
Numerical modelling

Collaborators



Gaspar Monsalve
Geophysics



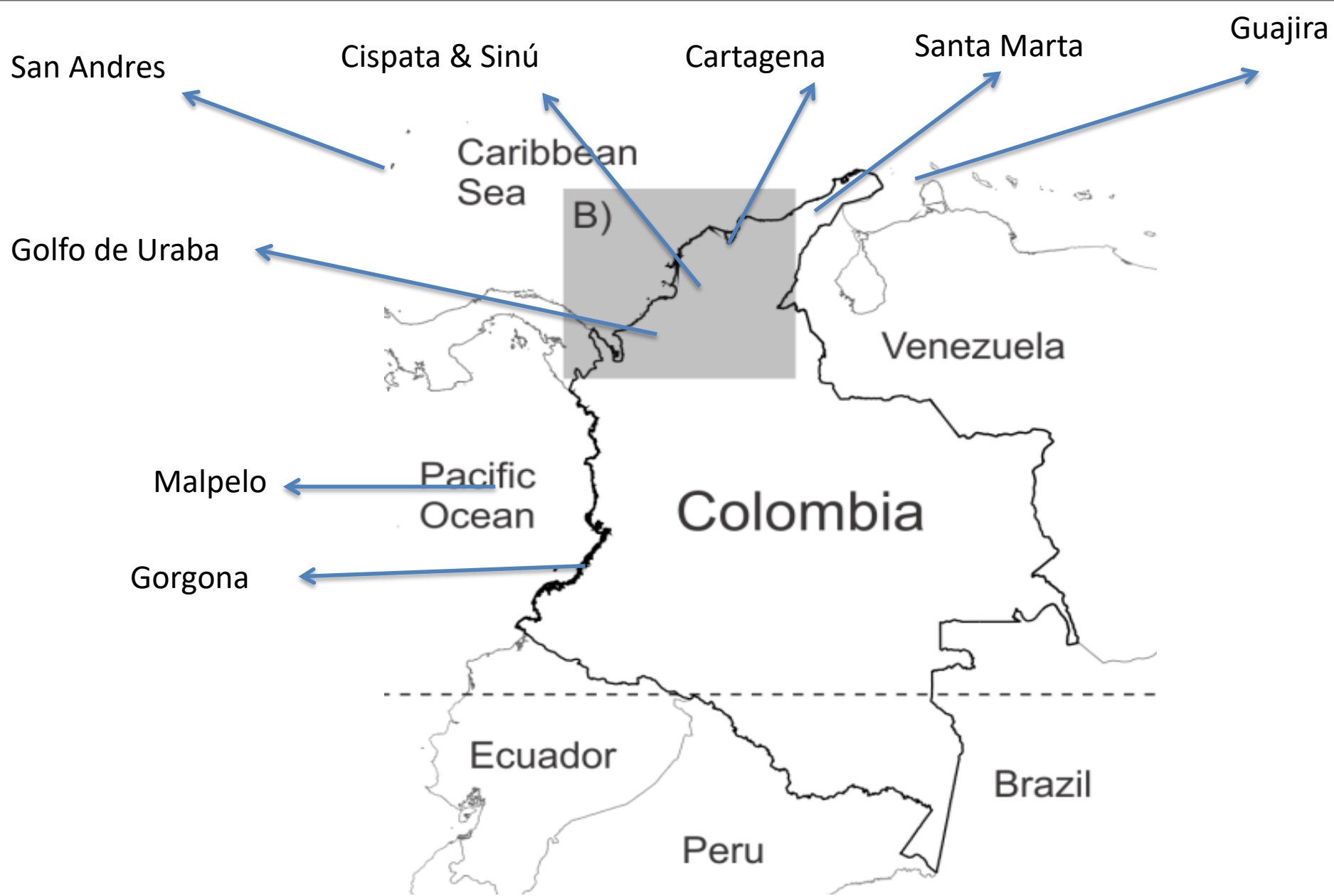
Carlos I. Sanchez
Electrochemistry



Jairo J. Espinosa
Automatic and Control



Freddy Bolaños
Automatic and Control



LABORATORY AND FIELD STRENGTHS

WAVE CURRENT FLUME

Measurement techniques in fluid mechanics, scale modeling wave phenomena - currents, power dissipation on submerged structures.



ENVIRONMENTAL AND EARTH SCIENCES LABORATORY
PALEOECOLOGY LABORATORY
PALYNOLOGY LABORATORY

FIELD INSTRUMENT

COSTAL VIDEO SYSTEM (HORUS)
WAVE SENSORS
ADCP, AQD AND AWAC
RIVER RAY
CTDO
METEOROLOGICAL STAT
DGPS
EKMAN BOX
ECHO SOUNDER

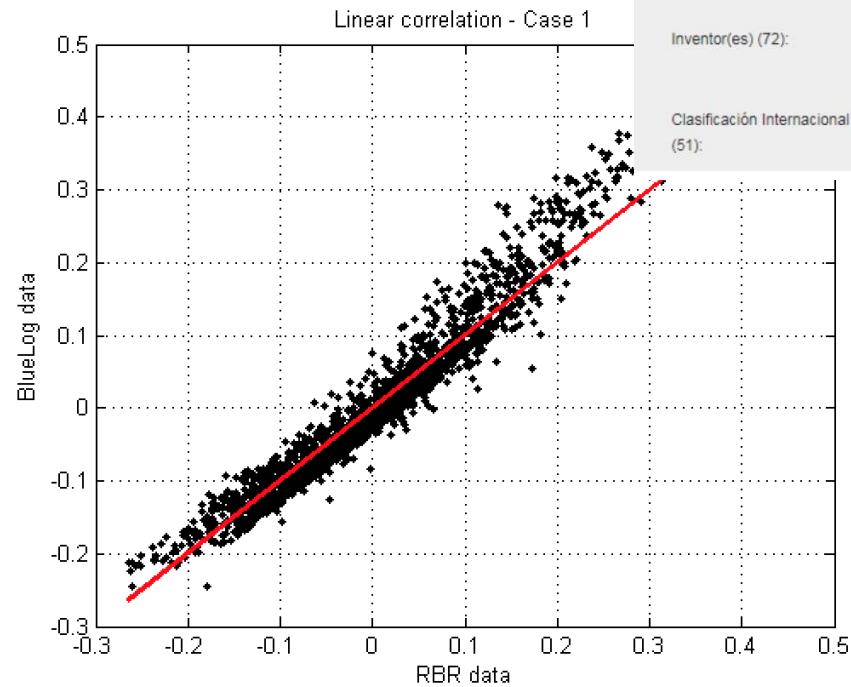


SEDE RECIBIR
FACULTAD DE MINAS

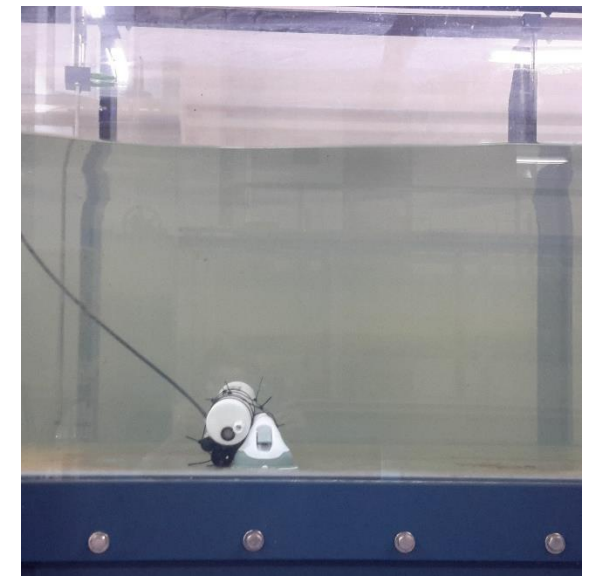
INSTRUMENTS DEVELOPMENT

SURFACE SENSOR BlueLOG (WAVES AND SEA-LEVEL)

