

## II JORNADAS DE CIÊNCIA NOS AÇORES

Secretaria Regional da Educação, Ciência e Cultura

Centro de Estudos do Clima, Meteorologia e Mudanças Globais  
da Universidade dos Açores



the weather constrains all the sectors of our economy!

the weather compromise the safety of people and property!

the climate is a resource!

the geography, our competitive factor!

we are working on this issues since 1864!

we can become the best place for understand the  
mid Atlantic meteorology and ocean atmosphere interactions that  
influences the climate of the world!

## **C CMMG - Main Motivations:**

### **Scientific:**

- peculiarities of climate and weather mechanisms of the islands that distinguish them from continents;
- specific needs on new methodologies to fit the requirements and scale of application to the different sectors of applied meteorology and climatology (environment, agriculture, hydrology, tourism, transports, fisheries, safety, etc.).
- a very good location for climatic and meteorological studies in the middle of an open space of utmost importance for the global climate;

### **Strategic:**

- planning with climate;
- climate as a resource;
- climate change, mitigation and adaptation.

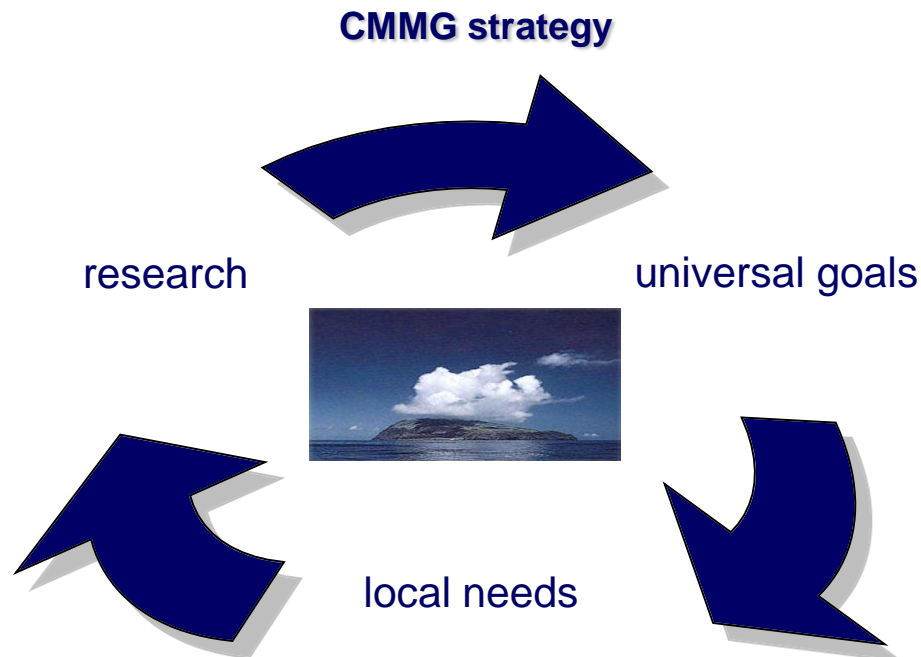
### **Operational:**

- specific needs and requirements on detailed climatic information, weather and sea state forecasting, with implications on the territory and resources management, economy, infrastructures and safety;
- operational data in real time.

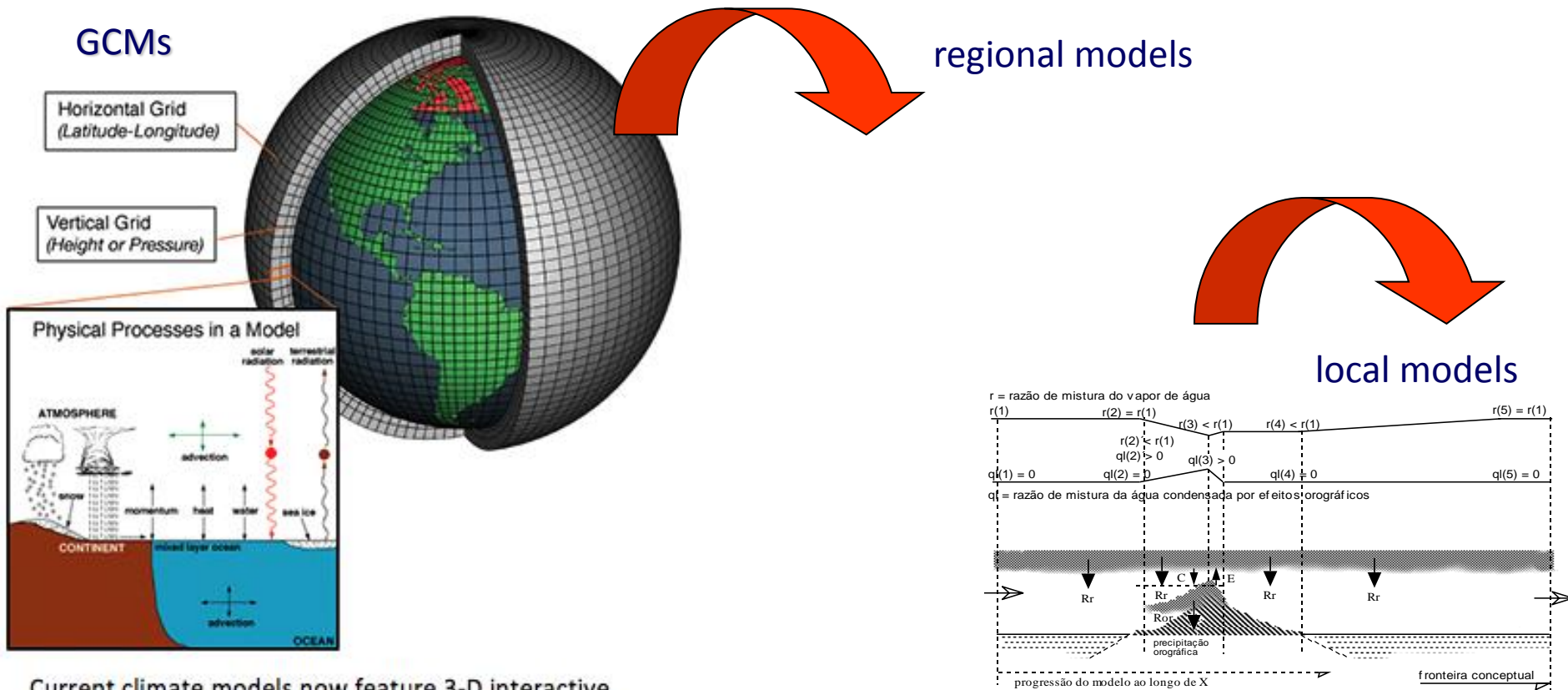
## **CMMG** tasks and strategy:

