Ocean Modelling for Science-Policy Integration

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Cambio Climático

Amplifica los fenómenos extremos

- Aumento de las sequías
  - Escasez de agua
- Aumento de las inundaciones
  - Acumulación de agua
  - Aumento de la contaminación costera

Cambio Climático

- Aumento de la contaminación costera
  - Condiciones sanitarias de las playas
  - Toxicidad de los metales en los peces
  - Degradación los ecosistemas
  - Agotamiento de las reservas de peces
  - Cambio en la dieta

Crossing the Line at a Global Scale


A HEALTHY GLOBAL OCEAN
1 NO POVERTY
Livelihoods of coastal communities
2 ZERO HUNGER
Healthy fish stocks and vital food sources
3 GOOD HEALTH AND WELL-BEING
Reduces exposure to contaminants
4 QUALITY EDUCATION
Study of natural, undisturbed ecosystems
5 GENDER EQUALITY
Protects women's jobs in marine industries
6 CLEAN WATER AND SANITATION
Prevents pollutants from contaminating freshwater systems
7 AFFORDABLE AND CLEAN ENERGY
Protects offshore renewable energy infrastructure
8 DECENT WORK AND ECONOMIC GROWTH
Preserves marine economies
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
Promotes cleaner industrial practices
10 REDUCED INEQUALITIES
Equitable access to healthy marine resources
11 SUSTAINABLE CITIES AND COMMUNITIES
Reduces degradation of coastal ecosystems that protect urban shorelines
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
Promotes circular economies
13 CLIMATE ACTION
Preserves carbon-sequestering marine ecosystems
14 LIFE BELOW WATER
Directly protects marine biodiversity
15 LIFE ON LAND
Supports biodiversity in interconnected habitats
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
Strengthens policies, regulations, and international cooperation
17 PARTNERSHIPS FOR THE GOALS
Stakeholder collaboration

Science-based targets are needed

Paris Agreement:

Indice	Target
Increase in global average temperature above pre-industrial levels	2 °C

- ✓ **Knowledge on system limits**
- ✓ **Science-based targets**

Science-based targets are needed

Sustainable Development Goal 14:

Indice	Target
coastal eutrophication index; plastic debris density	14.1 prevent and significantly reduce marine pollution of all kinds

✗ **Knowledge on system limits**

✗ **Science-based targets**

Limits for land-based discharges in the coastal zone

- Ad-hoc group
- Total Maximum Daily Loads
    - Best Available Technology

✗ **Science-based** ✗ **Ecosystem-relevant**

In this study,

Tosic et al., 2019
Marine Policy 108
(103641)

Objective:

To demonstrate a practical coastal water quality target-setting method that is:

i) appropriate at the local-scale

ii) science-based

iii) ecosystem-relevant

iv) applicable to developing countries where historical datasets are unlikely to be available.

Research Question: What fluvial suspended sediment load is needed to effectively ensure that the coral reef ecosystem threshold is not exceeded?

