



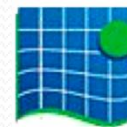
# ASIMUTH

Applied simulations and Integrated modeling  
for the understanding of toxic and  
harmful algal blooms

**Glenn Nolan and Caroline Cusack (Marine Institute, Ireland)**

**Laia Romero (Starlab, Spain)**

Representing the ASIMUTH consortium



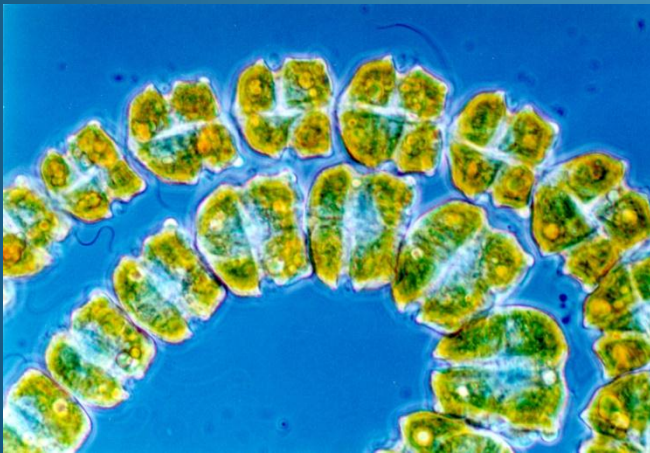
*Marine Institute*  
Fórsa na Mara

# Talk outline

- **Why a downstream service for Harmful Algal Blooms?**
- **The integrated approach**
- **Who is involved?**
- **What will we do?**
- **A possible template for our activity**
- **Web tool development**



# Aquaculture Background



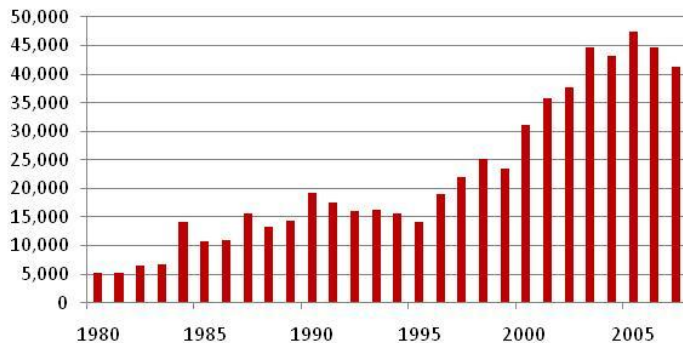
- **Harmful Algal Blooms (HAB)**
  - sporadic
  - largely unpredictable and may
  - seriously disrupt production plans of fish farms.
- **These blooms add costs through**
  - **fish mortalities**
  - **prolonged bay closures**
  - **waste disposal of fish**
  - **increased insurance deductibles.**

**ASIMUTH**

# Irish example – shellfish

- Ireland has a Shellfish Industry which has greatly increased its output since 1982
- (~50,000t > €60m)
- We have a number of toxins that require careful control
- An openly transparent and intensive management system in place

Tonnes Shellfish

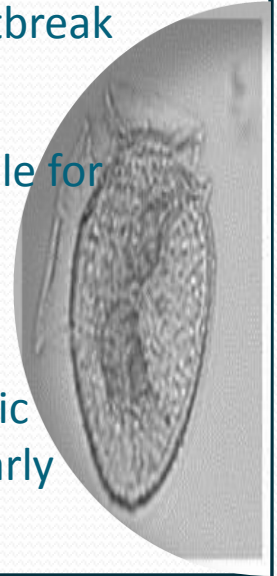


***Dinophysis acuminata*** - 1<sup>st</sup> toxic outbreak in western European waters.

Some spp. produce toxins responsible for Diarrhetic Shellfish Poisoning (DSP)

Present at low levels all year round

Higher numbers associated with toxic events in late spring summer and early autumn

