RÉPUBLIQUE FRANÇAISE
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Cerema
CLIMAT & TERRITOIRES DE DEMAIN

WEBINAR

Overview of international wave measurement observatories

Webinar organized by Cerema in collaboration with

ISPRA · ARTELIA · FMI · Rijkswaterstaat · hidrográfica · Vlaanderen verbeelding werkt · Vegagerðin · CDIP

Use of sea state data in engineering and research and development

Luc HAMM

ARTELIA

ARTELIA group

5 Markets

100% employee owned

An independent multi-disciplinary engineering & project management company

€637 M	85%	6100	40
2020 Turnover	in Europe	Employees	Countries

A presence in more than **40 countries**

55 branch offices in France

100% Capital held by managers and employees

ARTELIA Passion & Solutions

25/11/2021 ARTELIA 3

www.arteliagroup.com/en/

ARTELIA Maritime: Metocean studies and R&D

Meteocean Condition Analysis

Hydraulic studies

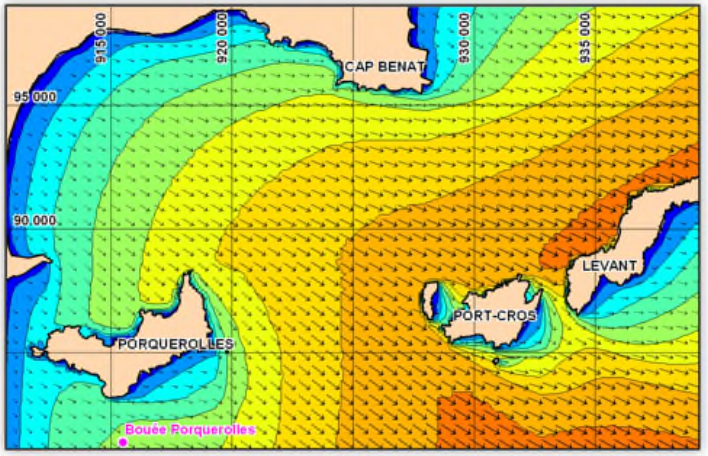
Numerical modelling

Open Ocean, an innovative company, joined ARTELIA's group in 2019

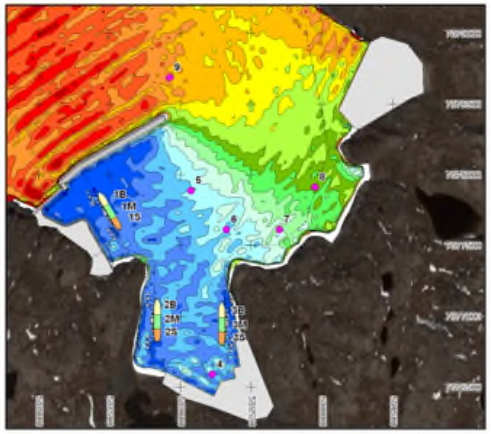
ARTELIA Maritime & Ports

Meteocean Condition Analysis

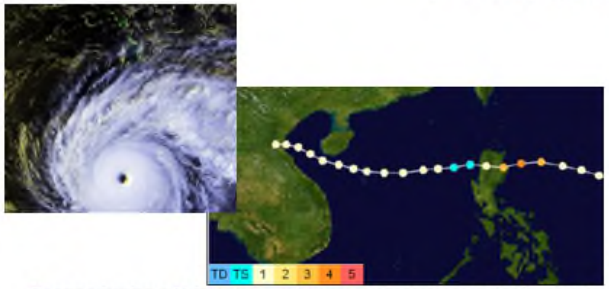
- Elaboration of offshore sea states climate : reconstitution of 20 to 30 year time- series of offshore wind and wave conditions
- Wind climate
- Numerical wave propagation study
- Cyclonic & Tsunami studies
- Harbor wave disturbance
- Hydraulic (current) modeling