Development of sensors and
measurement techniques



Descripción	
Solicitud de Patente publicada	
Número de Patente (11):	NC2017/0007958
Título (54):	DISPOSITIVO PARA LA ADQUISICIÓN DE DATOS EN CUERPOS DE AGUA
Fecha de Presentación (22):	04 ago 2017
Período de Aplazamiento:	0
Solicitante (71):	UNIVERSIDAD DEL NORTE, KM 5 ANTIGUA VÍA PUERTO COLOMBIA, BARRANQUILLA, ATLÁNTICO, CO UNIVERSIDAD NACIONAL DE COLOMBIA, Calle 59 A No. 63-20, MEDELLIN, ANTIOQUIA, CO
Contacto (74):	CARLOS REINALDO OLARTE GARCIA, Carrera 5 N° 34-03, BOGOTÁ, D.C., CO
Inventor(es) (72):	Andrés Fernando OSORIO ARIAS, Carrera 59A No. 63 - 20. Bloque 19., MEDELLIN, ANTIOQUIA, CO Cesar Augusto JARAMILLO GUTIÉRREZ, Carrera 59A No. 63 - 20. Bloque 19, MEDELLIN, ANTIOQUIA, CO
Clasificación Internacional de Patentes (51):	G01V 1/38



MODELLING STRENGTHS

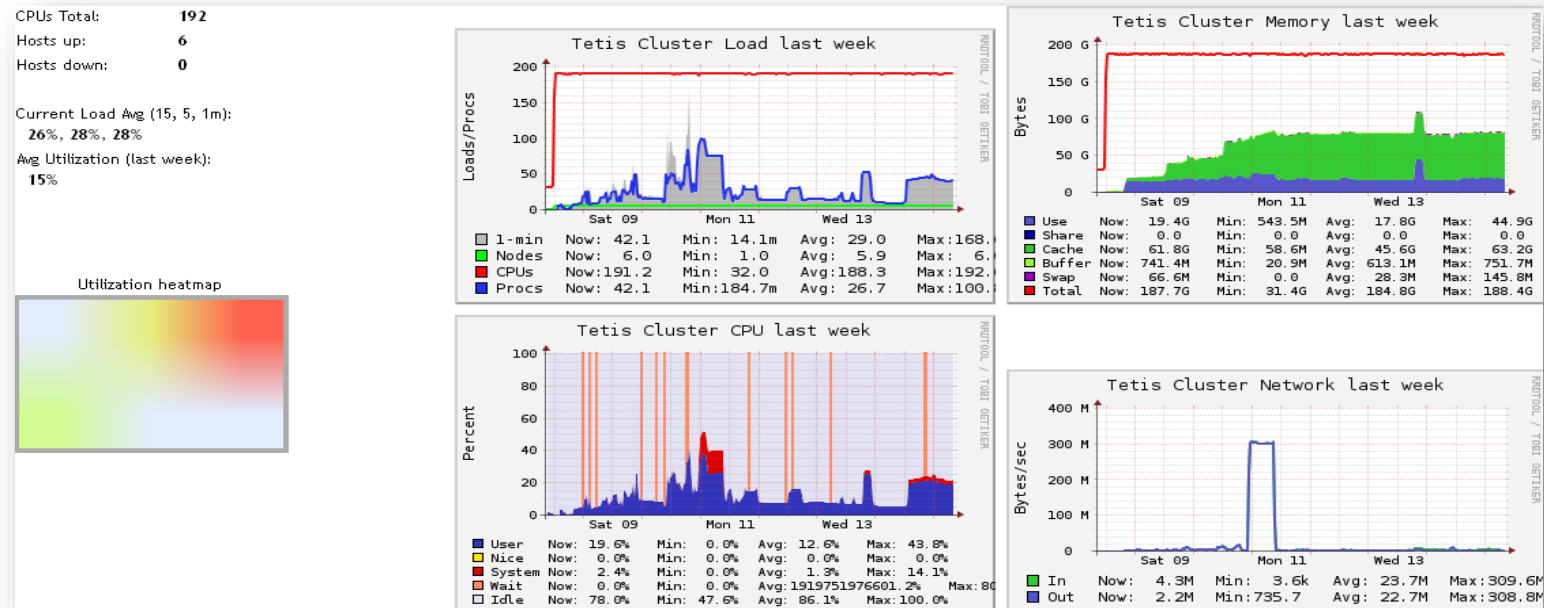
CLUSTER COMPUTING

Capacity:

IMPLEMENTED MODELS

- ROMS
- WWIII
- WRF
- OpenFoam
- SWASH
- DELF3D
- XBEACH...

- 2 TFLOPS (Calculo Teórico)
- 7 TB de Almacenamiento
- 2 GPU TESLA
- 128 Procesadores Dedicados a computo.
- Almacenamiento por nodo de 1 TB (4 TB en total)

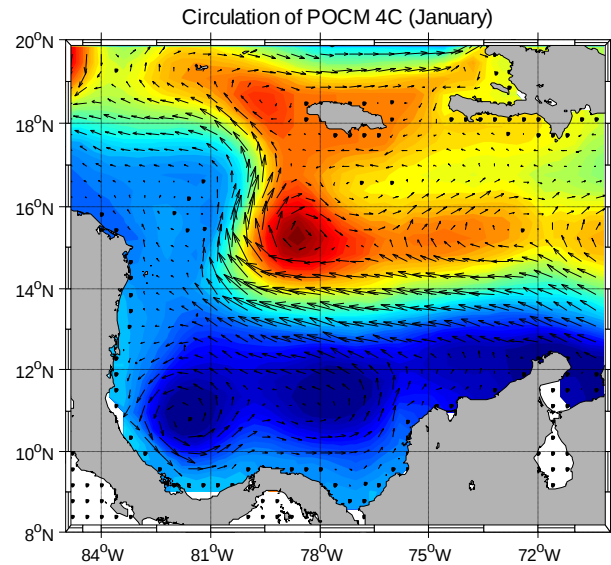


THE ATMOSPHERE-OCEAN-LAND INTERACTION IN THE CARIBBEAN SEA. 1968-2007

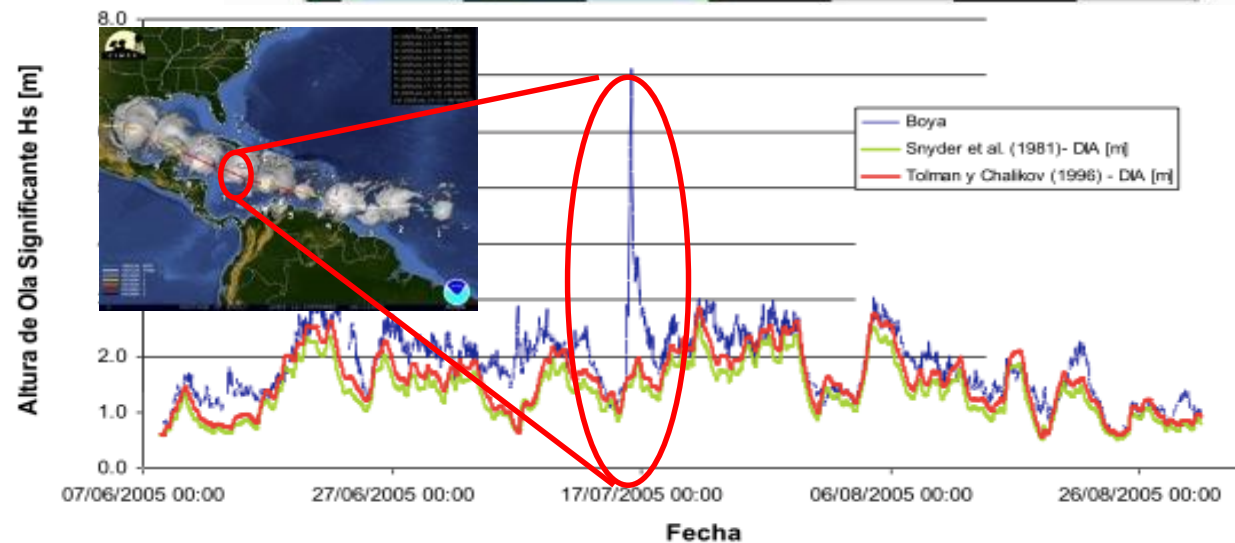
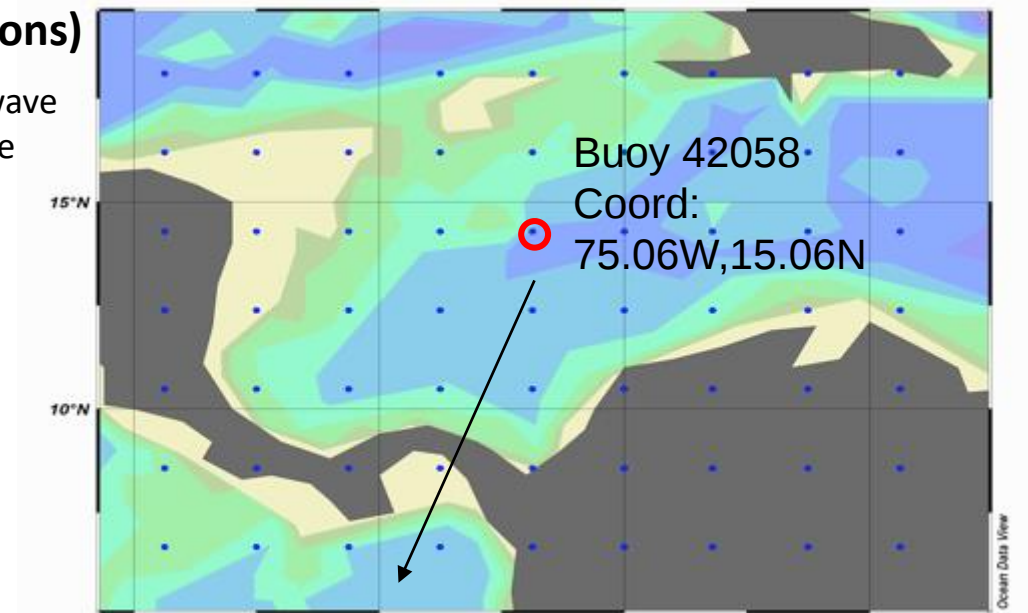
Waves Variability (Hurricane vs mean conditions)