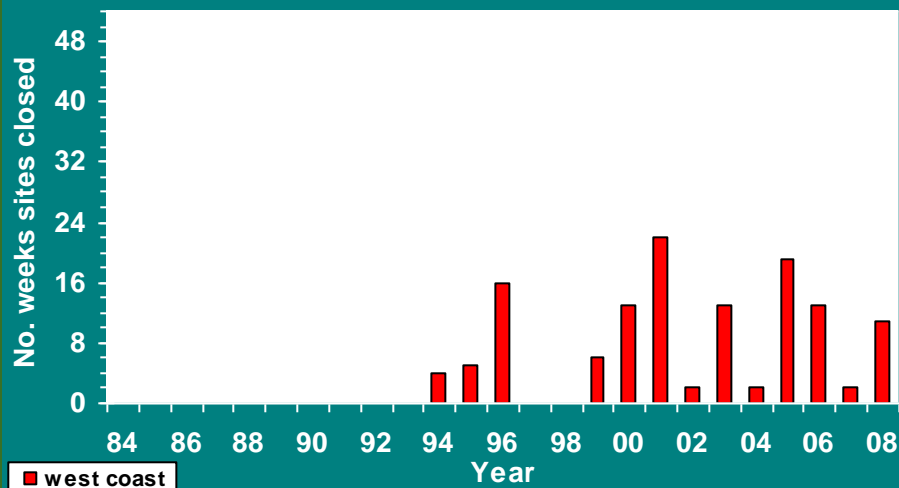


***Karenia mikimotoi*** bloom, summer 2005 Mass mortality of benthic fauna along the west coast

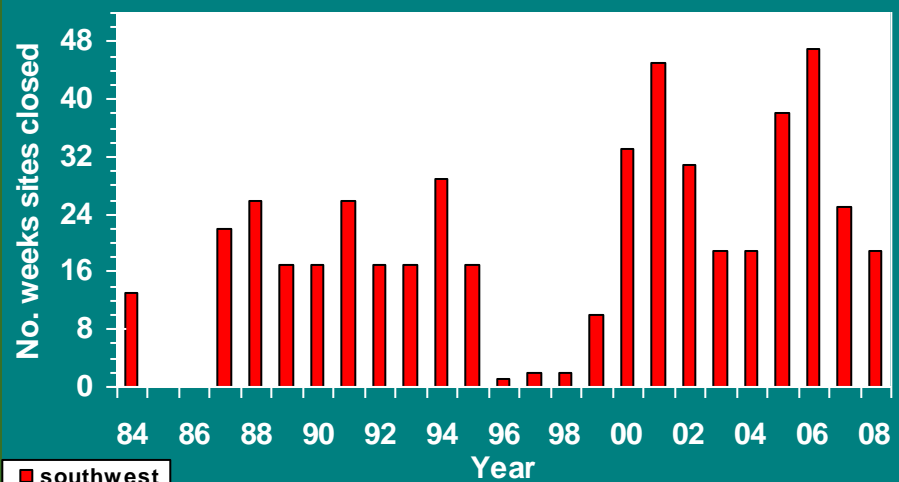


# Why do we need a HAB tracking and forecast system?

## WEST



## SOUTH WEST



## History of shellfish industry

### West coast

### Mean Closures per year

■ = 9 weeks

### Southwest coast

### Mean Closures per year

■ = 20 weeks

■ = OPEN

■ = CLOSED

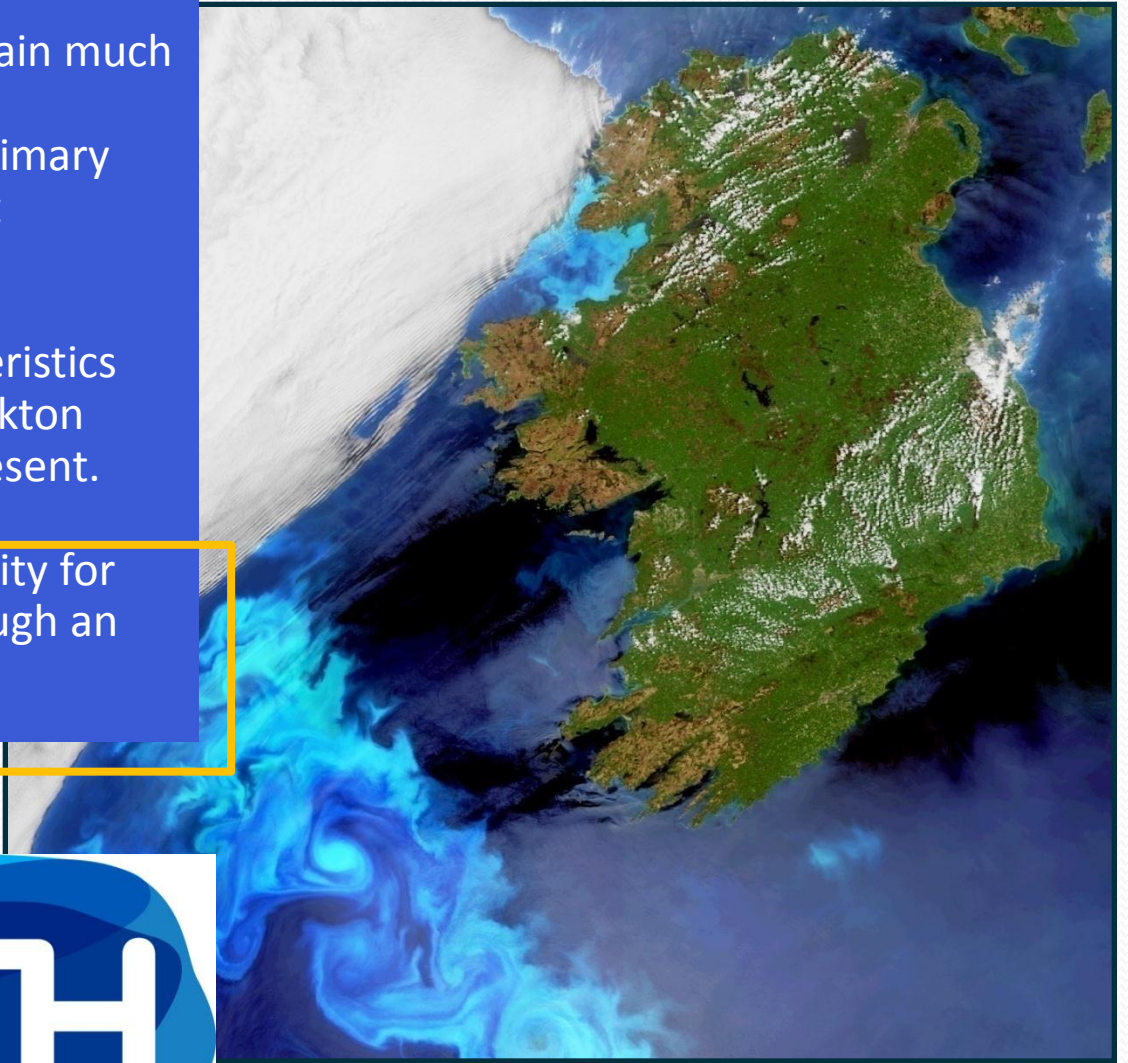


The marine environment is a physically forced ecological and biogeochemical system.

Circulation processes alone explain much of the observed pattern of the biogeochemical fields such as primary production, oxygen and nutrient distributions.

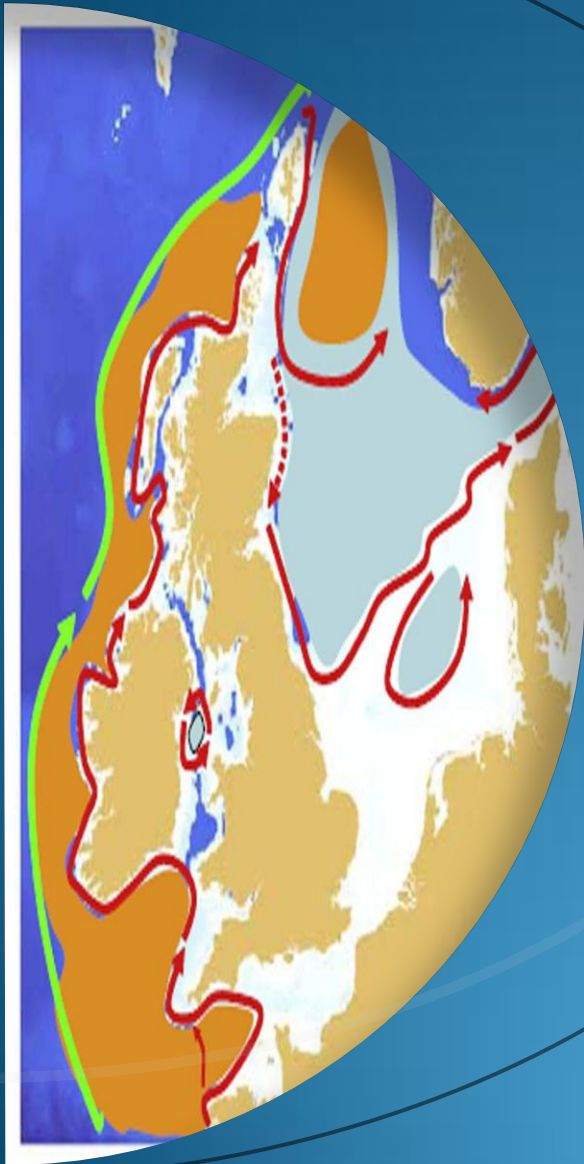
Regional physical water characteristics will select the type of phytoplankton species (including HAB spp.) present.