Generation and propagation of sea states



Harbor wave disturbance



Reconstitution of historical typhoons to determine cyclonic waves

ARTELIA Passion & Solutions

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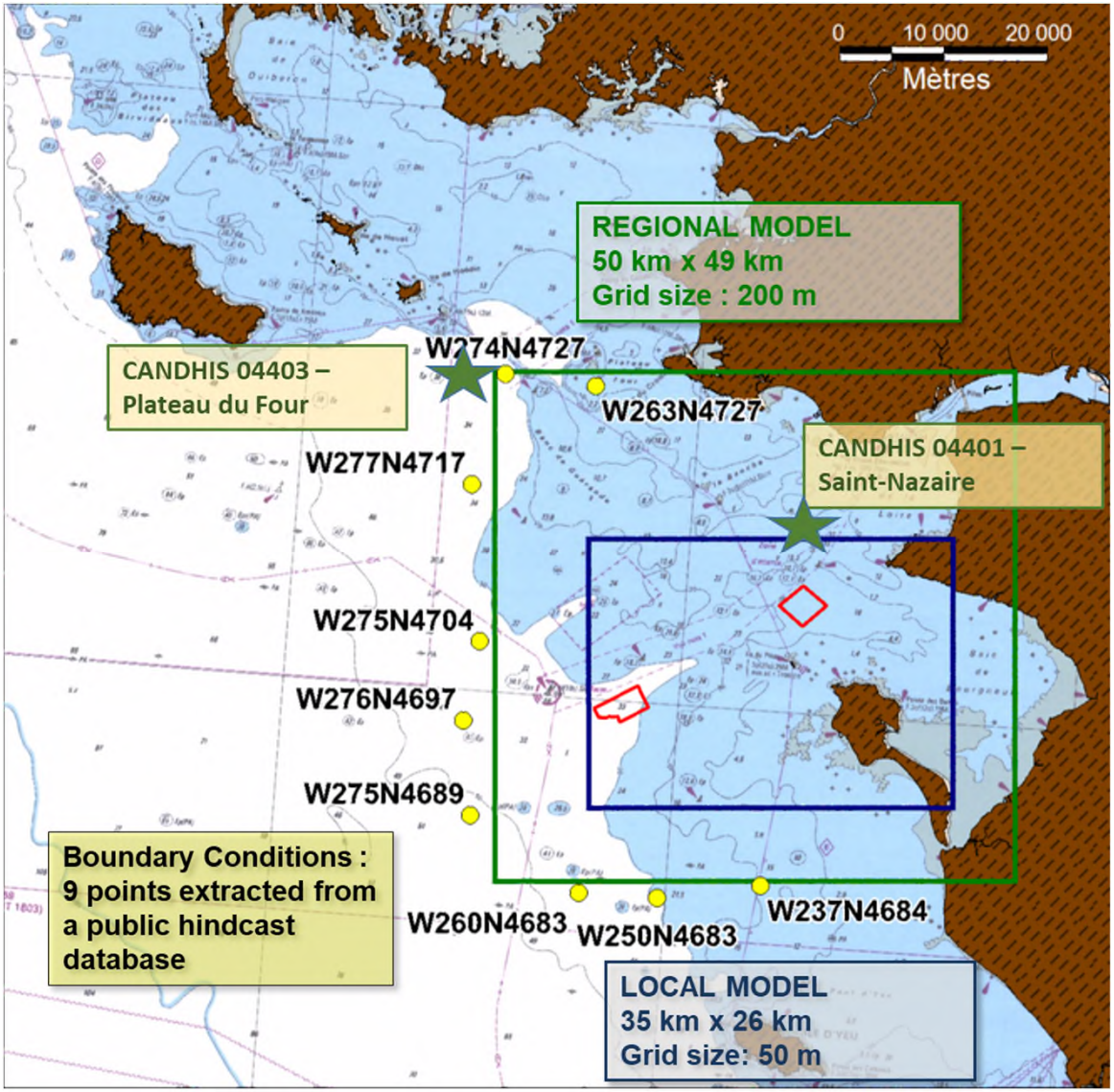
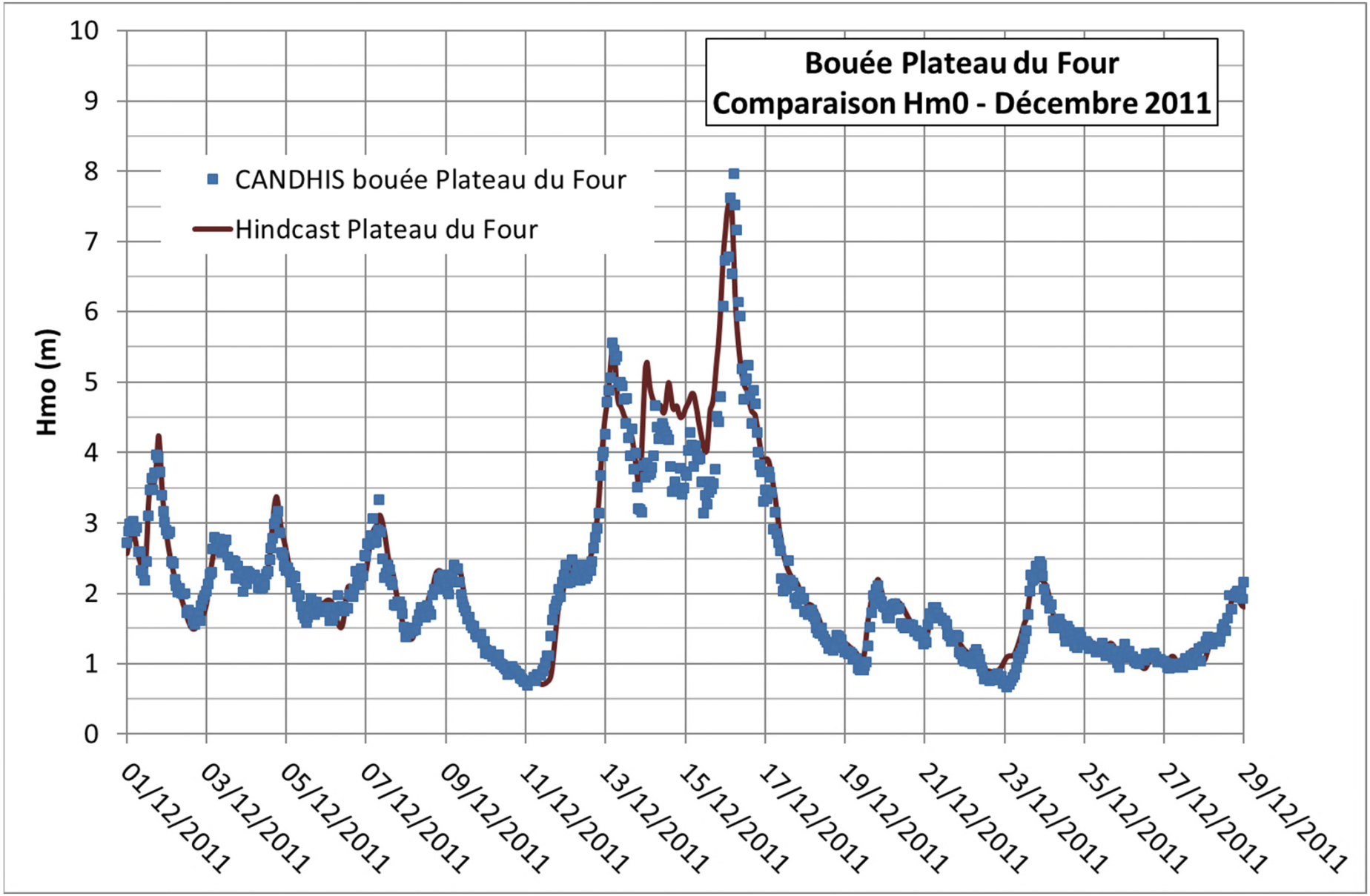
Open Ocean : On-line offer for Metocean analysis on demand: http://www.openocean.fr/en/