(improving methodologies better adapted to the reality and environment of the Atlantic Islands)

- T1 –Downscaling weather and sea state forecasting (numerical models);
- T2 - Islands Climatology & Hydrology (physical models);
- T3 - Climate Change & Environment (mitigation and adaptation);
- T4 - Chemistry and Physics of the Atmosphere (transatlantic circulation);
- T5 - Instrumental Meteorology and Meteo-oceanography (operational needs)
- T6 - Public and free dissemination of information (web page and GIS tools)

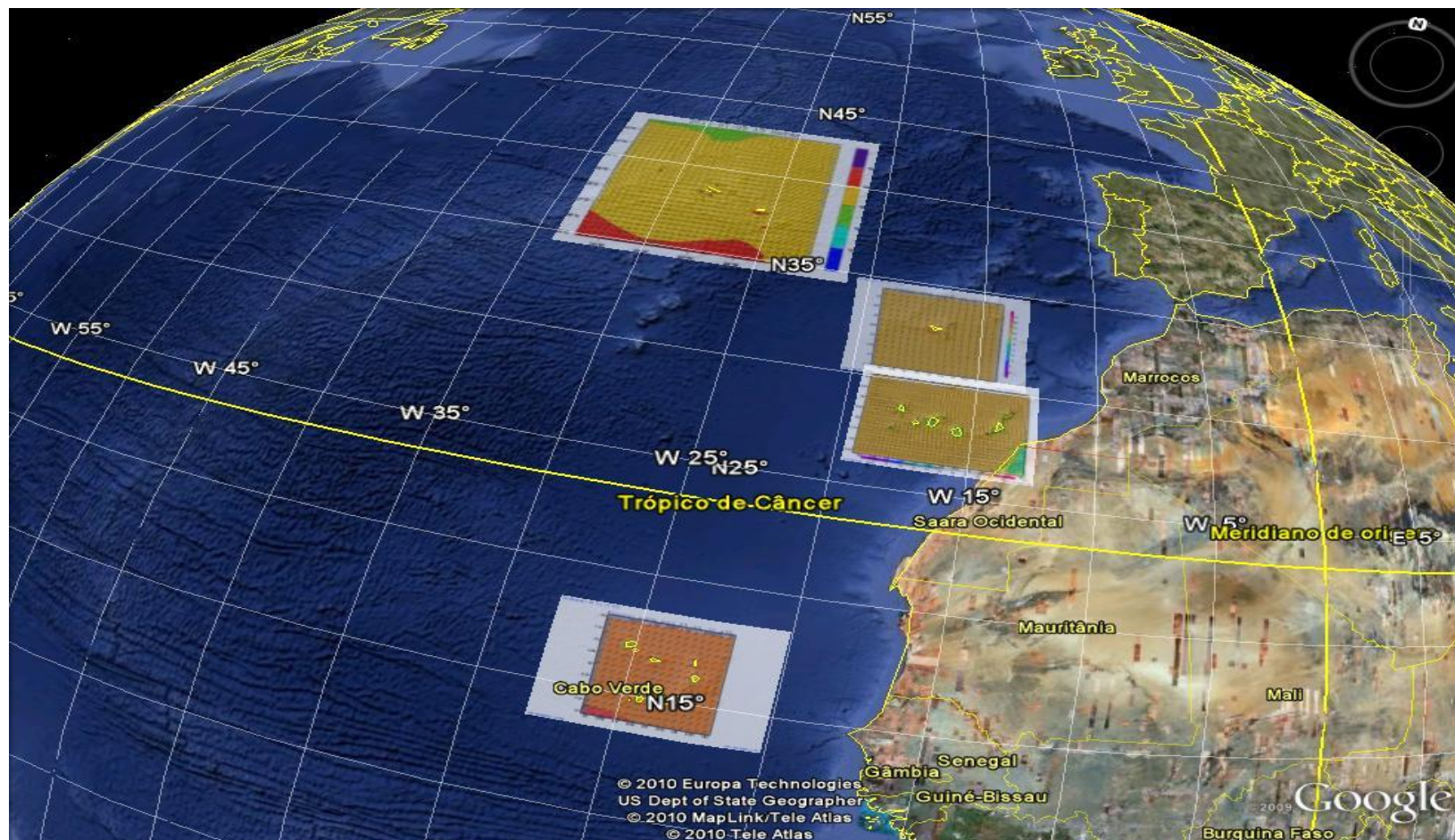


Downscaling weather and sea state forecasting (regional models);  
 better numerical models  
 downscaling from global circulation models to sub-grid scale phenomenon



Current climate models now feature 3-D interactive representations of both oceanic and terrestrial components and processes. Source: NOAA

## Downscaling weather and sea state forecasting (regional models);



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 05 / MAC / 2.3 / A1

**MacSimar**  
 PROGRESSO  
 MAC 2007 - 2013  
 Cooperação Transnacional

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coordenação: Eduardo B. de Azevedo

**PROJECTO**

**PARCEIROS / COLABORADORES**

**PRODUTOS CLIMAAT**

**DADOS ON - LINE**

**EQUIPAMENTOS**

**COOPERAÇÃO**

**CONTACTOS**

**NOTÍCIAS e EVENTOS**

**GALERIA DE FOTOS**

**LIGAÇÕES de INTERESSE**

**Continente**

- Mapas Meteorológicos
- Painéis Meteorológicos
- Valores Locais

**Continente WRF**

- Mapas (Modelo WRF)
- SkewT (Modelo WRF)

**Açores WRF**

- Mapas Meteorológicos
- Valores Locais
- SkewT

**Madeira**

- Mapas Meteorológicos
- Painéis Meteorológicos
- Valores Locais

**Links**

- Satellite
- Links Úteis
- WRF Tutorial

Google

**■ AÇORES - Mapas Meteorológicos (Modelo WRF)**

**Previsão com início às 00 horas de dia 13/Junho/2014**

+00 +03 +06 +09 +12 +15 +18 +21 +24 +27 +30 +33 +36 +39 +42 +45 +48 +51 +54 +57 +60 +63 +66 +69 +72