Montoya, R., Osorio A., Ortiz J.C., Ocampo F. (2013) . A wave parameters and directional spectrum analysis for extreme winds. Ocean Engineering,

Seasonal and interannual variability of SST, ANM, SSM



Scientific Products:
2 PhD / 3 MSc
4 Papers

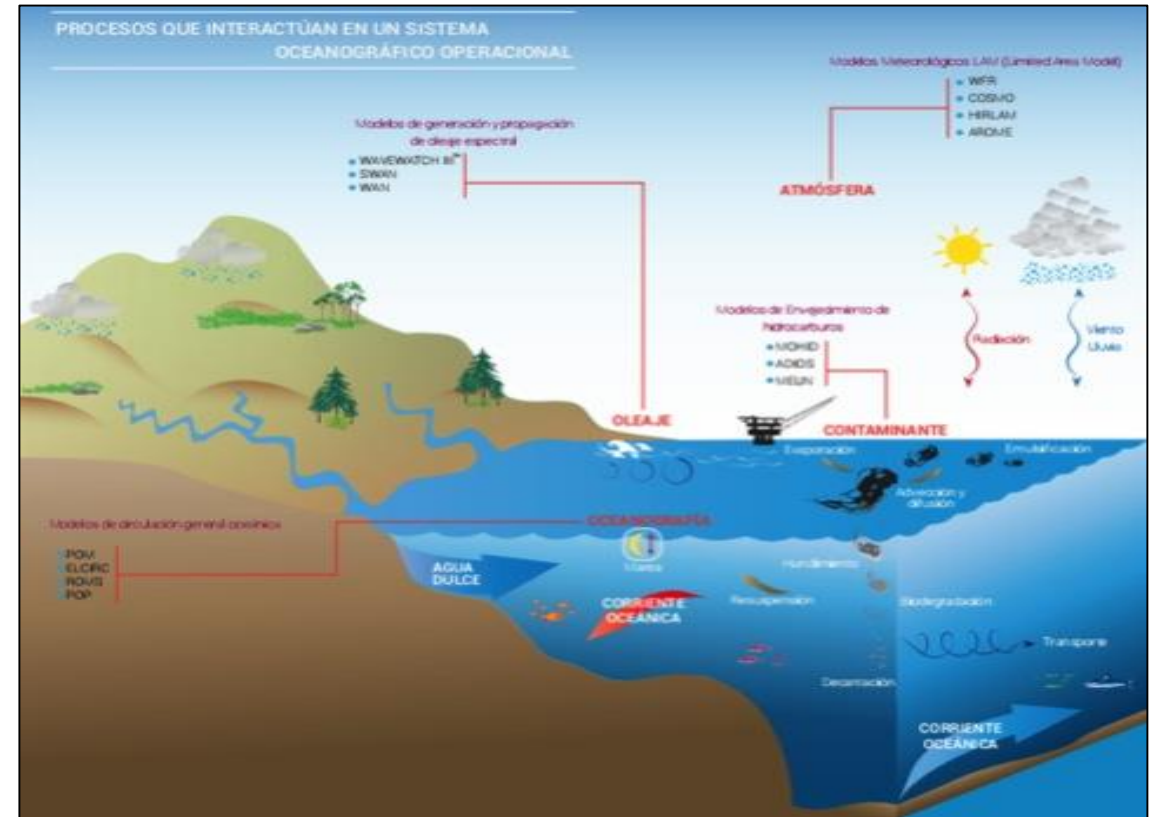


Implementation of atmosphere and oceanographic models in the caribbean sea for the offshore industry development of ROV for offshore industry

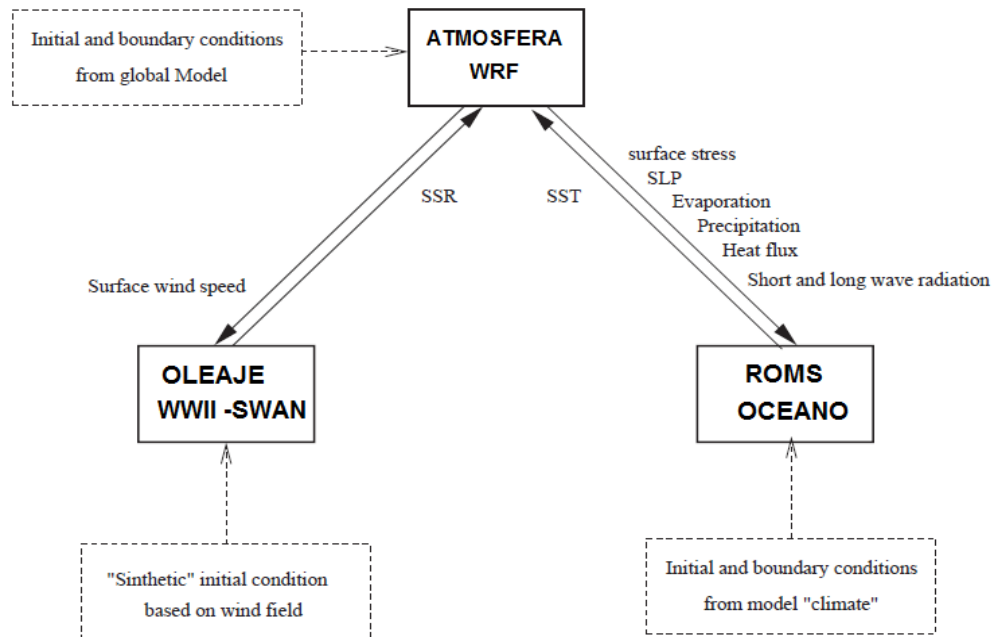
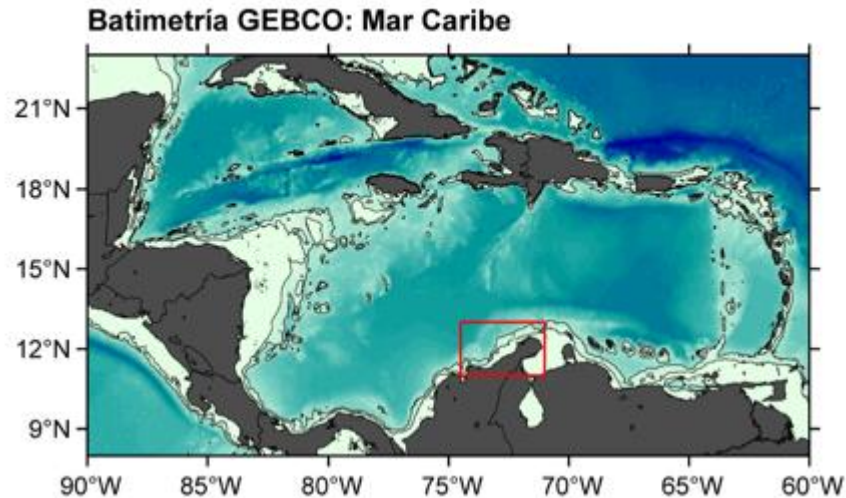
Implementation of atmospheric models (WRF), ocean (ROMS), wave (WWIII, SWAN) and oil dispersion (MEUN)