Engineering study: Mouth of the Loire estuary



Wave transformation modelling using SWAN software (T.U. Delft –The Netherlands)

Loire estuary: Validation of wave boundary conditions



Loire estuary: Validation of the local model – Choice of a remarkable storm

Cerema

NANTES SAINT-NAZAIRE PORT

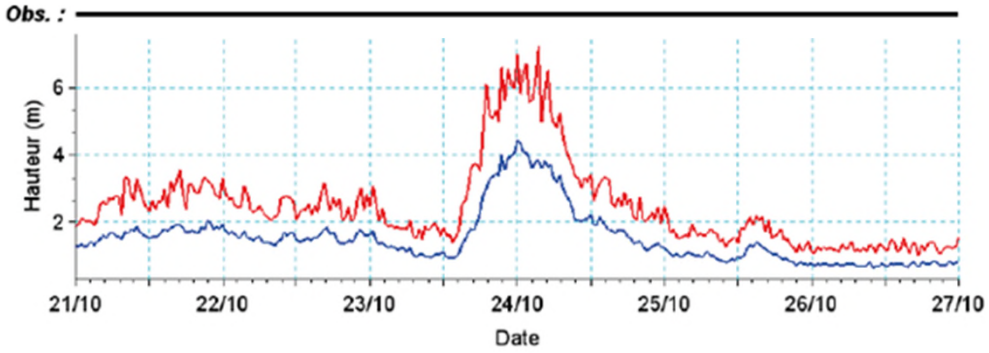
CANDHIS : 04401 – Saint-Nazaire

Sélection des événements remarquables

Tempête du 24/10/06

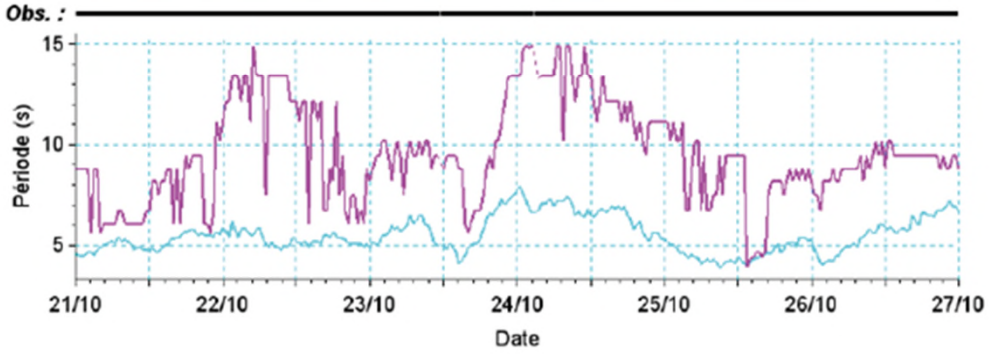