Developing a forecasting capability for HABs can only be achieved through an integrated approach.



# An integrated approach

# ASIMUTH



1. A HAB forecast system requires co-operation of scientists in collaboration with policy makers and stakeholders
2. Knowledge of regional physical processes and HAB dynamics (OCEANOGRAPHERS)
3. Select test sites where a good understanding of HABs has been established (NMP)
4. Select target HAB species to model (BIOLOGISTS)
5. Use all available existing resources e.g. NMP, satellite data and simulated data (DATA EXPERTS)
6. Develop model using historical data, validate and fine tune the model based on the outcome (MODELLERS)
7. When happy with results move on to nowcasting and forecasting (EXPERT INTERPRETATION)

# Project implementation

## Funding Scheme

FP 7 Cooperation – Space Theme

## Project No

261860

## Consortium

11 Partners Scotland, Ireland, France  
Spain and Portugal

## Start date

1<sup>st</sup> December 2010

## Duration

36 months

## Budget

€3,237,137





# Our objectives

## Development of forecasting capabilities to warn of impending harmful algal blooms.

### SCIENTIFIC OBJECTIVES

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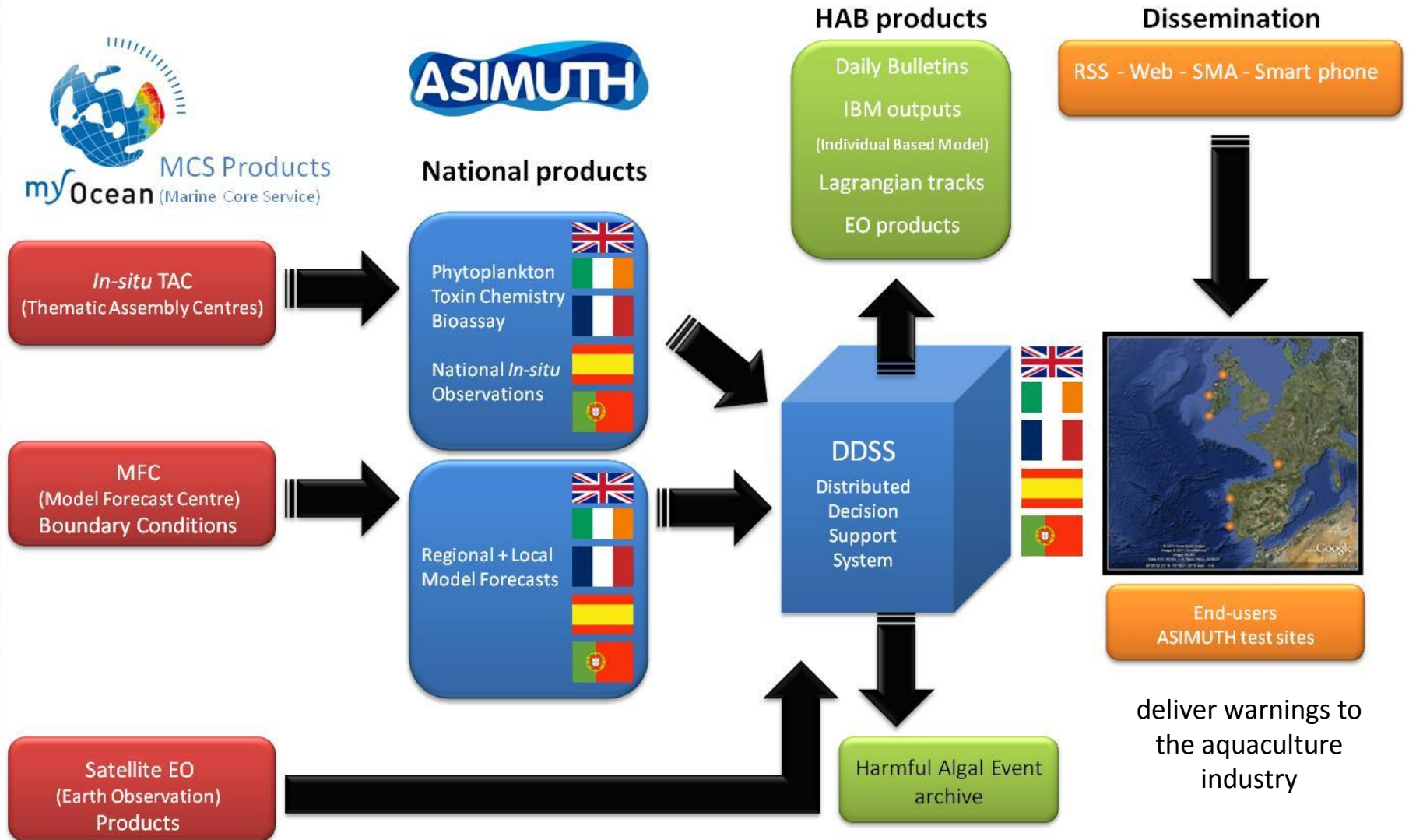
- Key past events → re-analysis and training the modelling system
- GMES Marine Core Services (MCS) → from hindcast to an operational forecasting
- Regional scale → nowcast for specific HABs at certain locations
- HAB-Distributed Decision Support system (HAB-DDSS) → Thematic Assembly Centre
- Expert interpretation → web-portal, warning system to end users