2014-06-14 06 horas

Slower Start Stop Faster

Selecione as variáveis... ▾

Selecione a região... ▾

Selecione o dia... ▾

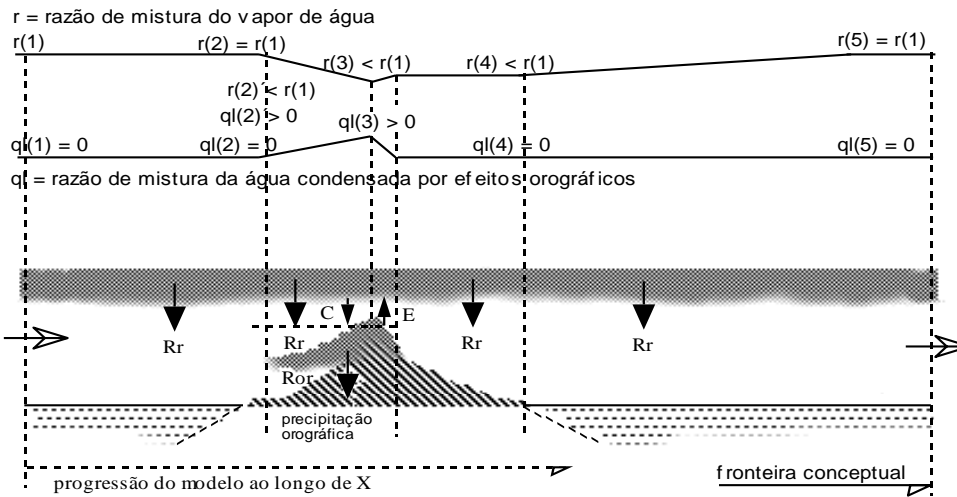


## On shore and near-shore Climatology (numeric detailed physical models);

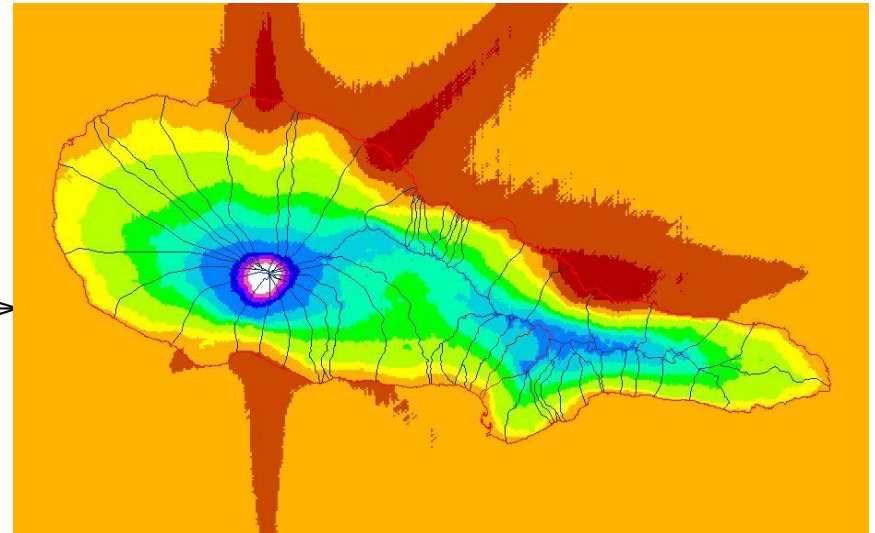
Simulation of local climate in islands environments

CIELO model (Clima Insular à Escala LOcal) – An GIS tool

(Azevedo, 1996; Azevedo *et al.* 1998; Azevedo *et al.* 1999,a,b; Azevedo *et al.* 2003; Santos *et al.*, 2004)

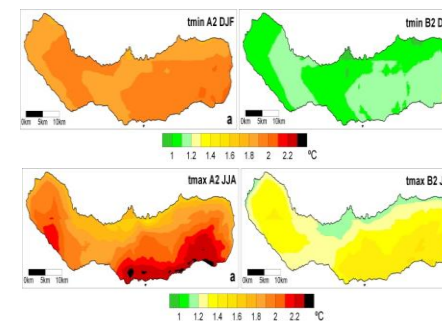
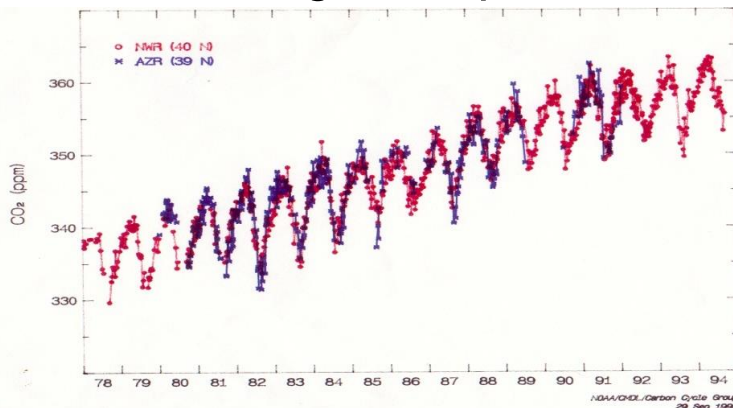
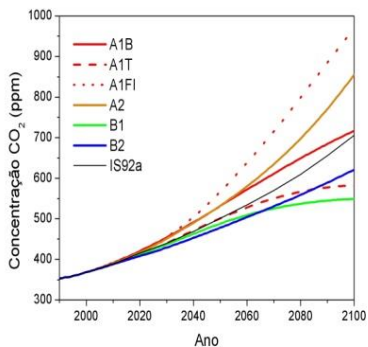


Rr- precipitação regional; Ror- precipitação orográfica; C- condensação;  
 E - evaporação; X-progressão do modelo de acordo com o sentido da circulação atm;  
 r- razão de mistura (vapor de água); ql- razão de mistura (água líquida em suspensão);