Évolution de H_{max}, $H_{1/3}$

Légende :
- H_{max}
- $H_{1/3}$



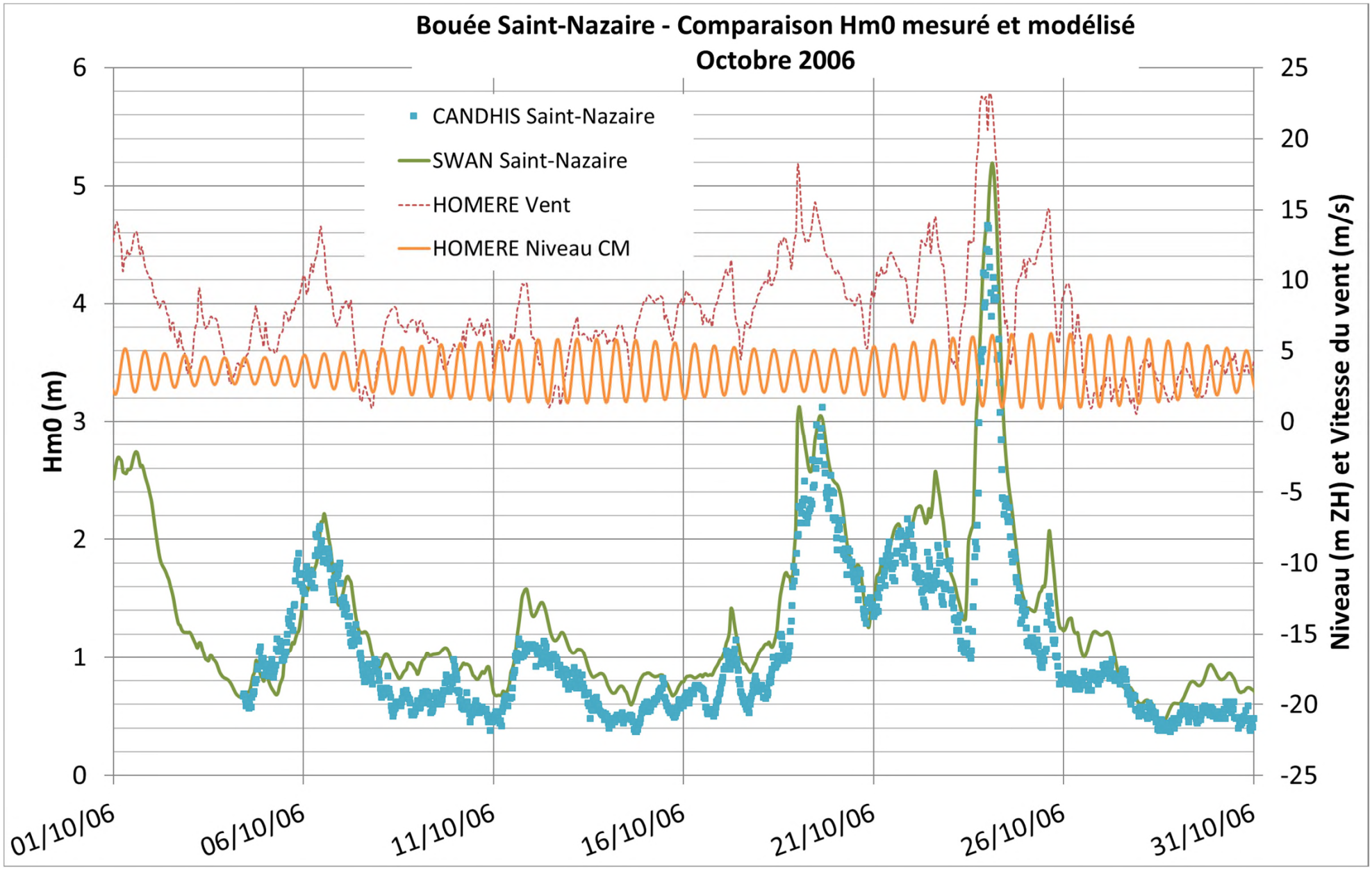
Évolution de T_p, T_{02}, Dir_p

Légende :
- T_p
- T_{02}
- Dir_p



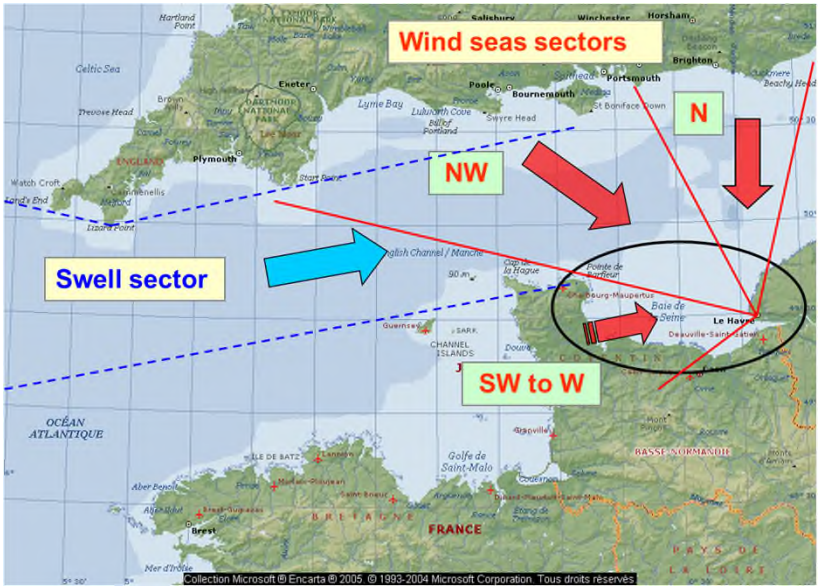
Pic du	$H_{1/3}$ (m)	H_{max} (m)	$T_{H1/3}$ (s)	T_{Hmax} (s)	H_{m0} (m)	T_p (s)	T_{02} (s)	T_e (s)	Dir_p (°)	$Etal_p$ (°)
24/10 0h00	4,44	7,00	10,6	10,6	4,66	13,4	7,8	10,4	-	-

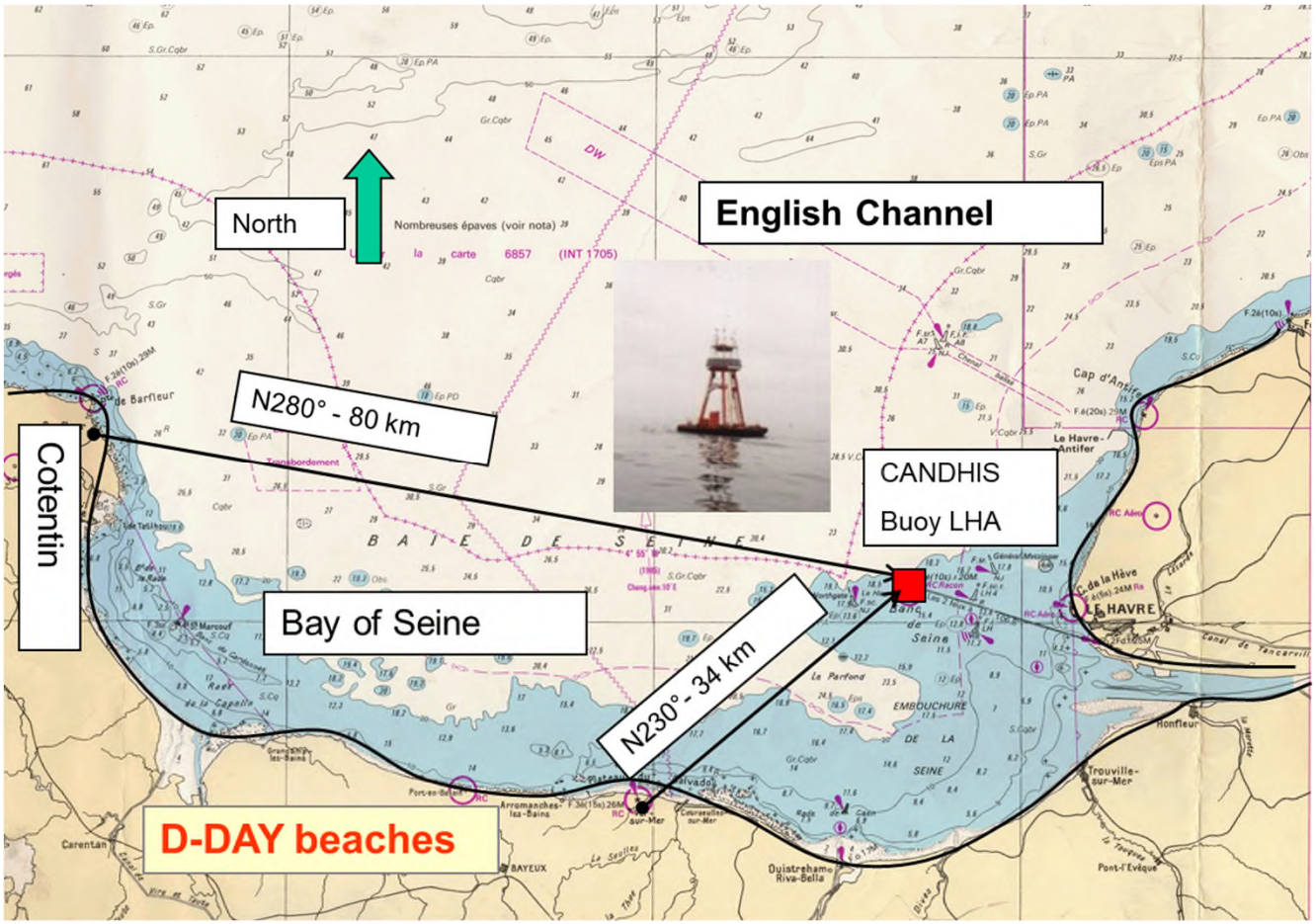
Loire estuary: Validation of the local model