### TECHNICAL OBJECTIVES

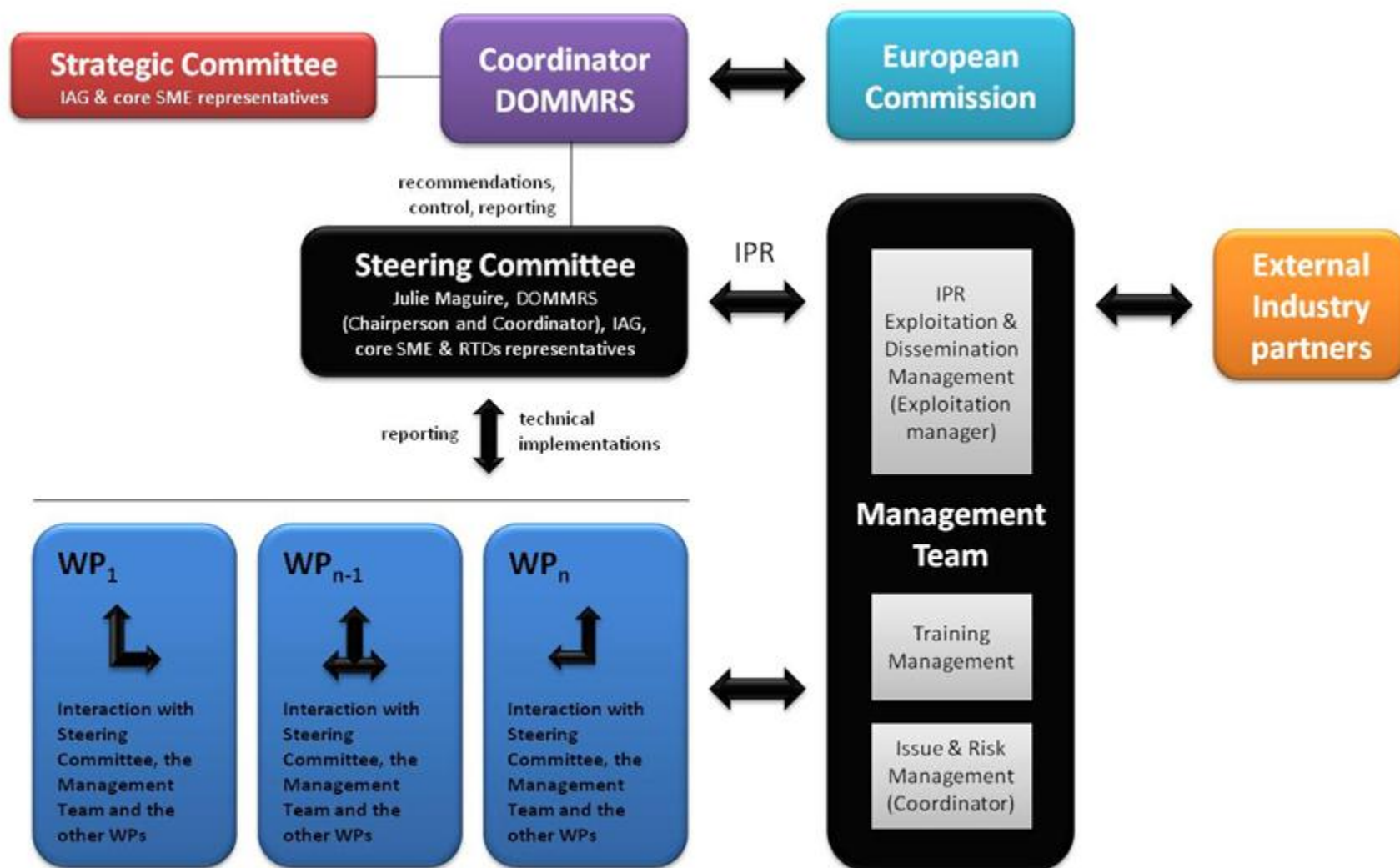
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- Tuning the system to various HAB species / risks and validation
- HAB-DDSS to assemble data meaningfully from large variety of sources
- Feedback loop for users to connect with the project experts
- Economic assessment of ASIMUTH to mitigate risk and improve productivity
- Dissemination activities and exploitation of the project outputs

# HAB Distributed Decision Support System



# ASIMUTH: Management Structure



IPR = intellectual property Rights

Level 1: **strategic Level** (composed of a Strategic Committee)

Level 2: **executive level** (represented by a Steering Committee and assisted by an Operational Management Team and)

Level 3: **implementation level** (takes care of direct implementation of the project)

# Workpackages

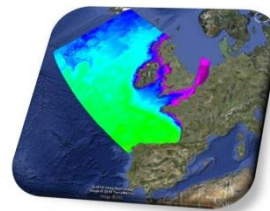
## WP1

Project  
Management



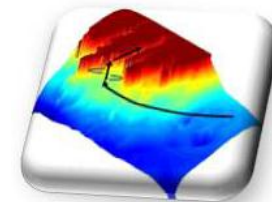
## WP2

HAB reanalysis



## WP3

Nowcast/  
Forecast



## WP4

ASIMUTH  
Alert system



## WP5

User Feedback



## WP6

Dissemination





## Project management activities



**WP1: Project management**

IFREMER



**WP2:**  
HAB Reanalysis  
& Model  
Training

MI



**WP3:**  
HAB Nowcast  
/ Forecast  
System

StarLab



**WP4:**  
ASIMUTH  
Alert System

DOMMRS



**WP6:**  
Dissemination  
& Exploitation



**WP5: User Acceptance and sustainable production**

DOMMRS

Research, Technology Development and Innovation-related activities

Dissemination  
activities

# Project activities

## Reanalysis and Training

Initial assignment of **key areas and species**, collate marine core service data and **satellite data**, develop model to run **hindcast** simulation, validate and fine tune model runs.

## Nowcast/Forecast

Design of **Regional VØ Model** System running for specific species and location, develop transport pathways and **acquire remote and in-situ measured data** which will all feed into HAB-DDSS

## Alert System

Design and develop **HAB-DDSS system** for **expert interpretation** of the regional information assembled within HAB-DDSS