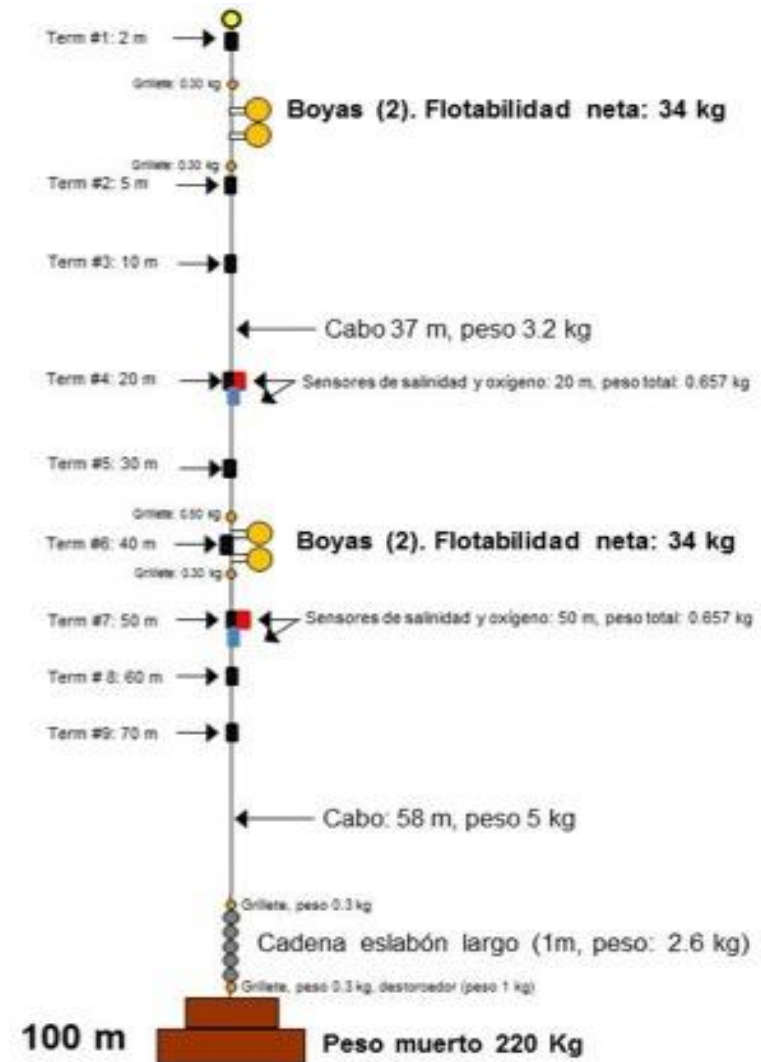
Funding: ECOPETROL and Department administrative of Science, Technology and Innovation of Colombia – COLCIENCIAS



Hindcast and Forecast – WRF – ROMS – WWIII



Adaptado de Lionello et al. (2003)



Wave Attenuation by Natural Ecosystems (Reefs and Mangroves)

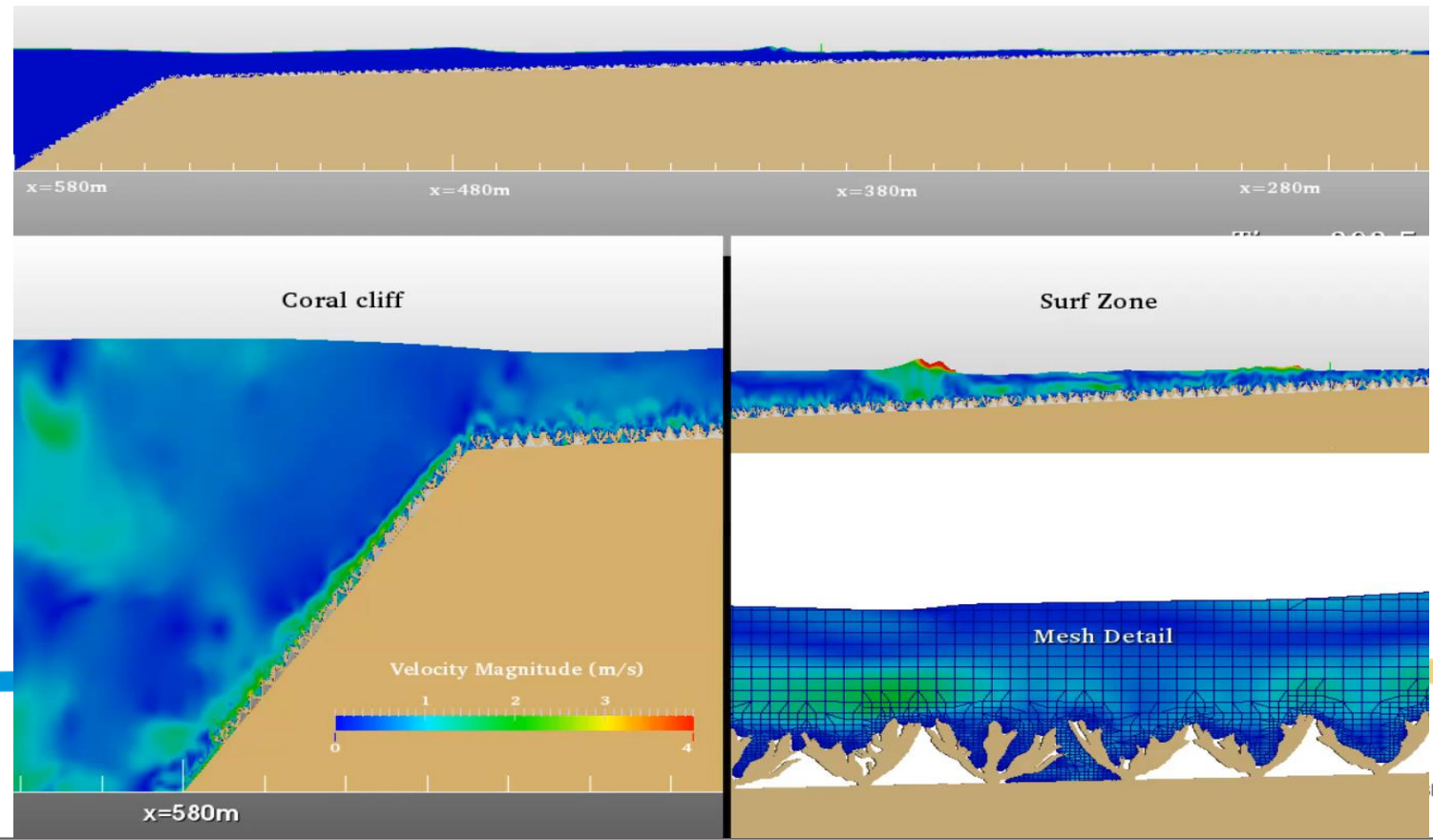
The objective of this project is to develop a generic methodology for the parameterization of natural ecosystems (reefs and mangroves), so that simpler parameterized structures (surrogates), which provide the same wave and flow attenuation performance as their very complex prototype counterparts, can be obtained. The parameterized structures are essential for scale modeling in laboratory, but also useful for numerical modelling.