MOHID Model

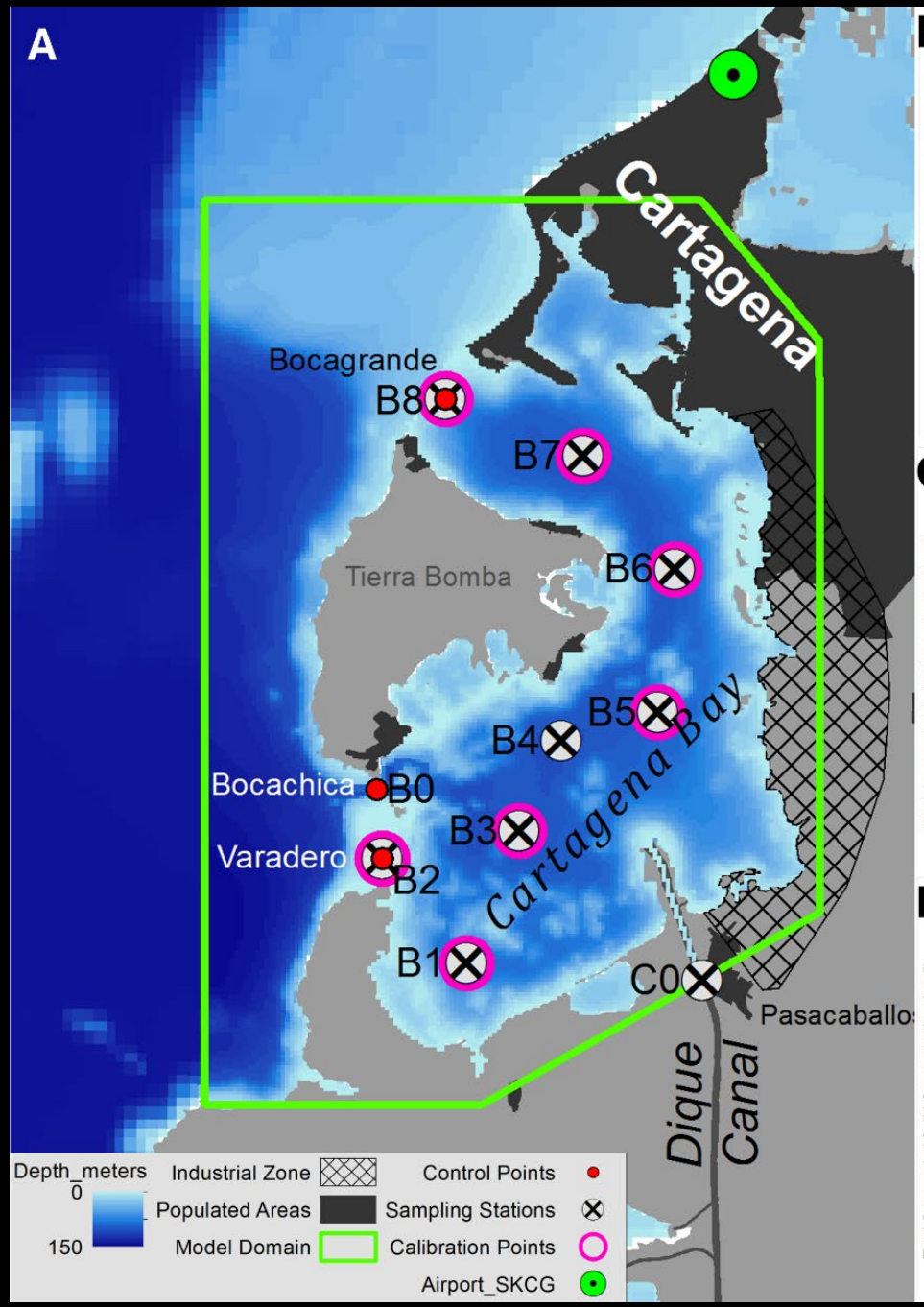
Tosic et al., 2019
J. Environ. Manage.
236: 695-714

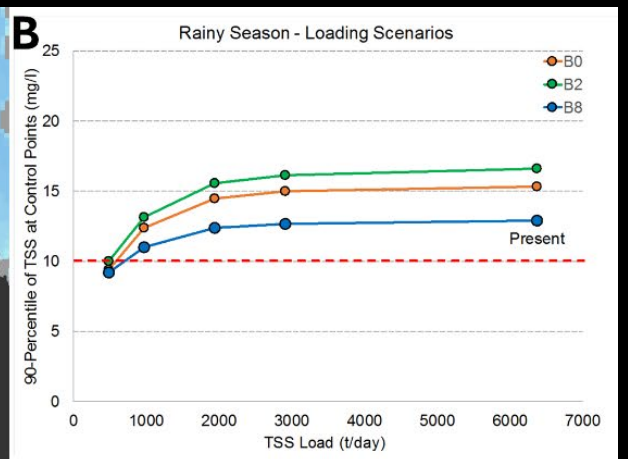
Horizontal Cartesian Grid: 75m resolution