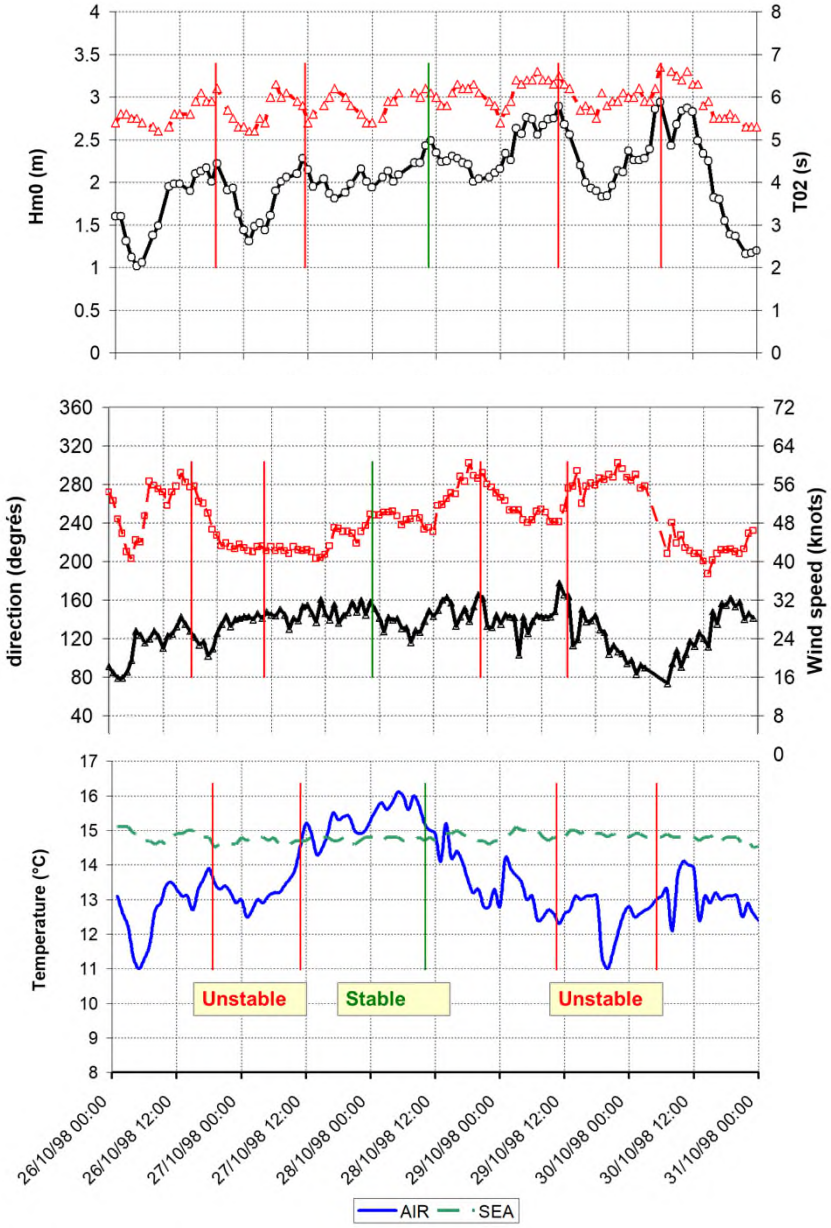
R&D on complex sea-states

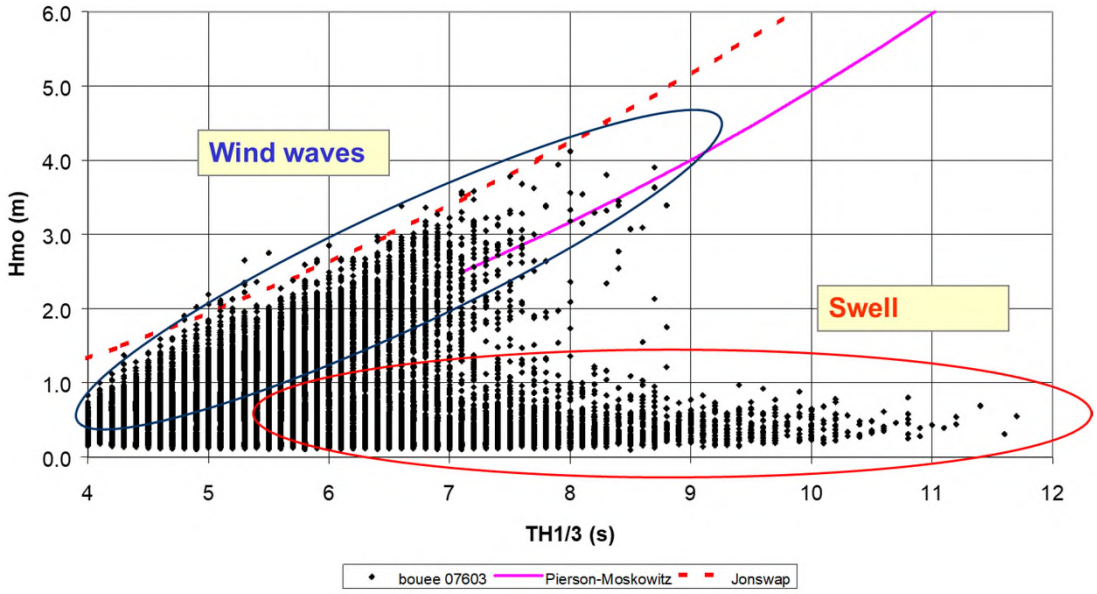
- **Non-directional wave recorder: Hippy 40**
- **Anemometer at 12 m above the sea level (wind speed and direction)**
- **Air temperature**
- **Sea temperature**