CFD model:

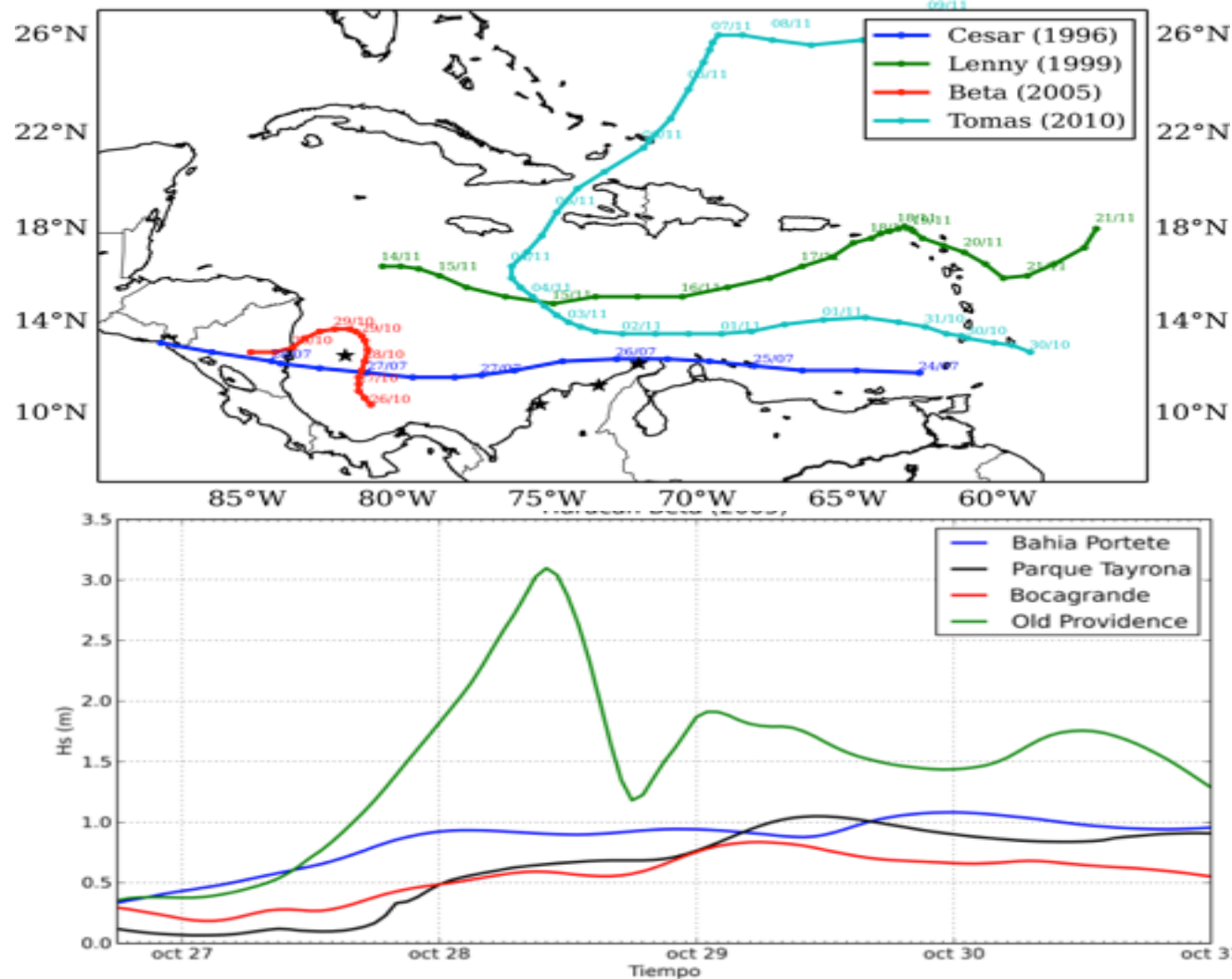
- OpenFoam model
- Regular waves
- Irregular waves (DataField – Tesoro island)

Vanegas C.A, Osorio A.F., Urrego L.E (2017) Wave dissipation across a *Rhizophora* mangrove patch on a Colombian Caribbean Island: An experimental approach. *Ecological Engineering*.
<https://doi.org/10.1016/j.ecoleng.2017.07.014>

Osorio-Cano JD, Osorio A.F, Peláez-Zapata D.S (2017) Ecosystem management tools to study natural habitats as wave damping structures and coastal protection mechanisms. *Ecological Engineering*.
<https://doi.org/10.1016/j.ecoleng.2017.07.015>



Impacts of extreme events in the Caribbean and Pacific island



Historical reconstruction of extreme events in the Caribbean and Pacific Colombian sea, and study of the response in the National Park island ecosystems (I.Rosario, I.Gorgona): Beaches, vegetation, Reefs, sedimentological indicators



G. Bernal, A.F. Osorio, L. Urrego, D. Peláez, E. Molina, S. Zea, R.D. Montoya, N. Villegas (2016). Occurrence of energetic extreme oceanic events in the Colombian Caribbean coasts and some approaches to assess their impact on ecosystems. *Journal of Marine Systems*. 164 , 85–100.

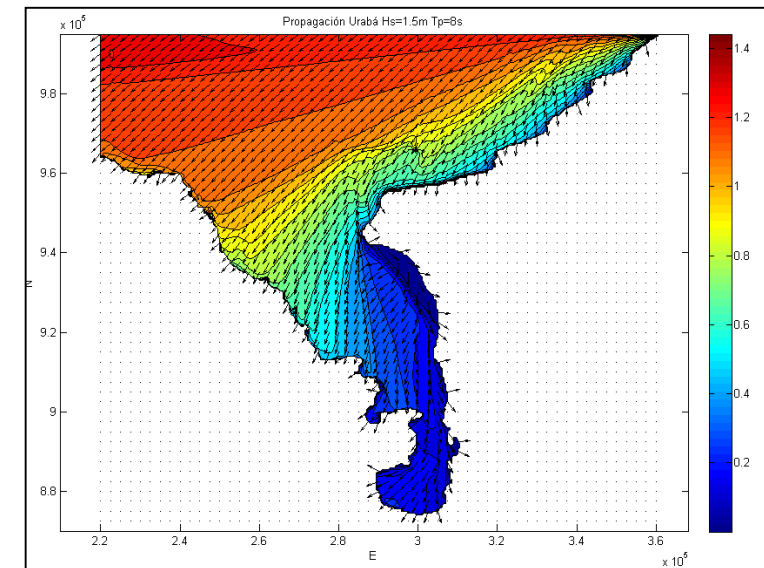
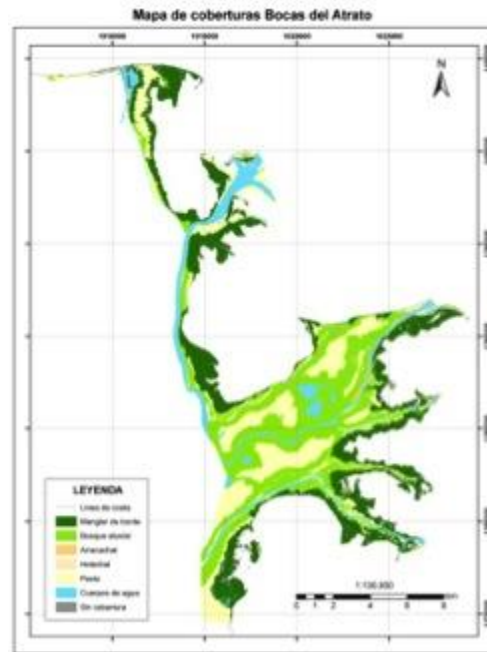
ESTUARINE EXPEDITION IN THE URABA'S GULF

Inventory of biological diversity in the mangroves of GU and study of the hydrodynamics and vegetation dynamics.

Scientific Products:
3 MSc
3 Papers

Juan F. Blanco, Mario H. Londoño-Mesa, Lizette Quan-Young, Ligia Urrego-Giraldo, Jaime H. Polanía, Andrés Osorio, Gladys Bernal & Iván D. Correa. (2011).

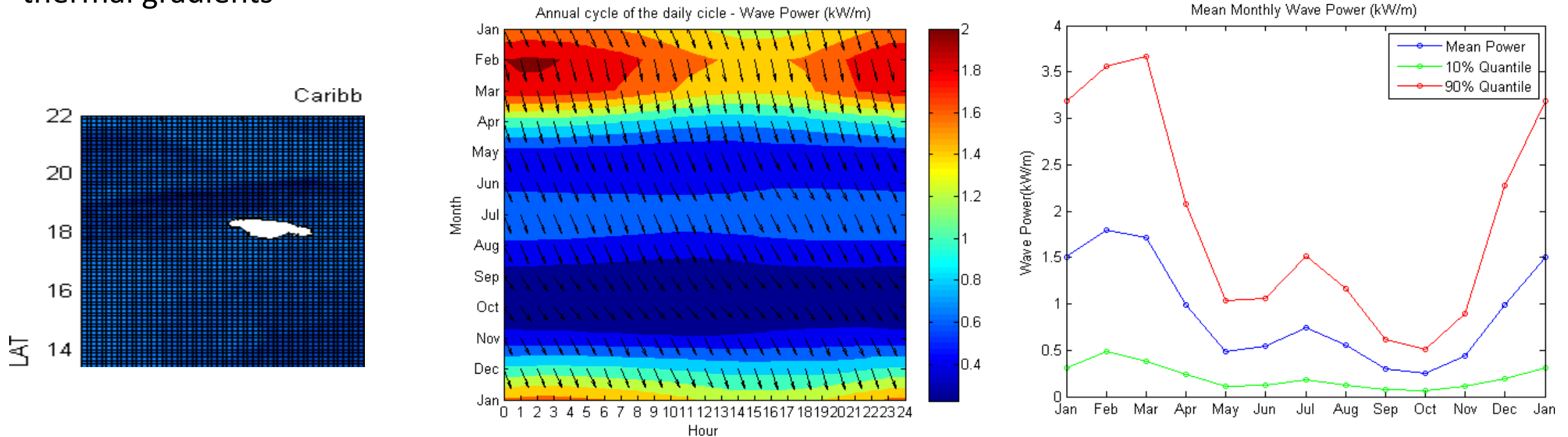
The Urabá Gulf Mangrove Expedition of Colombia. ISME/GLOMIS Electronic Journal (ISSN 1880-7682) is published by International Society for Mangrove Ecosystems (ISME). Available on-line at <http://www.glomis.com>.