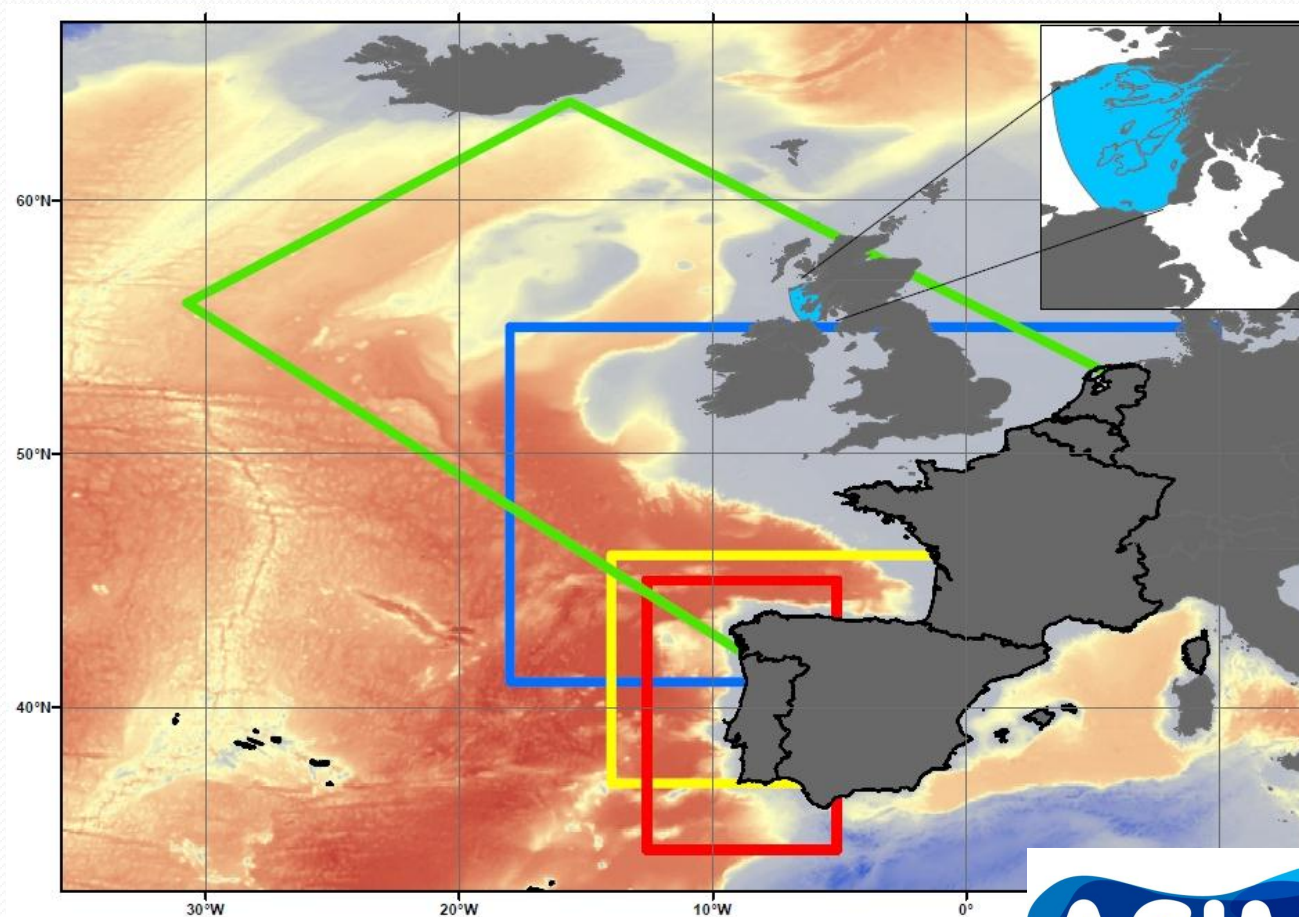
## User acceptance & Sustained production

**Economic assessment** to assess improved ability to **mitigate risk** and **increase productivity**, develop **business model** for project sustainability. Successful integration of system into **current user practices** and their working environment

## Dissemination

Project Website and bulletin board, develop warning system and circulate industry guidelines

# Model domains for downstream service



# NOAA HAB Forecast System

Operational since 2004

**Observations**  
(satellite imagery,  
buoys, field samples,  
respiratory irritation)

**Model output**  
(heuristic, empirical)

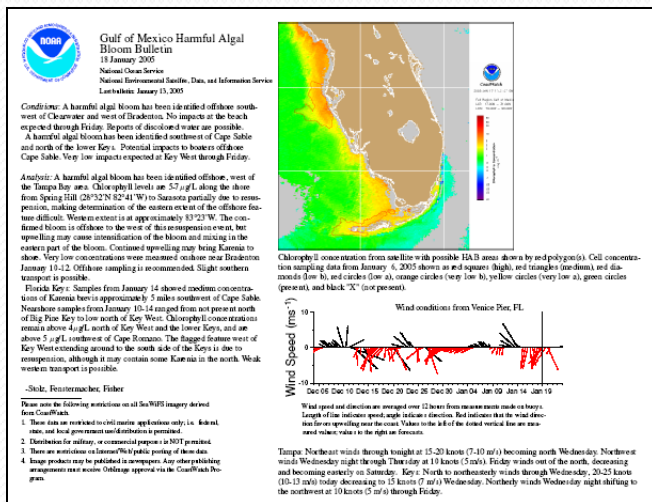
**Synthesis  
and Analysis**

A harmful algal bloom has been identified in patches from southern Lee to central Collier County. Patchy very low impacts are possible from southern Lee County to central Collier County today through Thursday. No other impacts are expected.

**Conditions Report (public)**

**HAB Bulletin (managers)**

**Courtesy:  
M.Tomlinson,  
NOAA**





# Comprehensive analysis distributed to Local/State/Federal Agencies



## Gulf of Mexico Harmful Algal Bloom Bulletin 21 September 2004 National Ocean Service/NCCOS and CSC NESDIS/CoastWatch and NDBC Last bulletin: September 17, 2004

### Analysis HAB Forecast:

No harmful algal blooms have been found along Florida's coast. Recent tropical storms have caused sediment resuspension and non-harmful blooms, which may cause discolored water.

### Analysis:

Samples taken last week from southwest Florida near Sarasota, Fort Meyers, and Naples showed no *Karenia brevis*. Imagery shows elevated chlorophyll along much of Florida's west coast: concentrations over 4 micrograms per liter off Cape San Blas and Cedar Key; over 5 micrograms per liter near Clearwater, Sarasota, Naples; and over 7 micrograms per liter Everglades City.

Winds have favored upwelling in southwest Florida for several days and are forecasted to continue for the rest of the week and through the weekend. These conditions are conducive to HAB formation, so this area should be monitored. Sampling here is recommended. Conditions in the panhandle don't favor HAB formation.