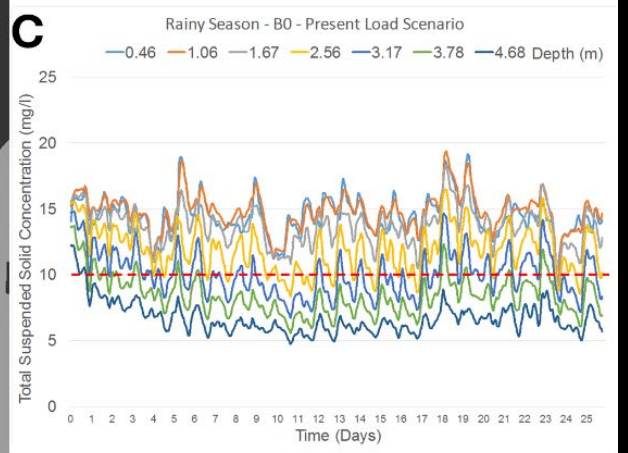
Mixed Vertical Discretization: 22 layers (top 7 sigma)

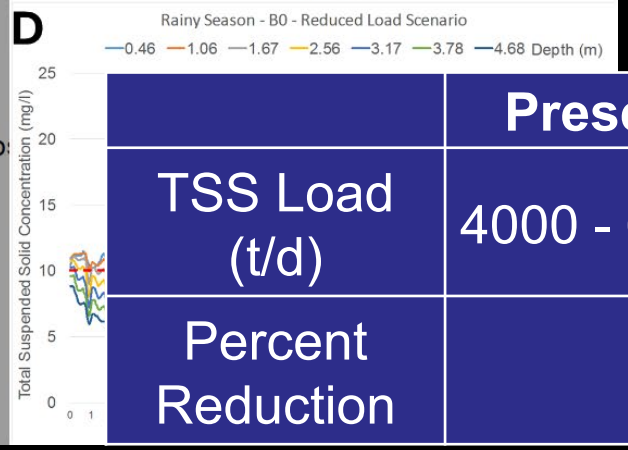
- Bathymetry: Nautical maps
- Tides: FES
- Winds: Airport METAR
- Atmosphere: GFS
- Boundaries: Mercator & Canal measurements

- Month-long simulations (Windy, Transition, Rainy)
- Initial conditions: CTD field measurements
- Final result: Compared to next month's measurements