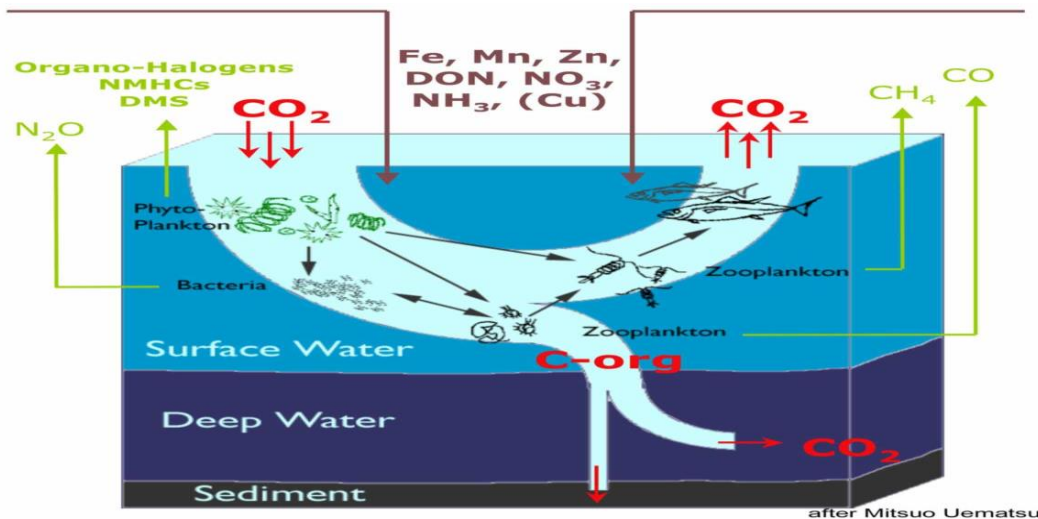




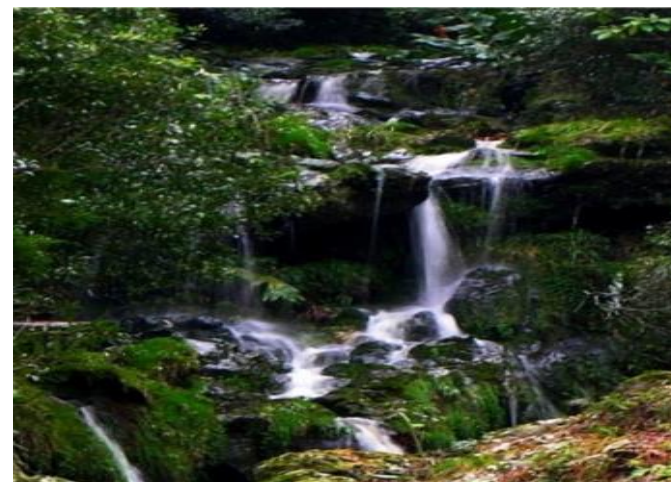
# understanding climate change – implications, mitigation and adaptation