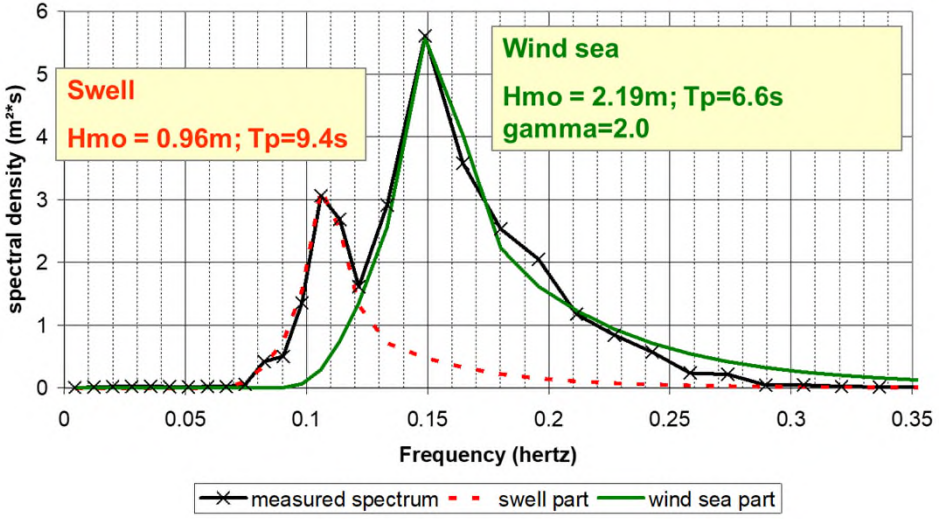


R&D on complex sea-states

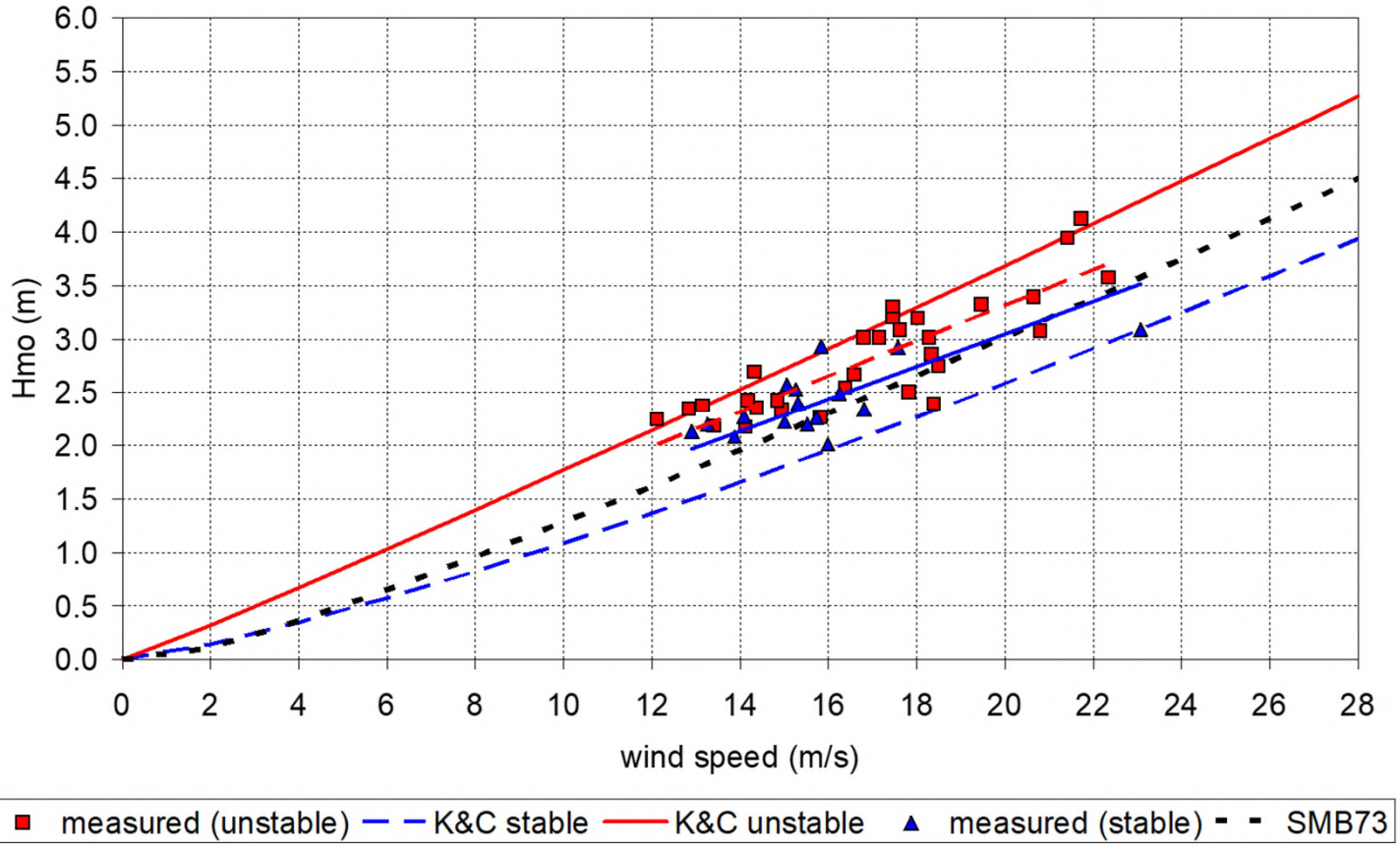




October 28, 1998 at 11:00



R&D on complex sea-states



Correlation of wave and wind data show a scatter around mean values well described by the upper and lower curves of Kahma and Calkoen (2012)

But in our particular case, combined sea and swell play a significant role! (scientific research)