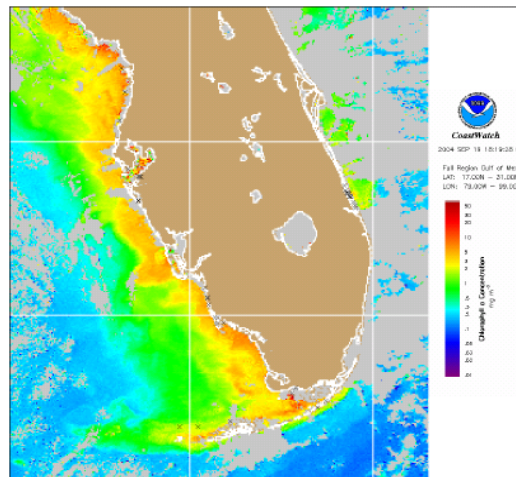
Bronder, Stolz

Please note the following restrictions on all SeaWiFS imagery derived from CoastWatch.

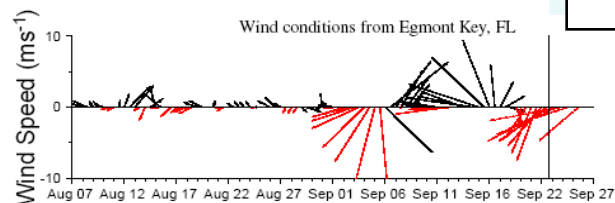
1. These data are restricted to civil marine applications only; i.e. federal, state, and local government use/distribution is permitted.
2. Distribution for military, or commercial purposes is NOT permitted.
3. There are restrictions on Internet/Web/public posting of these data.
4. Image products may be published in newspapers. Any other publishing arrangements must receive OrbImage approval via the CoastWatch Program.

**D**

**C**



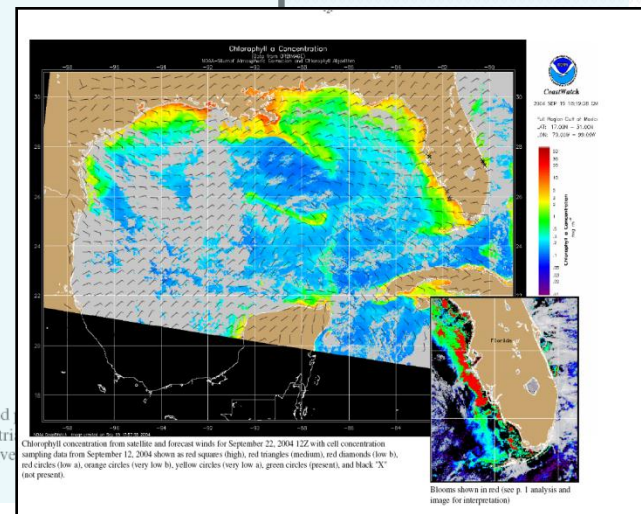
Chlorophyll concentration from satellite with possible HAB areas shown by red triangles (high), red diamonds (low b), red circles (low a), orange circles (very low b), yellow circles (very low a), green circles (medium), and black "X" (not present).



Wind speed and direction are averaged over 12 hours from measurements made on buoys. Length of line indicates speed; angle indicates direction. Red indicates that the wind direction favors upwelling near the coast. Values to the left of the dotted vertical line are measured values; values to the right are forecasts.

Southwest Florida: Winds have been northeasterly for the past few days, and are forecasted to shift to easterly then northeasterly over the next couple of days. The NWS Marine Forecast calls for easterly winds until Thursday, then northeasterly winds over the weekend. Florida Panhandle: Winds have been northeasterly for the past few days, and are forecasted to become easterly for the next couple of days.