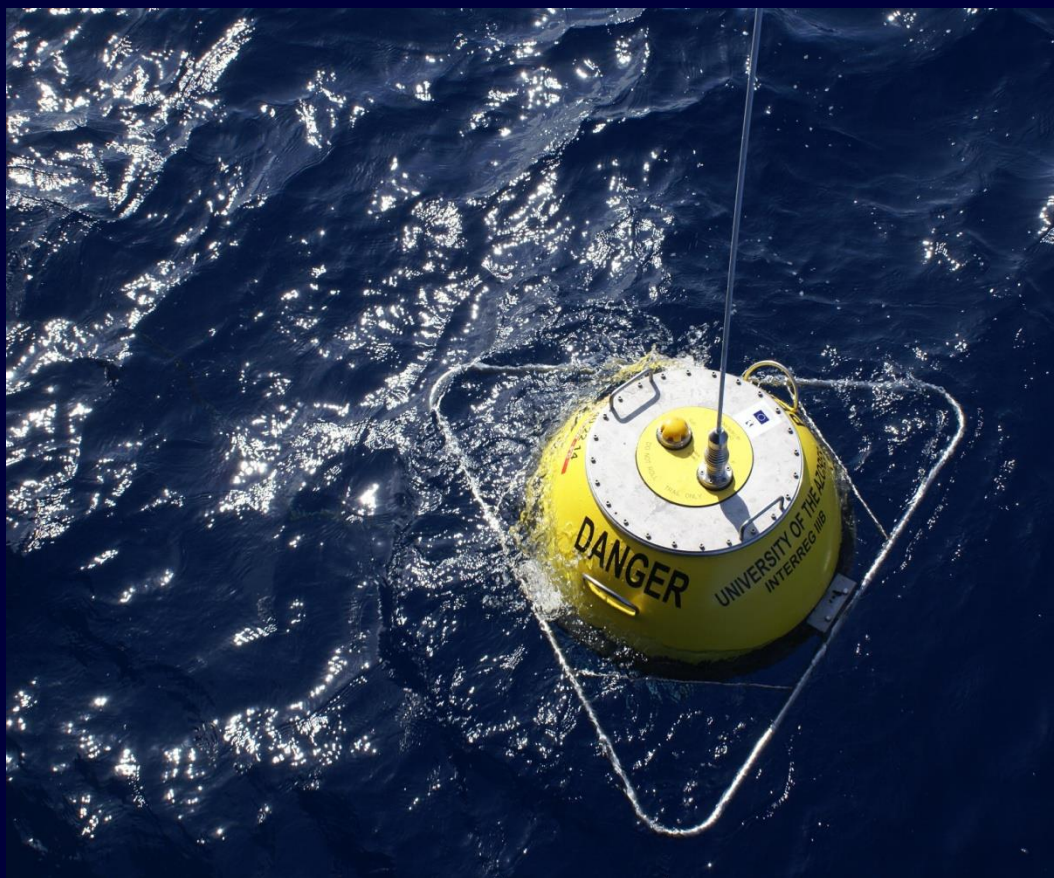
## ocean-atmosphere interactios



## terrestrial ecosystems interactions



## our platforms - Instrumental meteorology and meteo-oceanography





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Resumo de dados

Escolha do Arquipélago

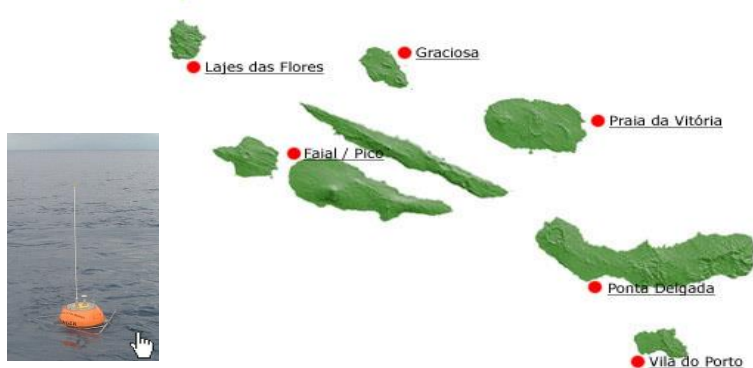
**Lajes das Flores - Bóia Bond 3**

<b>Bóia:</b>	Flores
<b>Posição:</b>	39_21.86N/031_10.00W
<b>Dia Hora Fuso 0(TU):</b>	13-06-2014 12:40
<b>Dia Hora Local:</b>	13-06-2014 12:40
<b>Altura Significativa (Hz):</b>	2,39 m
<b>Altura máxima (Hmax):</b>	5,12 m
<b>Período Médio:</b>	5,7 s
<b>Período Máximo</b>	10,2 s
<b>Observado:</b>	
<b>Período Onda de Altura Máx.:</b>	7,8 s
<b>Direcção da Agitação:</b>	233 °
<b>Temperatura da água à superfície:</b>	19,1 °C

**Faial / Pico - Bóia Bond 4**

<b>Bóia:</b>	FAIAL / PICO
<b>Posição:</b>	38_35.26N/028_32.26W
<b>Dia Hora Fuso 0(TU):</b>	13-06-2014 12:40
<b>Dia Hora Local:</b>	13-06-2014 12:40
<b>Altura Significativa (Hz):</b>	0,84 m
<b>Altura máxima (Hmax):</b>	1,35 m
<b>Período Médio:</b>	3,8 s
<b>Período Máximo</b>	8,6 s
<b>Observado:</b>	
<b>Período Onda de Altura Máx.:</b>	7 s
<b>Direcção da Agitação:</b>	325 °
<b>Temperatura da água à superfície:</b>	17,8 °C

# Instrumental meteorology and meteo-oceanography EuroGOOS – MONIZEE - CLIMAAT network



Ver Arquipélago

### Dados da Estação

<b>Código:</b>	0002
<b>Localização:</b>	Porto da Praia da Vitória
<b>Entidade:</b>	CLIMAAT
<b>Latitude:</b>	38° 42' 42"
<b>Longitude:</b>	27° 03' 08"
<b>Altitude(m):</b>	10

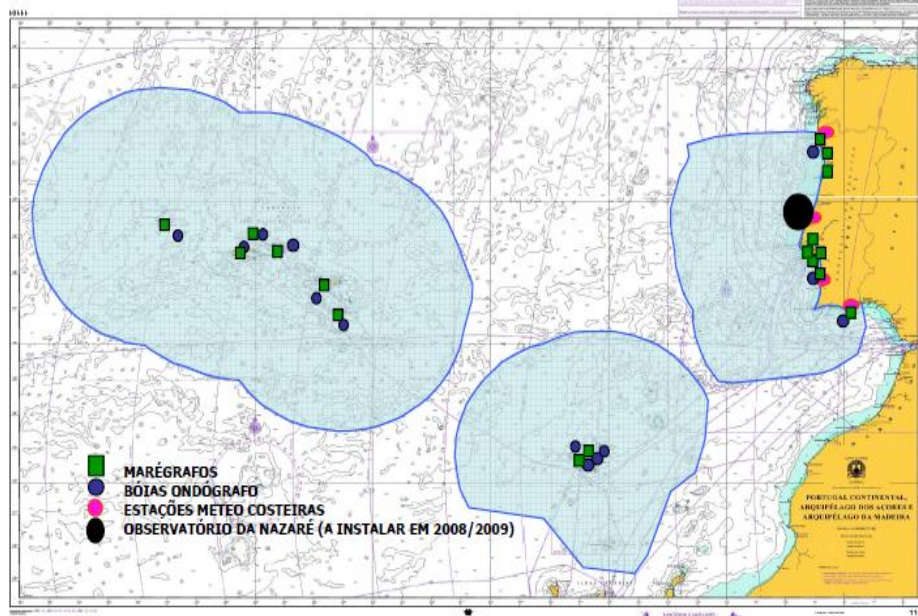


### Dados em tempo real - Último registo

<b>Data do registo:</b>	<b>06/07/2010 00:07:30</b>
Temperatura do ar	20.5 °C
Direcção do vento	43 °
Radiação solar difusa	234.43 w/m2
Radiação solar global	234.43 w/m2

### Dados Horários - Última leitura horária:

<b>Data do registo:</b>	<b>05/07/2010 23:59:36</b>	<b>Gráfico</b>
Temperatura média do ar	20.8 °C	Ver »
Integral da radiação solar difusa	844 Kj/m2 hora	Ver »
Integral da radiação solar global	844 Kj/m2 hora	Ver »
Média vectorial da direcção do vento	47 °	