Marine electric potential in Colombian territorial waters

Potential marine energy coming from different types: waves, tides, salinity gradients, and thermal gradients

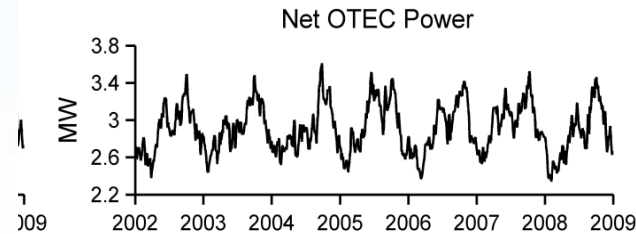
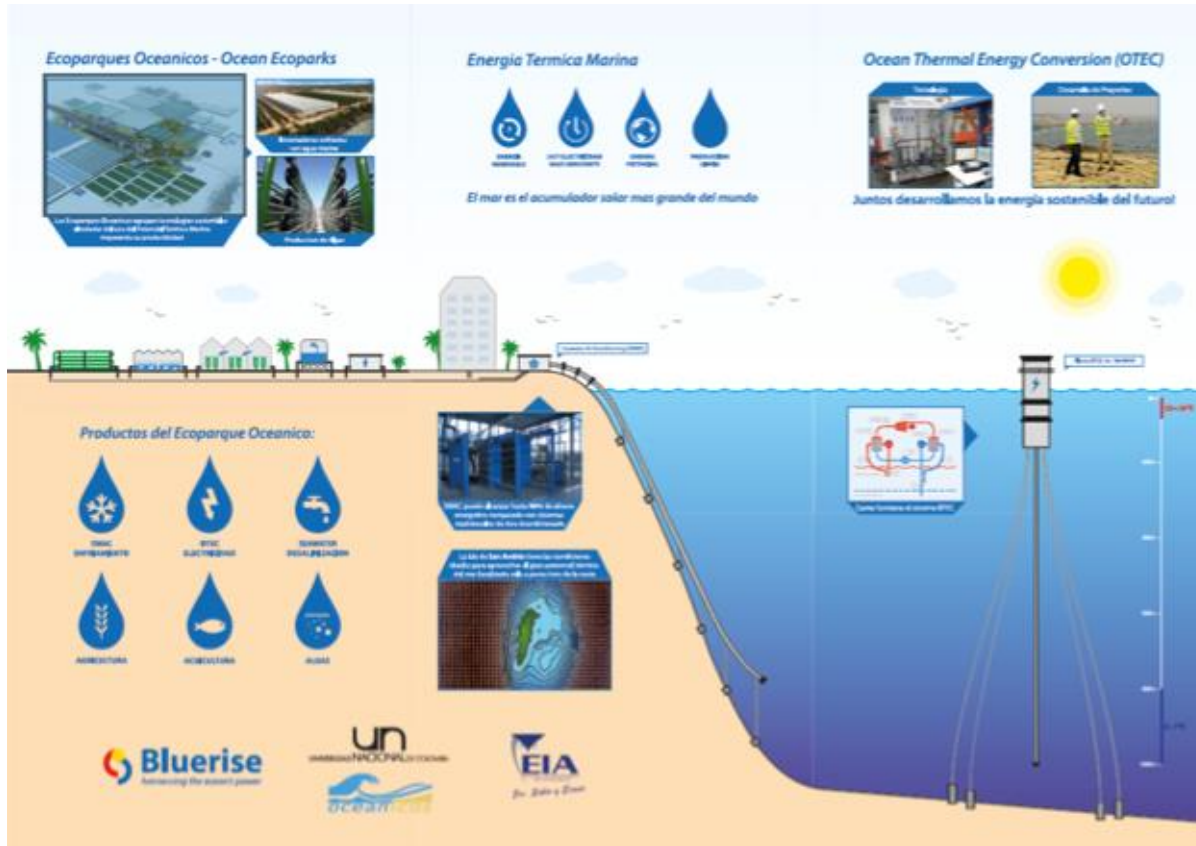
Santiago Ortega, Andres F. Osorio, Pablo Agudelo. (2013) Estimation of the wave power resource in the Caribbean Sea in areas with scarce instrumentation. Case study: Isla Fuerte, Colombia. Renewable Energy. 57 pp. 240-248.



Oscar Alvarez-Silva and Andrés F. Osorio (2014) salinity gradient energy potential in Colombia considering site specific constrains. . Renewable Energy Journal

FEASIBILITY STUDY FOR OTEC, SWAC AND OCEANIC ECOPARK FROM DOW IN SAN ANDRÉS. (UNAL-EIA-BLUERISE)

Feasibility study for the implementation of technology: ocean thermal potential (OTEC), Air Condition (SWAC) from Deep Ocean Water (DOW) and Oceanic Ecopark from DOW on the island of San Andres.



Devis-Morales et al. (2013) *Ocean Thermal Energy Resources in Colombia*. Renewable Energy Journal.

Osorio et al (2016) *Assessment of the marine power potential in Colombia* Renewable and Sustainable Energy Reviews 53, 966–977.

Osorio A.F. et al (2016). *Beyond electricity : The potential of ocean thermal energy and ocean technology ecoparks in small tropical islands*. EnergyPolicy,