**A**

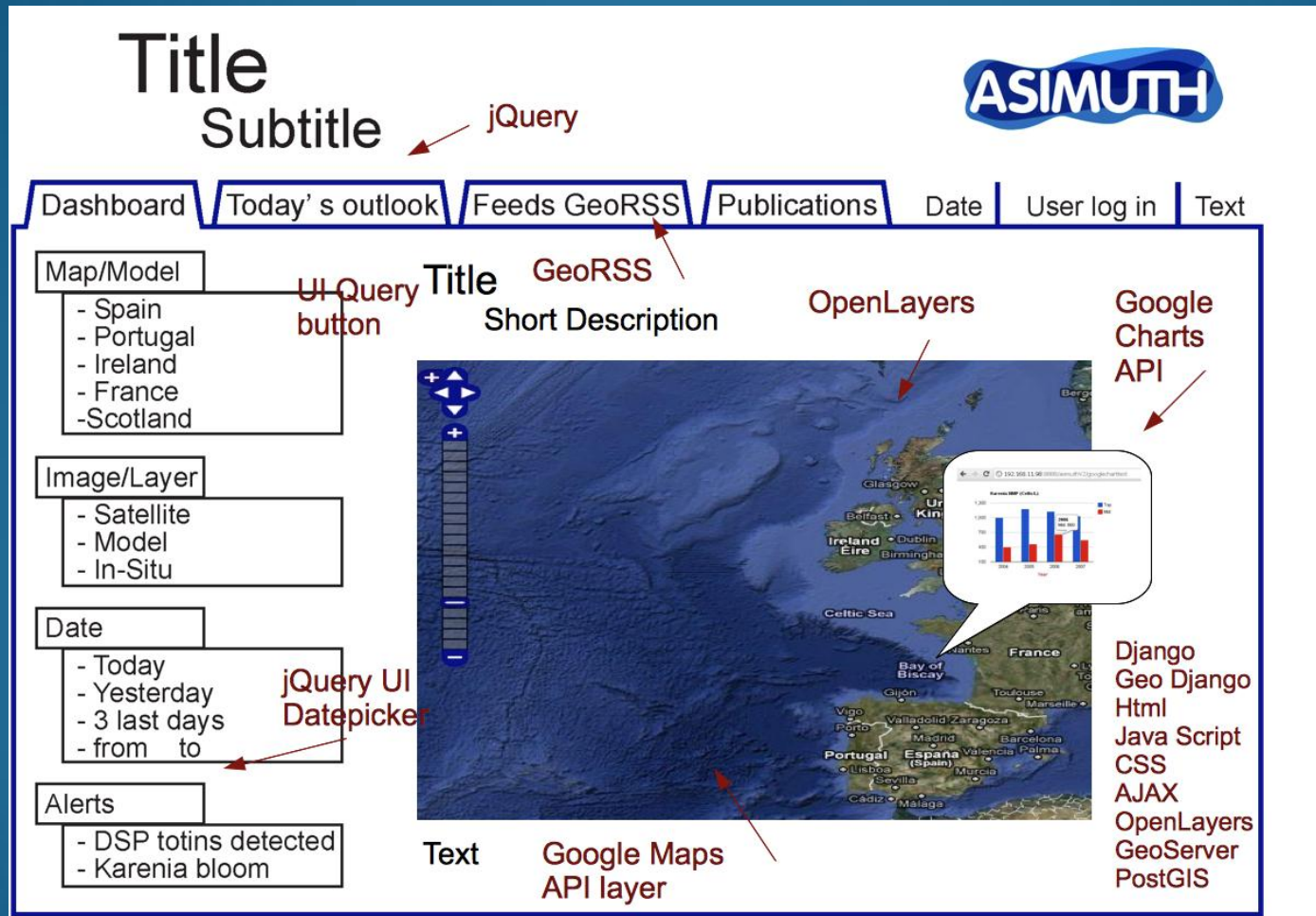


**B**

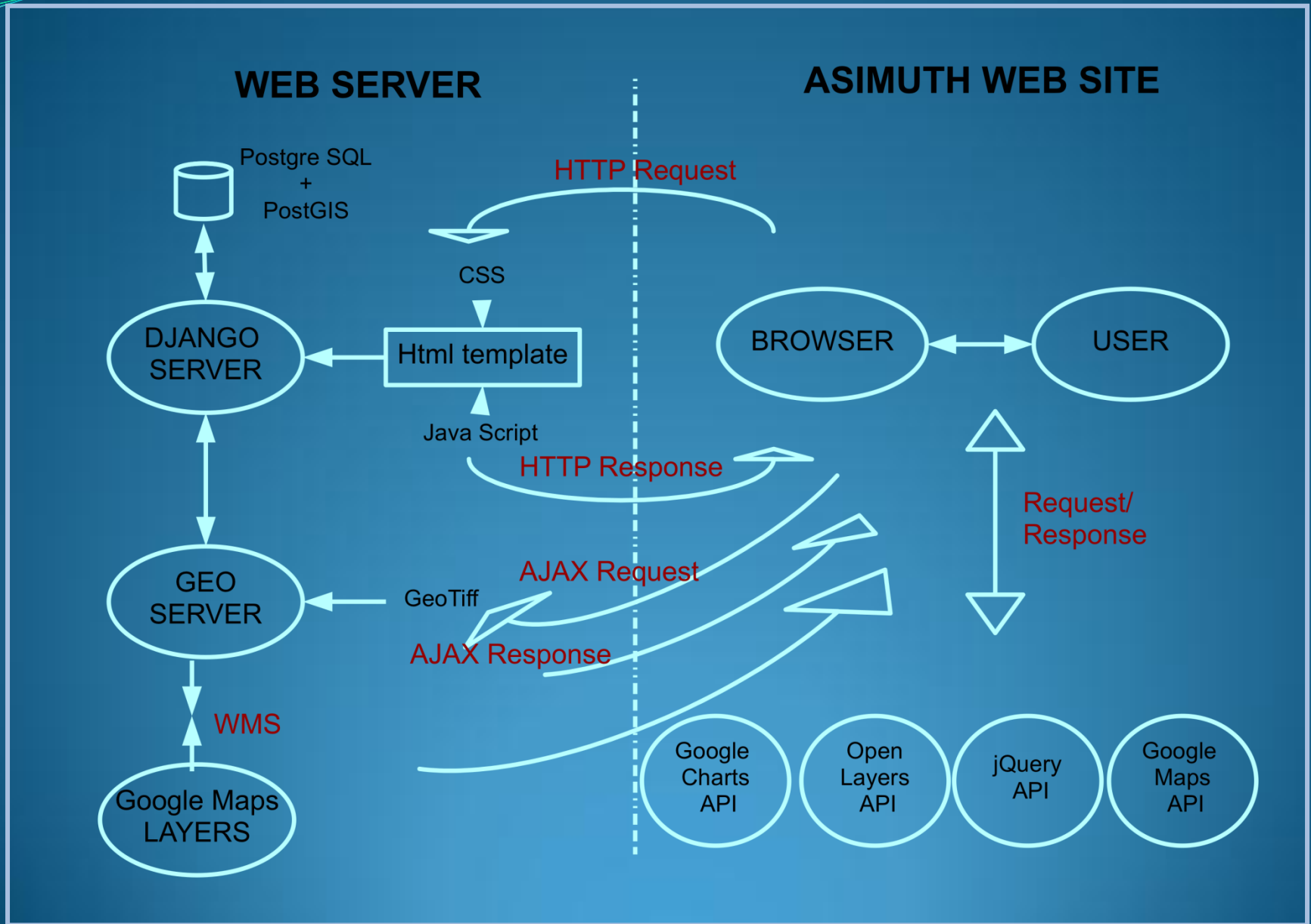
**Sent as PDF**

**Courtesy:  
M.Tomlinson,  
NOAA**

- A number of technologies need to be combined in order to build this site.
- Review and selection were conducted
- The complexity of Asimuth web site is to merge GIS data into a fast and usable web application.
- New API's and methodologies used to ensure all the requirements are met.