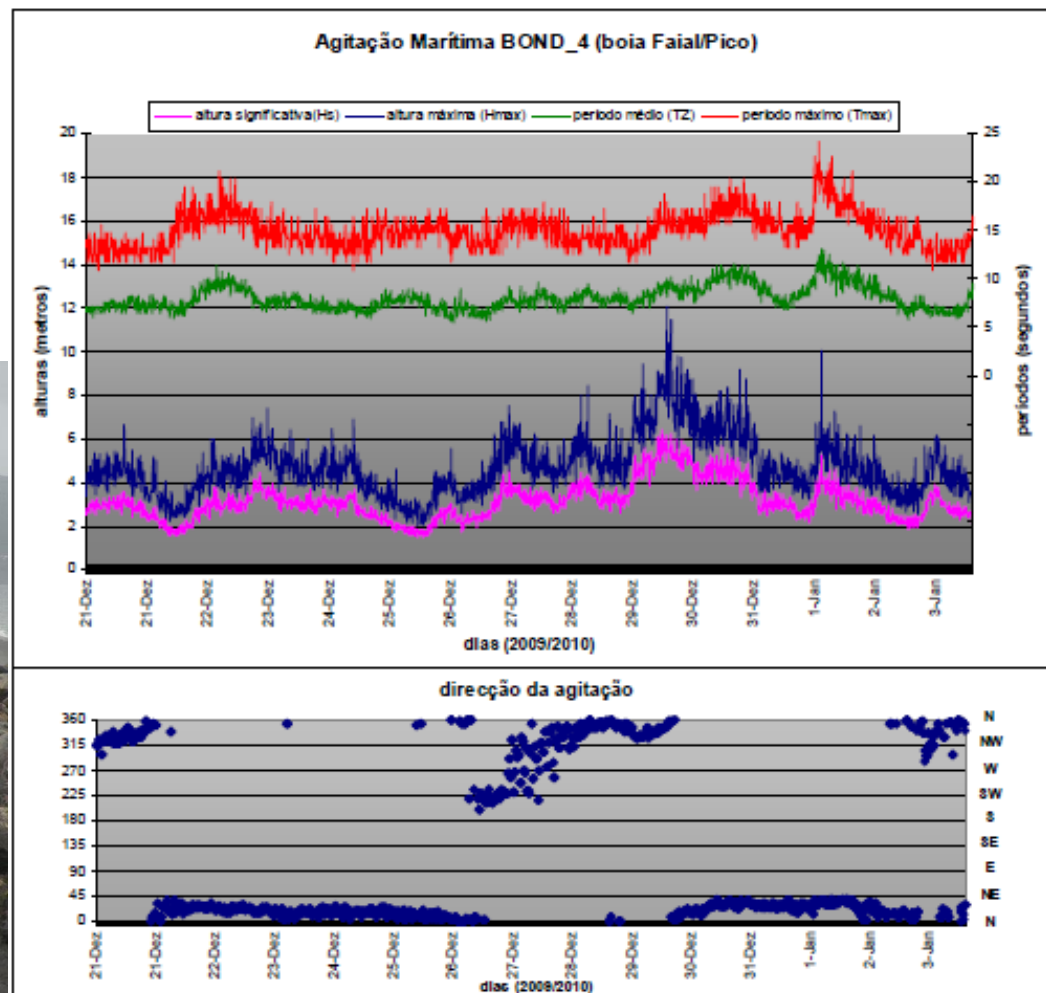
# Extreme wave climatology and structural responses

## AGITAÇÃO MARÍTIMA BOND\_4 (FAIAL/PICO) (APRECIAÇÃO GRÁFICA SUMÁRIA)

PERÍODO  
 DE 21 DE DEZEMBRO DE 2009 A 3 DE JANEIRO DE 2010

ANGRA DO HEROÍSMO, 4 DE JANEIRO DE 2010

	HS	HMAX	TZ	TMAX	THMAX
Máximos observados	6.40	12.07	13.10	24.20	18.80
Médias	3.12	4.69	8.01	15.00	10.78



## MANAGING WAVE-INDUCED RISKS IN PORT OPERATIONS

João Alfredo Santos<sup>1</sup>, Sara Rodrigues<sup>1</sup>, Liliana Pinheiro<sup>1</sup>, Diogo Rúben Neves<sup>1</sup>, Conceição Juana Fortes<sup>1</sup>, Maria Teresa Reis<sup>1</sup>, Anabela Simões<sup>2</sup>, Eduardo Brito de Azevedo<sup>3</sup>

<sup>1</sup> Laboratório Nacional de Engenharia Civil, Departamento de Hidráulica e Ambiente, Av. do Brasil, 101, 1700-066 Lisboa, Portugal

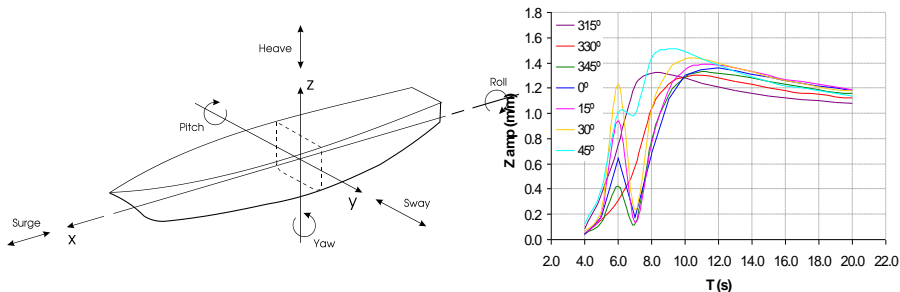
<sup>2</sup> Universidade dos Açores, 9700-416 Praia da Vitória, Portugal

<sup>3</sup> Universidade dos Açores, Centro do Clima, Meteorologia e Mudanças Globais, Campus da Terra Chã, 9701-851 Angra do Heroísmo, Portugal

Email: jasantos@Inec.pt  
 Phone: +351 21 844 3451  
 Fax: +351 21 844 3019

### Abstract

The use of regional models for sea wave propagation and of numerical models for wave propagation enabled the development of an integrated decision support tool for port management that is able to issue warning or alert messages to the relevant members of the port community whenever port safety is at stake.



## waves climatology for the ports of the Azores

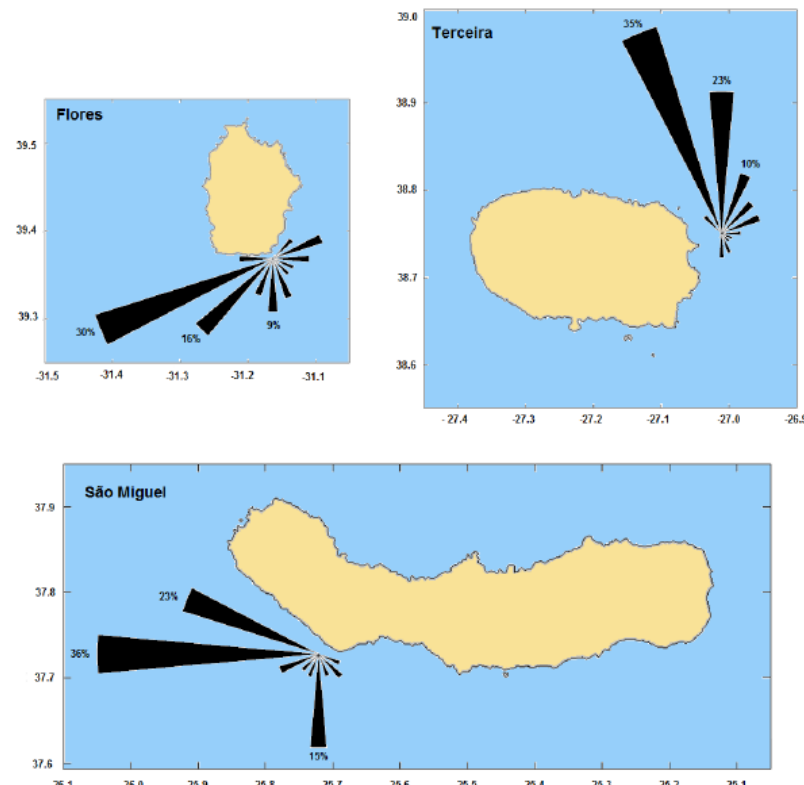


Figura 6 – Distribuição de frequência relativa de THTP nas Flores, Terceira e São Miguel