Funding: DNP – Direction of National Planning



DEVELOPMENT OF COASTAL VIDEO MONITORING SYSTEM

www.horusvideo.com

Funding: AECID, UNICAN

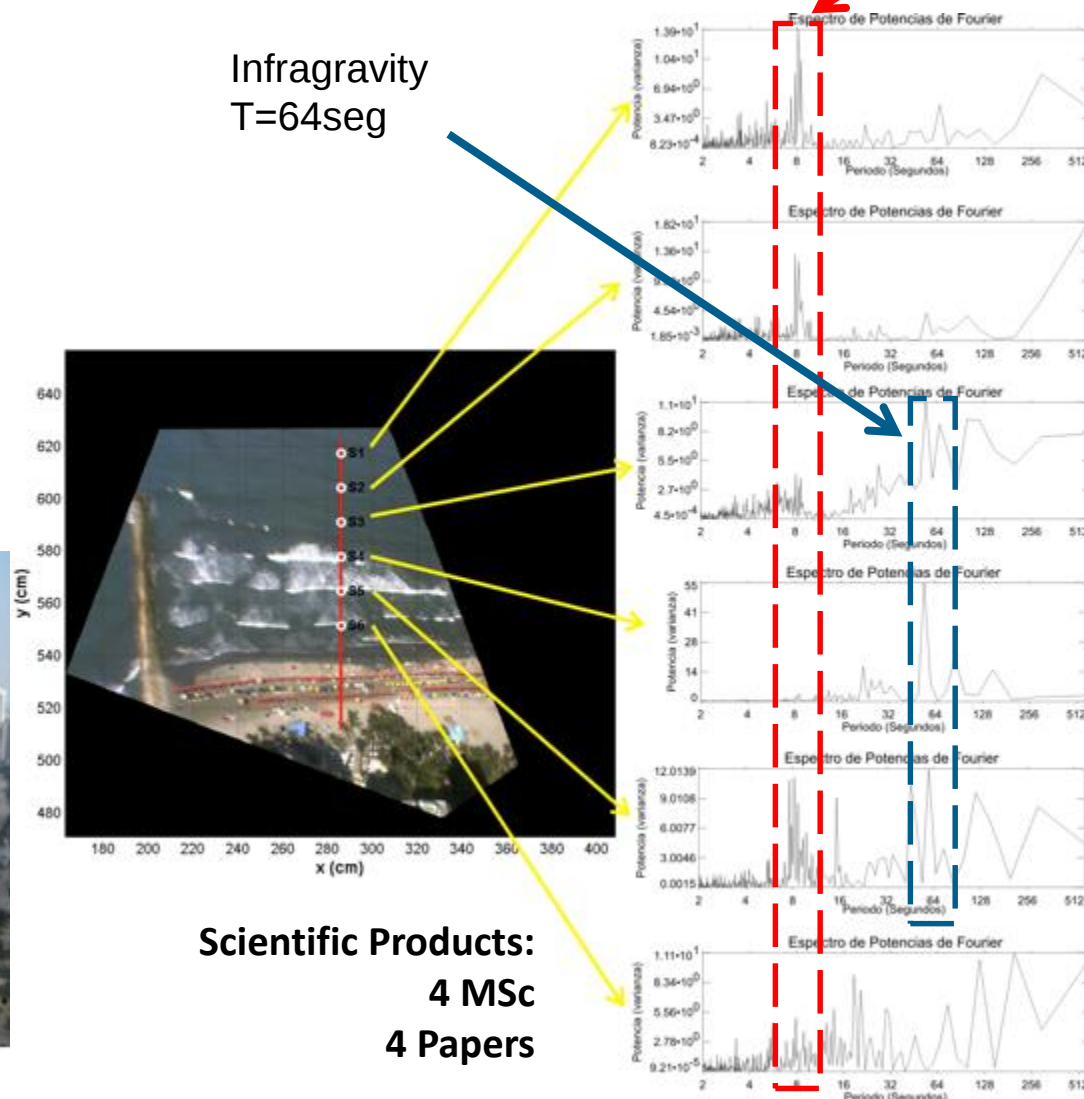
Osorio, A.F. et al (2012) An algorithm for the measurement of shoreline and intertidal beach profiles using video imagery: PSDM, Computers & Geosciences, ISSN: 0098-3004, 46, pp. 196-207

Pérez J.C. et al R. (2012). Environmental Applications of Camera Images Calibrated by Means of the Levenberg-Marquadt Method. Computers & Geosciences.



Infragravity
 $T=64\text{seg}$

$T_p=8\text{seg}$



Scientific Products:
4 MSc
4 Papers

IMPLEMENTATION OF THE PROJECT “TECHNOLOGY NEEDS ASSESSMENT “ IN COLOMBIA

Assessment of technology needs for adaptation to climate change in Marine and Coastal areas of Colombia

Organize the assessment

Development Priorities

Prioritize sub-regions

Prioritize technology

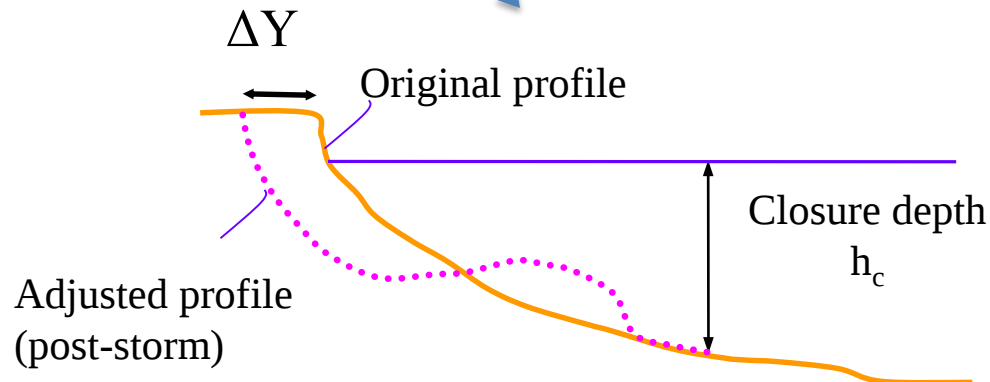
Make an Action Plan and a national strategy

What is the impact due to extreme events in the shoreline?

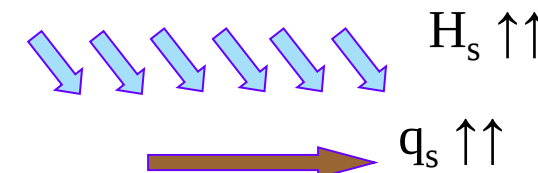
(1) Cross-shore

(2) Longshore

Shoreline erosion



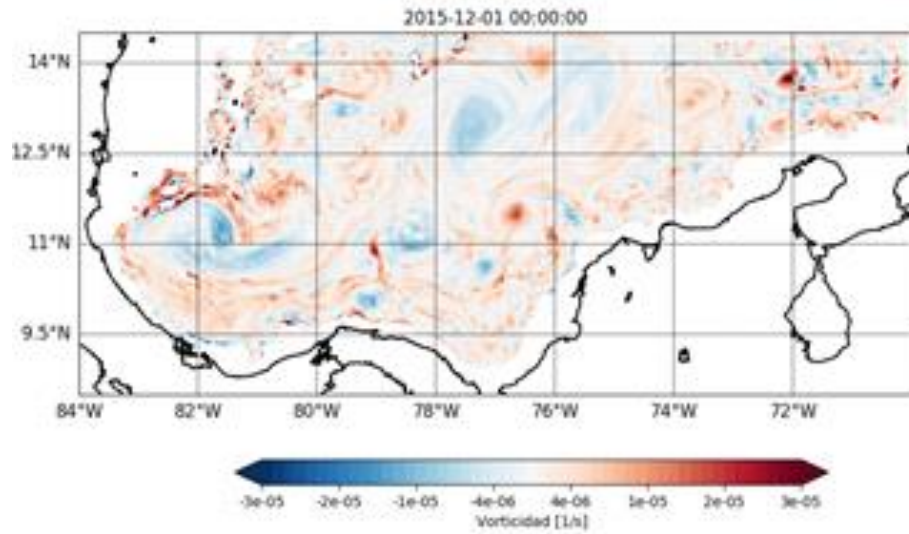
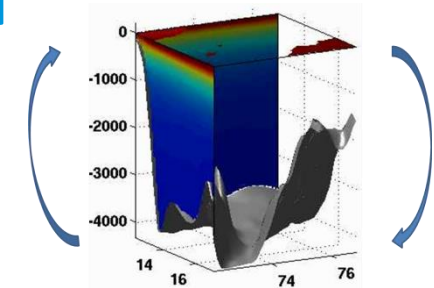
$$\Delta Y = f(H_s, T_p, D_{50}, \text{duration}) = H/wT$$



Littoral drift

Ocean circulation in the Colombian Caribbean Sea

20 years database



1996

2016

Mediciones

ENSO (+)

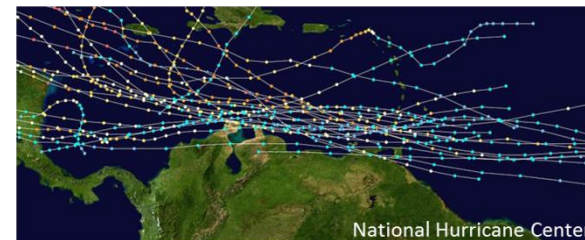
1997-1998 Muy fuerte
2002-2003 Moderado
2004-2005 Débil
2015-2016 Muy fuerte

ENSO (-)