Hamm L and and Gorjux B. (2005).“The role of swell and atmospheric stability in wind wave prediction : A practical application in the bay of Seine (France)” Proc. 5th Int. Symposium WAVES 2005, 3-7 July 2005, Madrid, Spain, paper 144

R&D on complex sea-states: directional measurements

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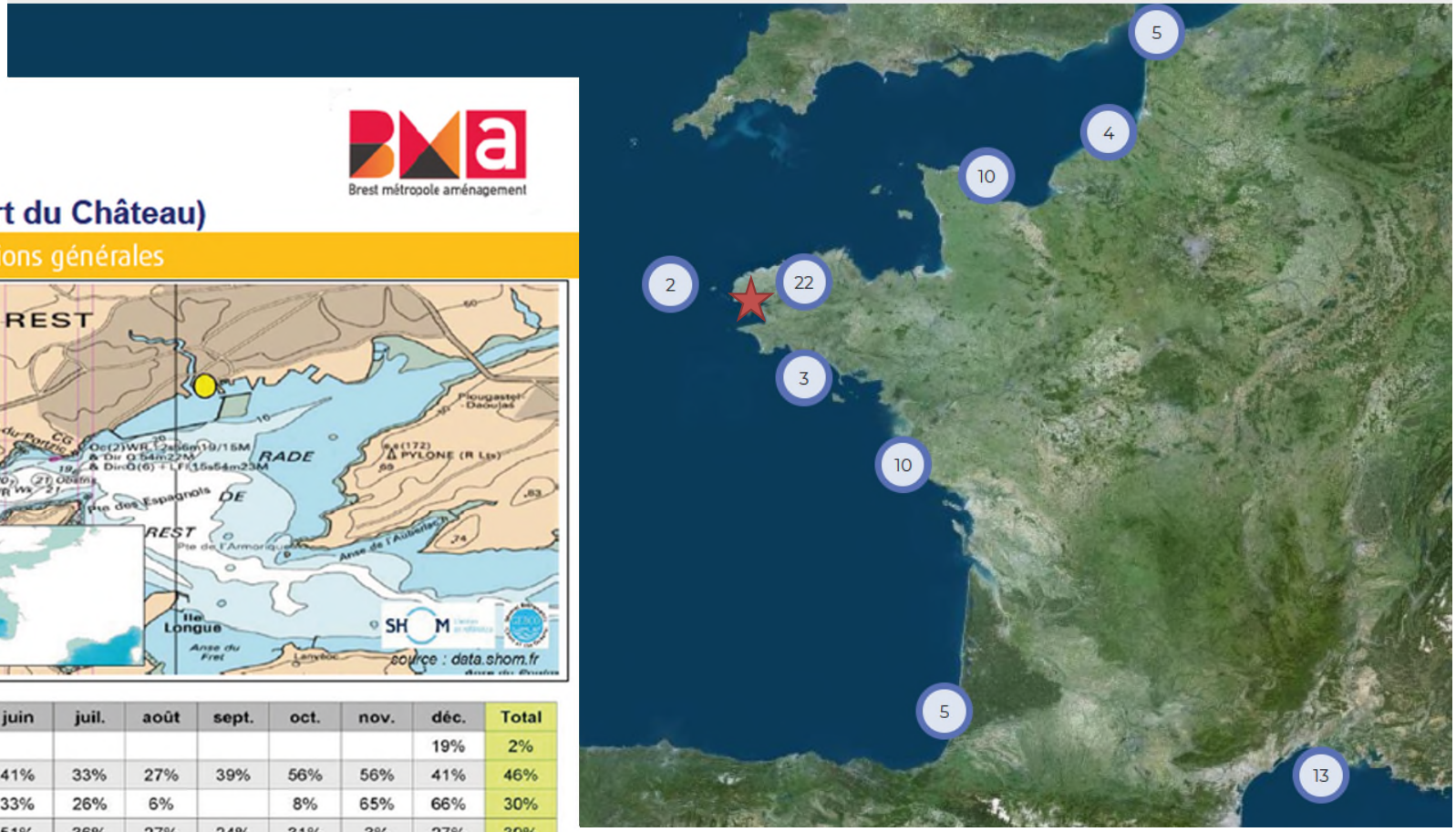
Centre d'Archivage National de Données de Houle In-Situ

Accueil | Carte



Cerema

Brest métropole aménagement

CANDHIS : 02909 – Brest (Port du Château)