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	%
<1	2.9	2.0	0.6	0.6	0.2	0.2	0.1	0.9	0.5	0.1			0.1	0.1	0.8	2.6	11.5
1-2	11.1	4.7	4.0	3.9	1.4	0.8	1.0	1.4	2.1	0.4	0.1	0.1	0.1	0.1	2.2	17.2	50.6
2-3	6.0	2.6	1.5	1.5	0.8	0.6	0.5	0.8	1.0	0.3		0.1		0.1	0.6	10.8	27.2
3-4	2.1	0.7	0.4	0.4	0.4	0.1	0.1	0.2	0.1					0.2	3.3	7.9	
4-5	0.6		0.2	0.1	0.2	0.1									0.6	1.9	
5-6			0.1		0.1										0.2	0.5	
6-7			0.1													0.2	
>7																0.1	
%	22.7	10.1	6.7	6.5	3.1	1.8	1.8	3.3	3.9	0.8	0.2	0.2	0.2	0.2	3.8	34.7	100

# DATACENTER - national and international partnerships

## DATACENTER CENTRO DO CLIMA, METEOROLOGIA E MUDANÇAS GLOBAIS



Welcome Eduardo Brito de Azevedo

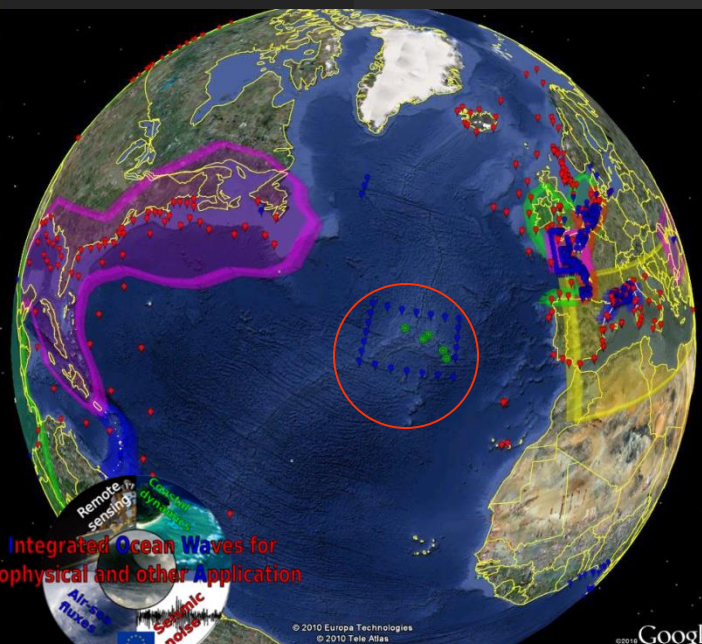
Buoy data

[10\\_m\\_Data](#)

[MKIII System File](#)

Graciosa   
 16 October 2010 17 October 2010

DATE/TIME	HS	HMAX	TZ	TMAX	THMAX	THTP	TEMP
2010-10-17 03:20:00	2.24	3.71	5.6	11.7	6.2	89	18.8
2010-10-17 03:10:00	2.02	3.38	5.3	9.4	6.2	89	18.8
2010-10-17 03:00:00	2.18	3.27	5.5	10.2	7.0	89	18.8
2010-10-17 02:44:00	2.15	3.57	5.2	10.2	7.0	89	18.8
2010-10-17 02:34:00	2.28	3.26	5.5	13.3	6.2	90	18.8
2010-10-17 02:24:00	2.19	3.58	5.8	10.2	6.2	90	18.8
2010-10-17 02:13:00	2.07	2.78	5.4	10.2	7.0	90	18.8
2010-10-17 02:03:00	1.86	3.14	5.0	9.4	7.0	84	18.8
2010-10-17 01:53:00	2.15	3.90	5.7	9.4	6.2	84	18.8
2010-10-17 01:42:00	2.00	3.00	5.3	9.4	7.8	87	18.8
2010-10-17 01:32:00	2.12	3.04	5.4	9.4	6.2	87	18.8
2010-10-17 01:22:00	1.98	3.34	4.9	9.4	6.2	87	18.8
2010-10-17 01:11:00	2.07	2.93	5.2	10.9	7.0	90	18.8
2010-10-17 01:01:00	1.87	3.10	5.2	10.9	6.2	90	18.8
2010-10-17 00:51:00	1.87	3.29	5.2	10.9	5.5	90	18.8