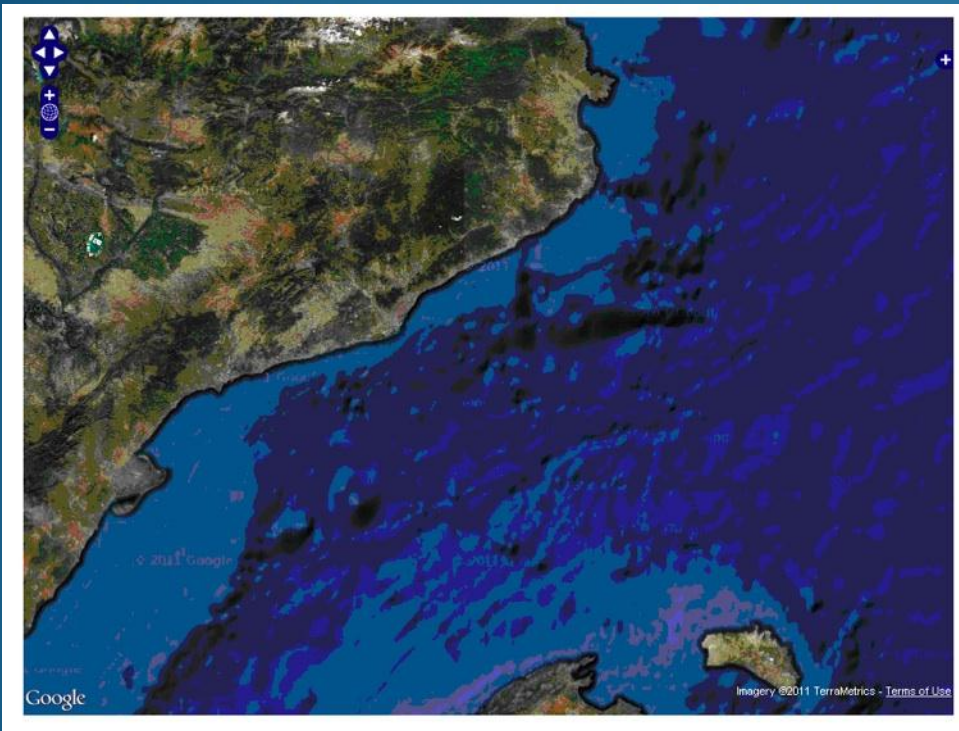
# Background technology design





# Background technology design

- Google Charts API is needed to load the base world map layer inside the Openlayers Map control

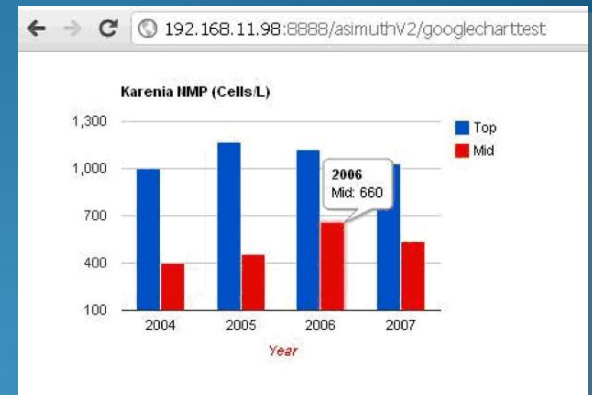
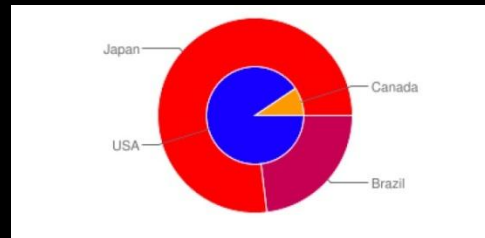
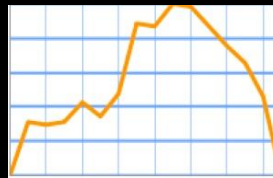
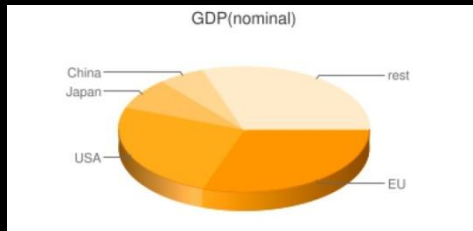


- Online web application that ease the map service publishing on internet.
- World maps like satellite image, street maps or physical maps that are not updated in real time
- Good base maps where to superpose a satellite image.
- Working since 2005, free not including any ads
- Google Maps API to embed Google Maps images into another external javascript API: OpenLayers



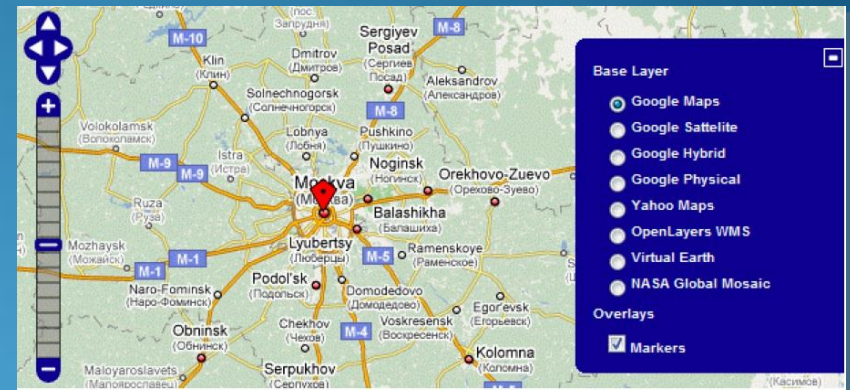
# Google Charts API

Google Charts API is needed to make the visual representation of the data



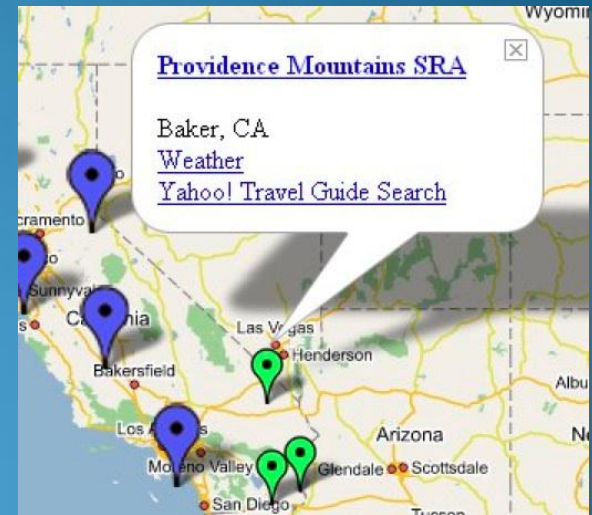
# Geoserver and OpenLayers

- GeoServer is needed to stream image files from satellite, models to the openlayers map control of the web site.
- GeoServer is the reference implementation of the Open Geospatial Consortium (OGC) Web Feature Service (WFS) and Web Coverage Service (WCS) standards, as well as a high performance certified compliant Web Map Service (WMS).
- Openlayers API is used to draw the main map control and manage all the interaction with the user as well as the data synchronization with the data sources.
- Openlayers framework intends to separate map tools from map data so that all the tools can operate on all the data sources.



# Geo RSS Feeds

- RSS stands for Really Simple Syndication or Resource Description Framework (RDF) Site Summary or Rich Site Summary
- Commonly used to publish the latest blog entries to RSS readers, tools used to read the data delivered in what's called an “RSS feed.” The feed is delivered in Extensible Markup Language (XML) that's typically published automatically by a blog or other software. The RSS feed itself looks like HTML with tags and values associated with those tags.
- Feeds can be sent by experts in field, fish farmers, etc.



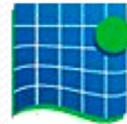
# Thank you for your attention

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