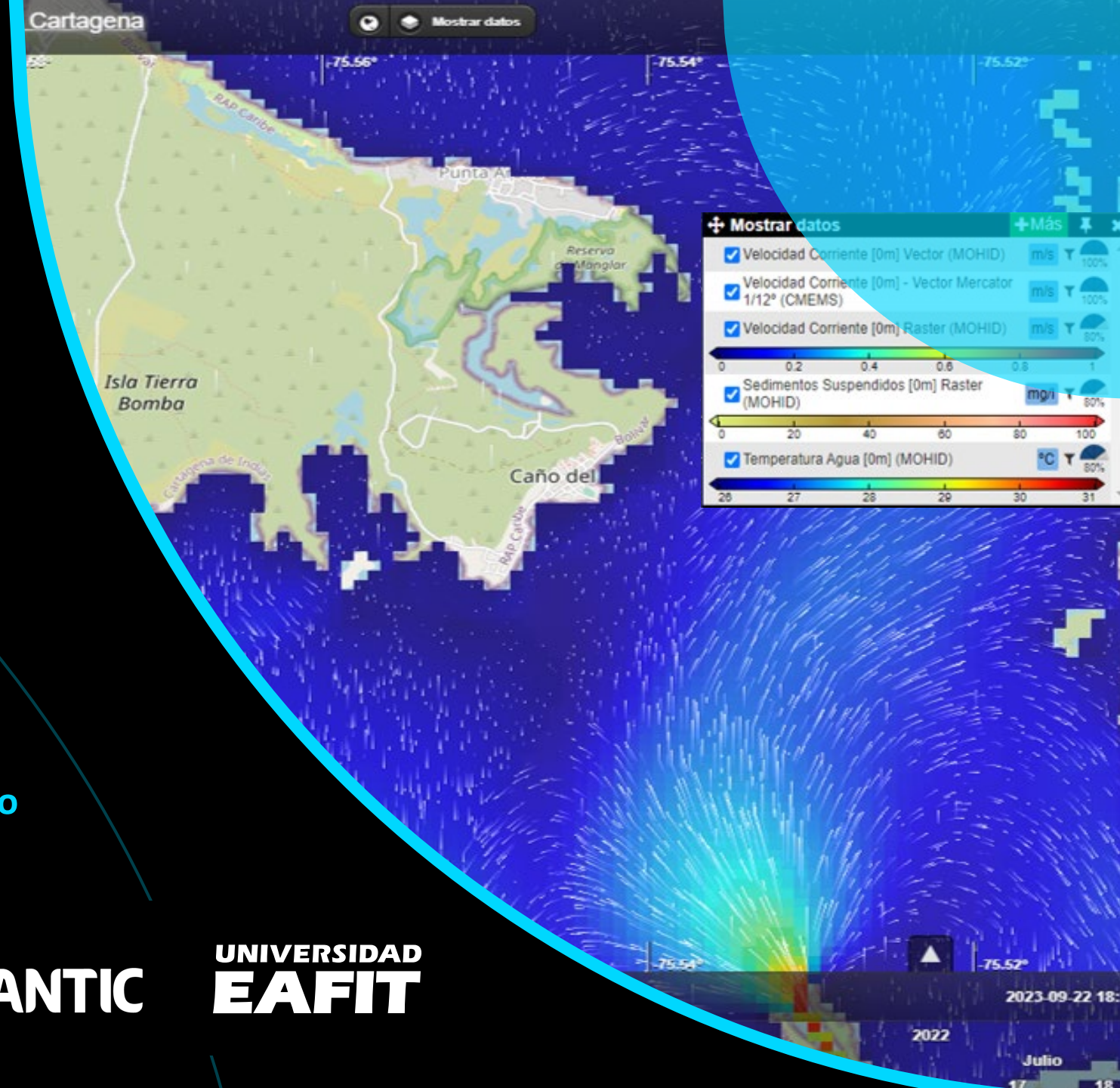


	Present	Reduction
TSS Load (t/d)	4000 - 6000	500 - 700
Percent Reduction		80 – 90%

Observatorio Bahía de Cartagena

Pronósticos en tiempo real de condiciones de bahía
En línea y pública:

http://bahiacartagena.omega.eafit.edu.co



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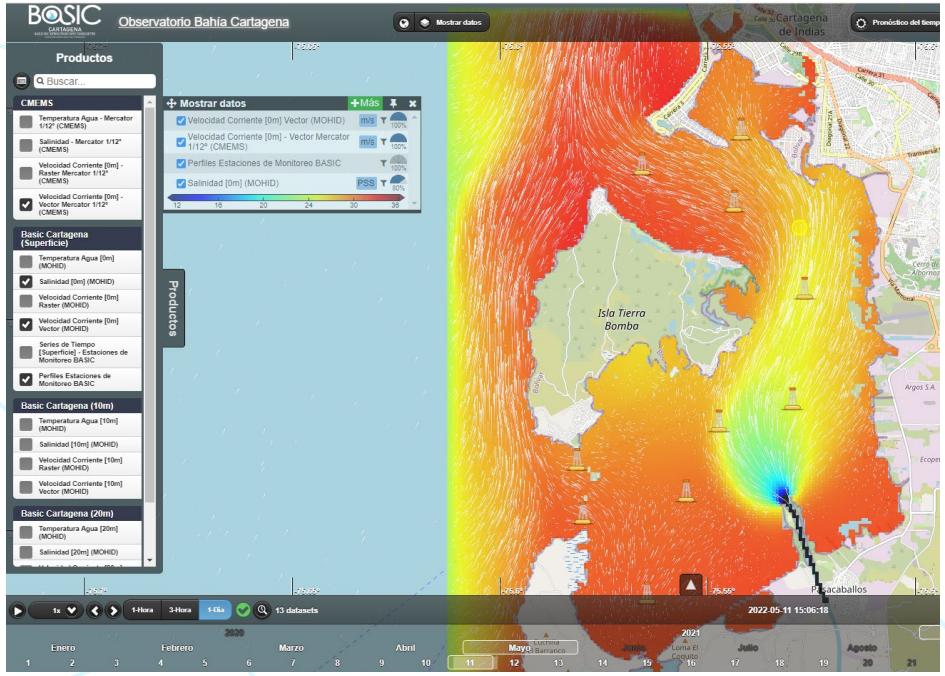
Observatorio Bahía Cartagena