Joint Technical Commission for Oceanography and Marine Meteorology

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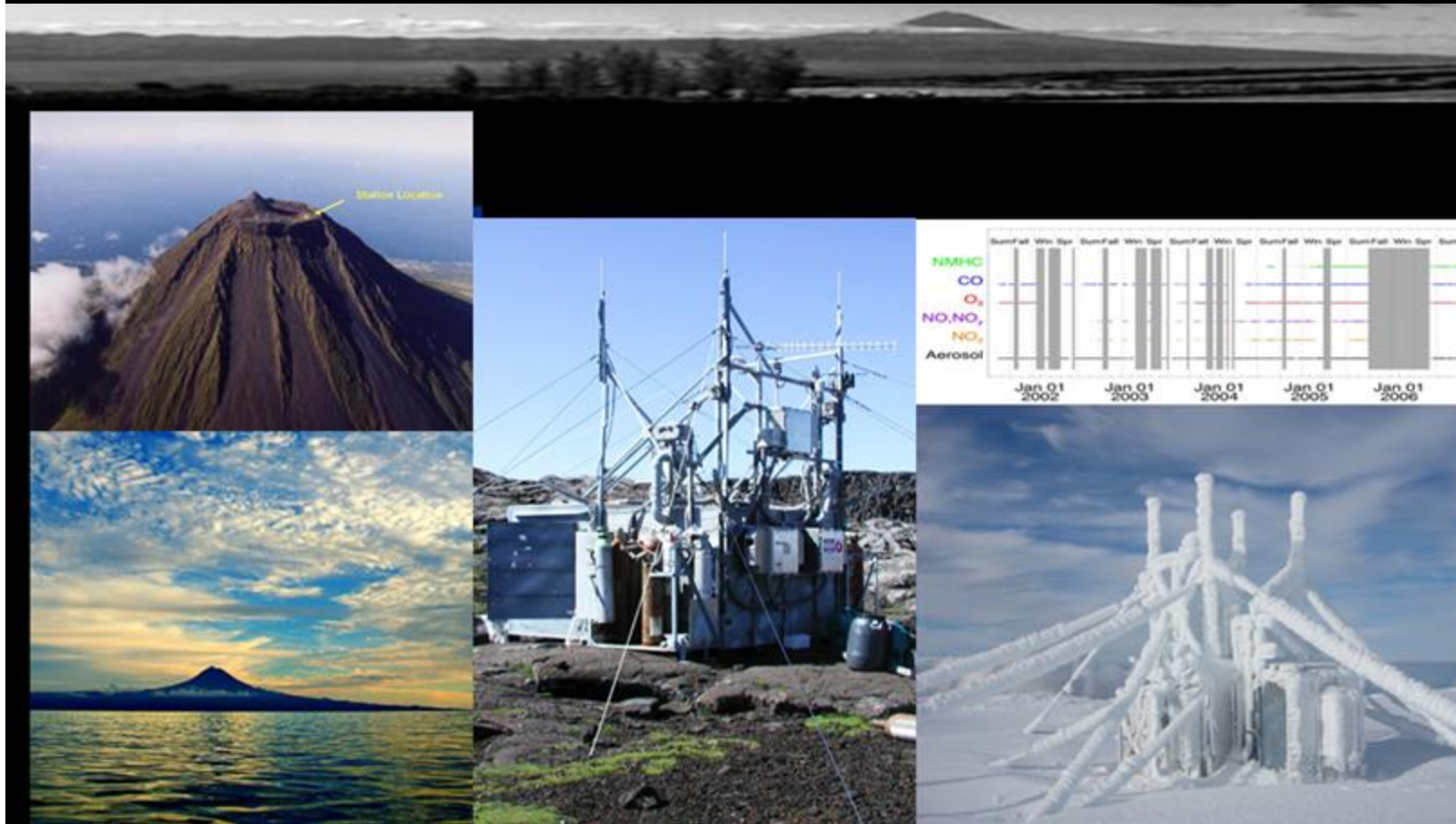
Institut français de recherche pour l'exploitation de la mer  
 French Research Institute for Exploitation of the Sea

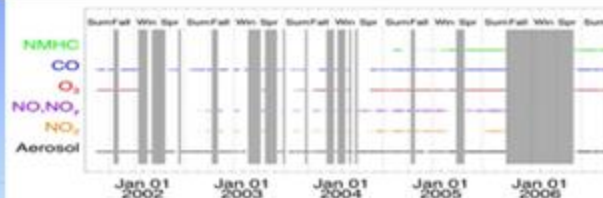
marinha-portugal

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

# Our Platforms - PicoNARE

## International Platform for the mid-atlantic free atmosphere studies

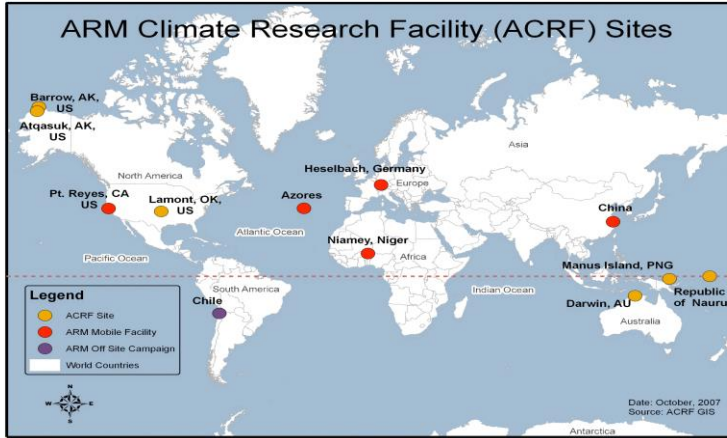




Year	Start	End	Parameters
2002	Jan 01	Apr	NMHC, CO, O <sub>2</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , Aerosol
2003	Jan 01	Apr	NMHC, CO, O <sub>2</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , Aerosol
2004	Jan 01	Apr	NMHC, CO, O <sub>2</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , Aerosol
2005	Jan 01	Apr	NMHC, CO, O <sub>2</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , Aerosol
2006	Jan 01	Apr	NMHC, CO, O <sub>2</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , Aerosol



# Eastern North Atlantic (ENA) Graciosa Island - ARM Facility



# CMMG

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- GALERIA DE FOTOS
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Visitante: 5114354

Projectos **CLIMAAT** e **CLIMACOST** (Interreg IIBB)(MAC 2.3/A3 - 03/MAC/2.3/A5 - 05/MAC/2.3/A1)  
 Clima e Meteorologia dos Arquipélagos Atlânticos - Clima Marítimo e Costeiro  
 Rede de Informação, Divulgação e Cooperação Científica  
[RESUMO](#) > [FICHA DE PARCEIROS](#) >

<p><b>Portal da Agitação Marít. (Ondógrafo)</b></p>	<p><b>Estações Meteorológicas Automáticas</b></p>	<p><b>Previsão do Estado do Tempo</b></p>
<p><b>Previsão Oceanográfica</b></p>	<p><b>Previsão do Estado do Mar (Açores)</b></p>	<p><b>WeatherCams</b></p>
<p><b>CIELO - Clima Insular à Escala Local</b></p>	<p><b>CIELO - Hidrologia dos Açores</b></p>	<p><b>CIELO - Cartografia Climática</b></p>