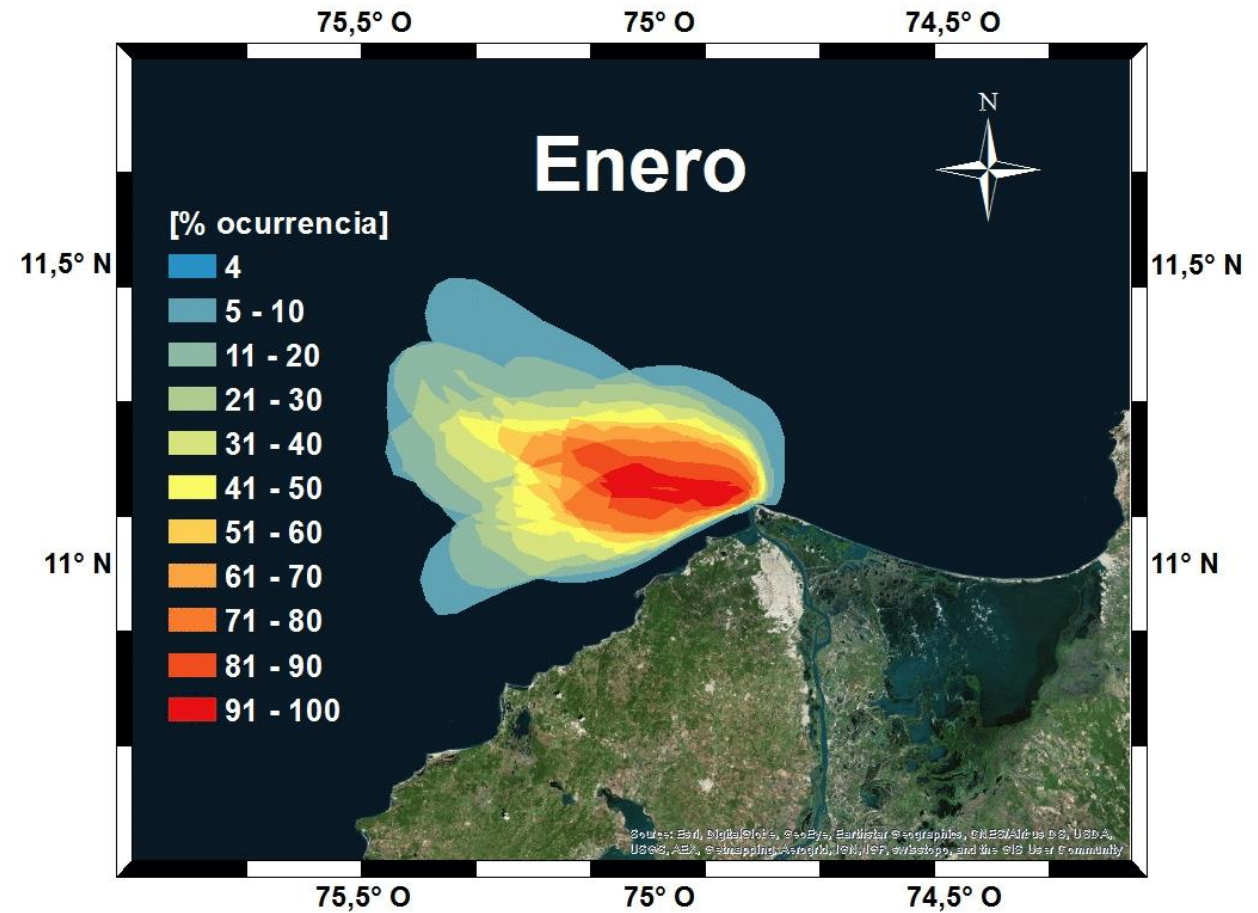
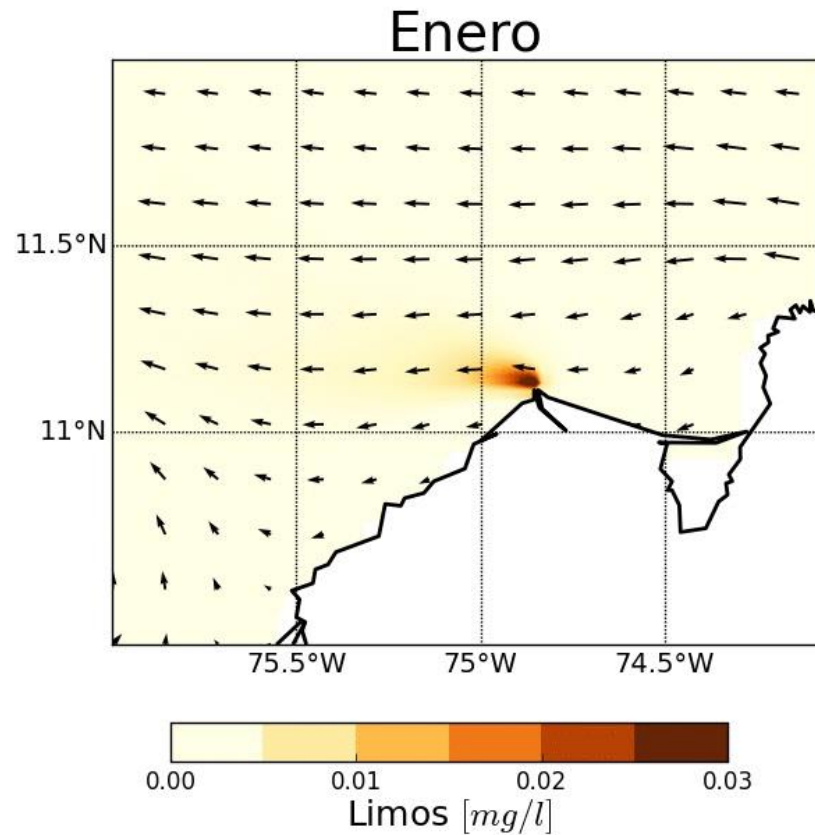
1998-1999 Moderado
1999-2000 Moderado
2007-2008 Moderado
2010-2011 Moderado

Tormentas tropicales

- 40 (1996-2016).
- 24 – Huracanes categoría 4-5
- Matthew 10-2016 y Otto, 11-2016

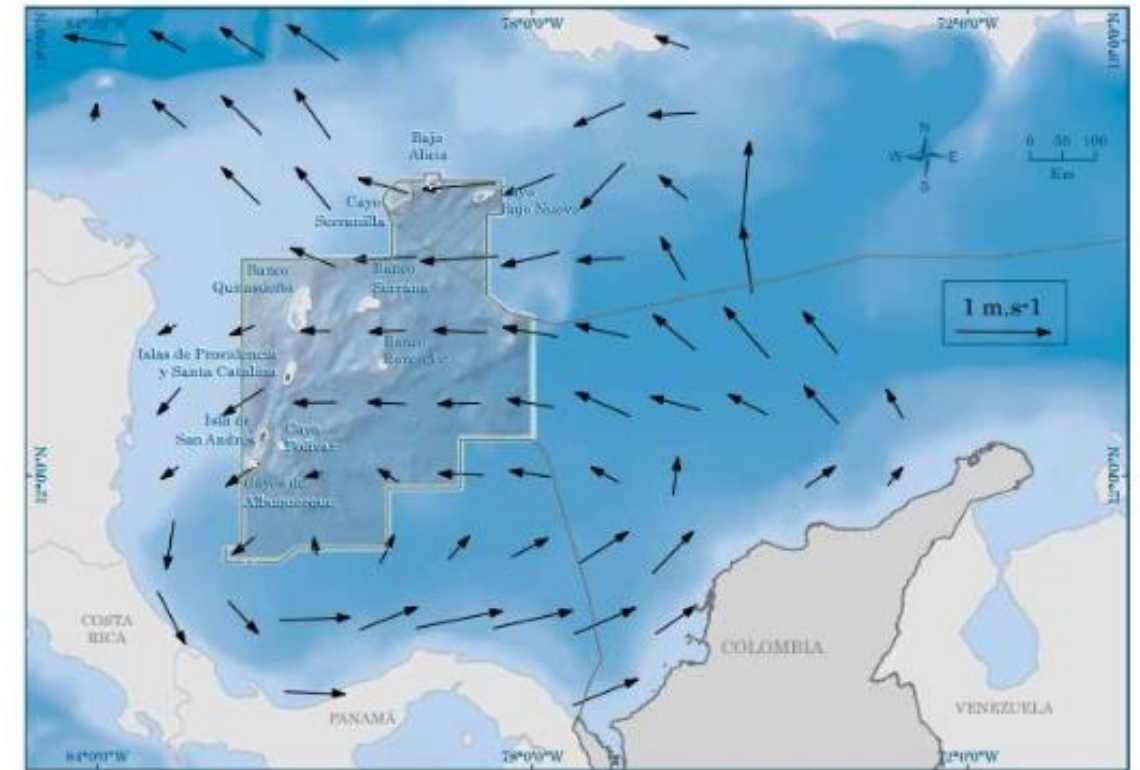


Magdalena river plume temporal and spatial variability



Arredondo, 2017

Seaflower biosphere reserve physical and biological connection



Lopera, 2018