Informations générales

Durée d'observation : 1,78 an
du 16/12/2004 au 25/02/2009

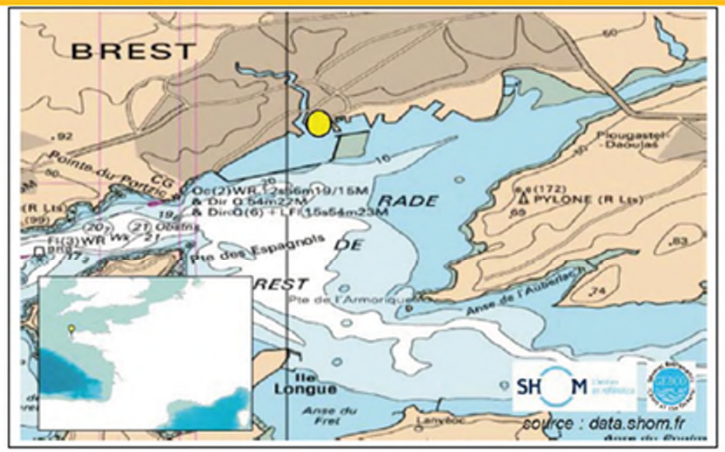
Latitude : 48°22,618'N

Longitude : 04°29,304'W

Distance à la côte : 0,1 mile

Profondeur : 9 mètres

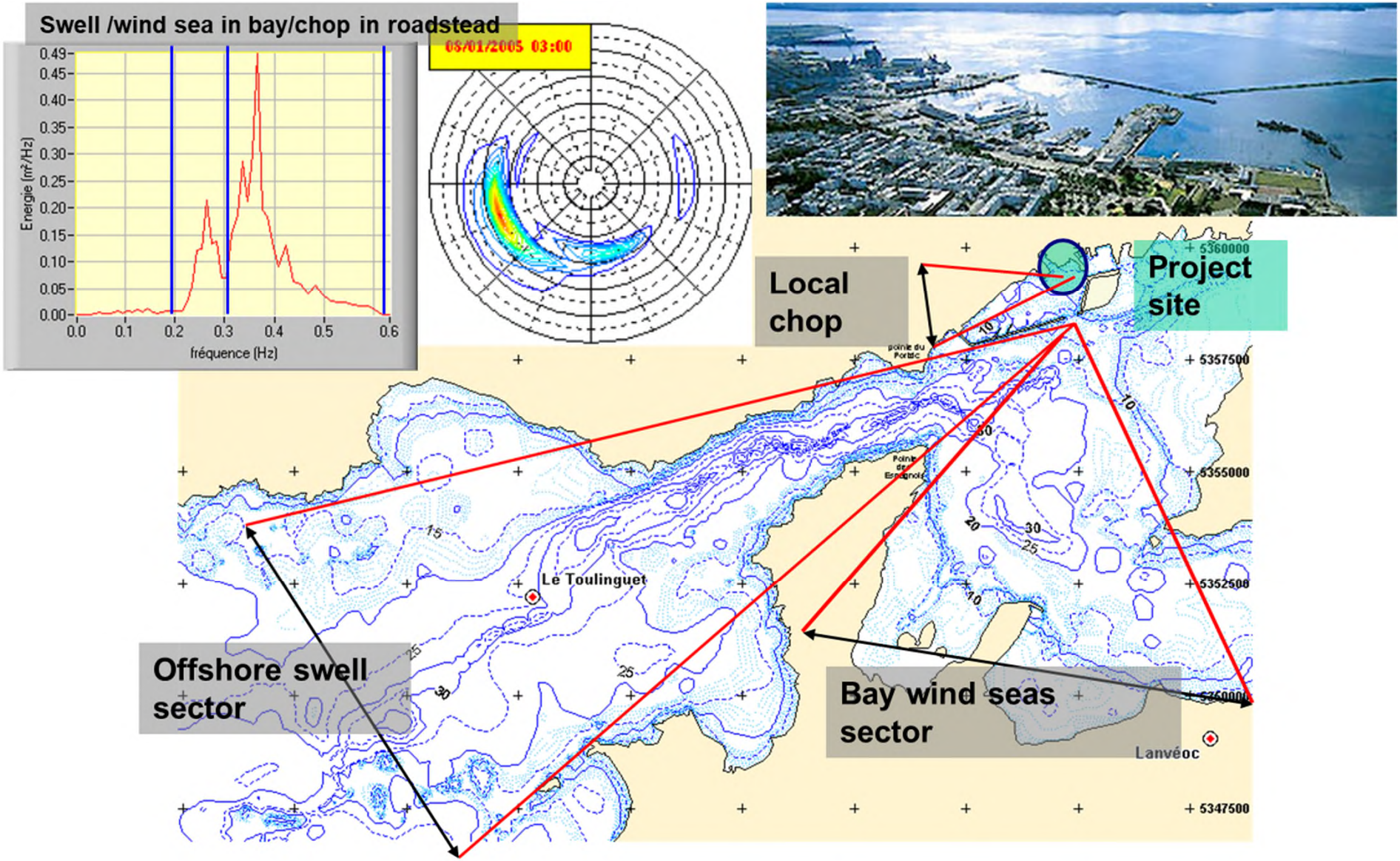
Marnage (VEM) : 6,2 mètres



Taux de disponibilité :

	janv.	fév.	mars	avril	mai	juin	juil.	août	sept.	oct.	nov.	déc.	Total
2004												19%	2%
2005	60%	47%	45%	59%	53%	41%	33%	27%	39%	56%	56%	41%	46%
2006	49%	55%	14%	13%	30%	33%	26%	6%		8%	65%	66%	30%
2007	67%	76%	59%	29%	35%	51%	36%	27%	24%	31%	3%	27%	39%
2008	76%	52%	54%	47%	34%	47%	68%	57%	46%	51%	50%	45%	52%
2009	61%	42%											9%
Total	52%	45%	29%	25%	25%	29%	27%	19%	18%	24%	29%	33%	30%

R&D on complex sea-states: directional measurements



Present and future needs

Access to real-time data in order to check wave conditions after a significant event

Access to combined data including waves, wind, sea level, air and sea temperature & current

A core group of permanent buoys for long-term monitoring

More mobility of other buoys for operating a few monthes or years at local places where important projects are under development

Access to full spectro-angular information

Separation of wave systems in complex sea-states