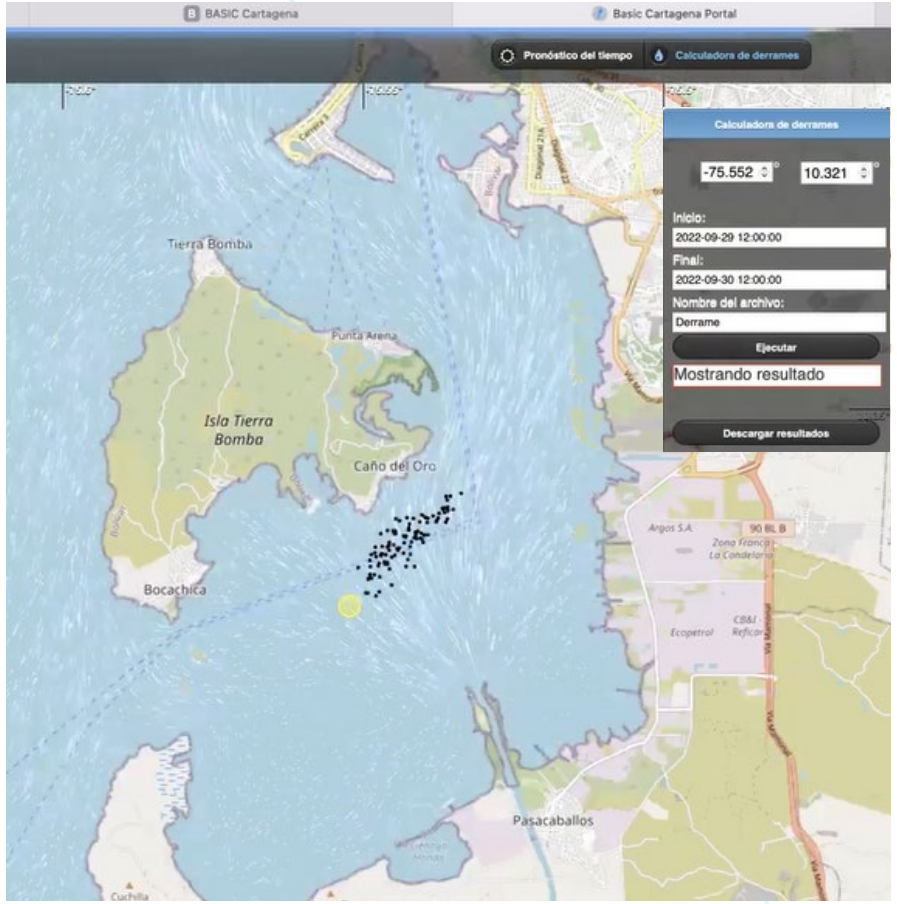
Monitoreo:

- Temperatura
- Salinidad
- Caudal

▶ **Hidrodinámica**

Simulador de derrames

▼



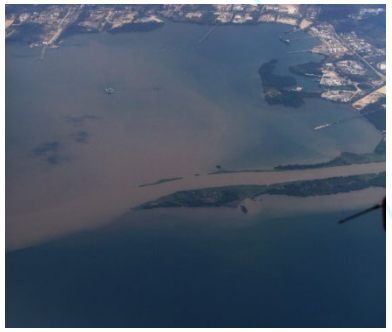
Observatorio Bahía Cartagena

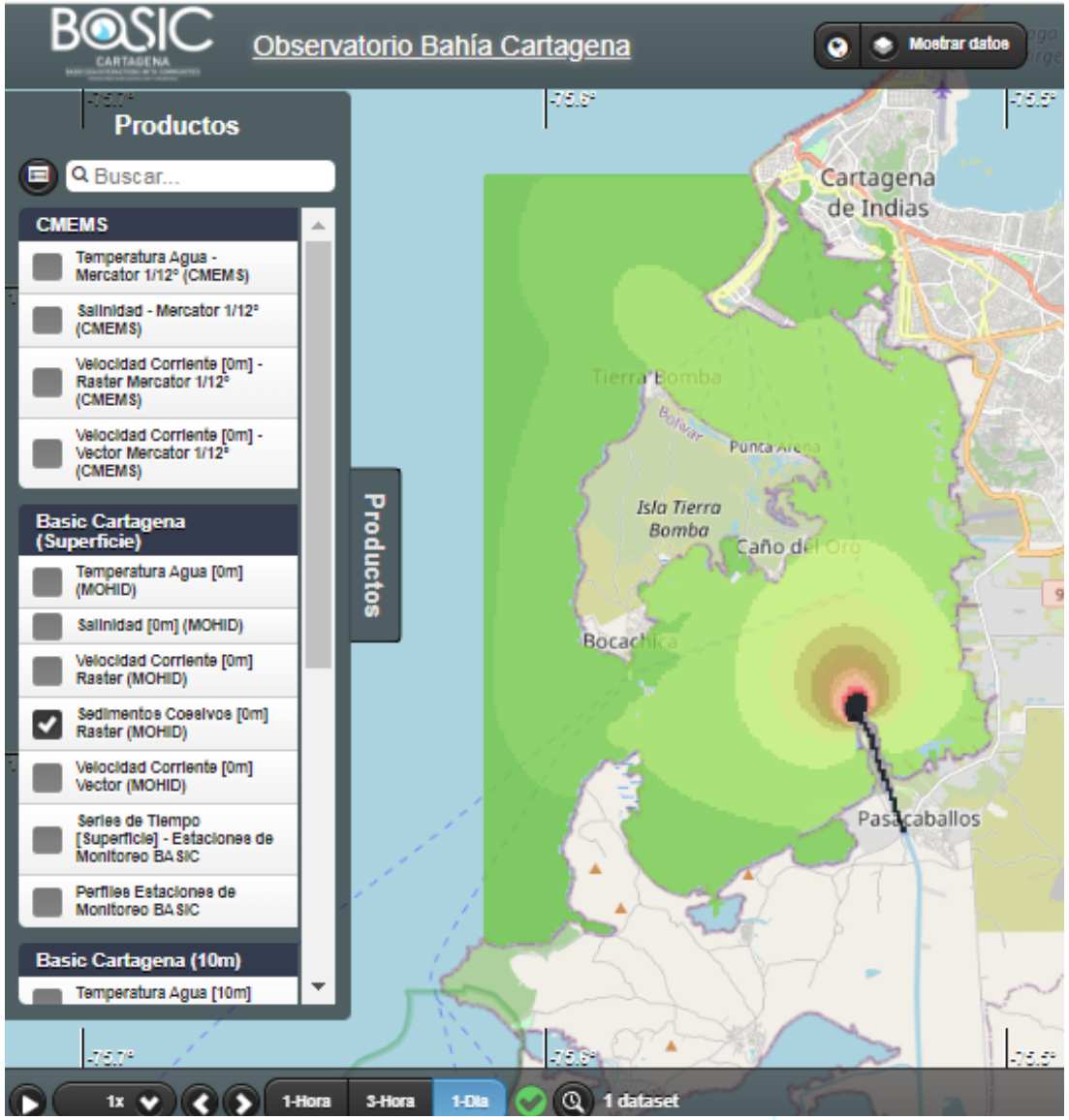
Pronósticos de Sedimentos en Tiempo Real

Arrecifes

Playas

Transporte de Contaminantes





Obrigado

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