First DBCP Mediterranean Training Workshop on Ocean Observations and Data Applications

Marine Observational Advances in Tunisia

Ing. **Lotfi KHAMMARI**
Chief Ingineer in Hydrometeorolgy
Chief Service Of Marine Forecast

المعهد الوطني للرصد الجوي
Institut National de la Météorologie

09-11 Nov. 2022

01 Mediterranean Sea

Characteristics

Surface: 2,5 Mkm²
Depth: reaches more than 2,000 m over the entire maritime basin with pits of more than 5,000 m

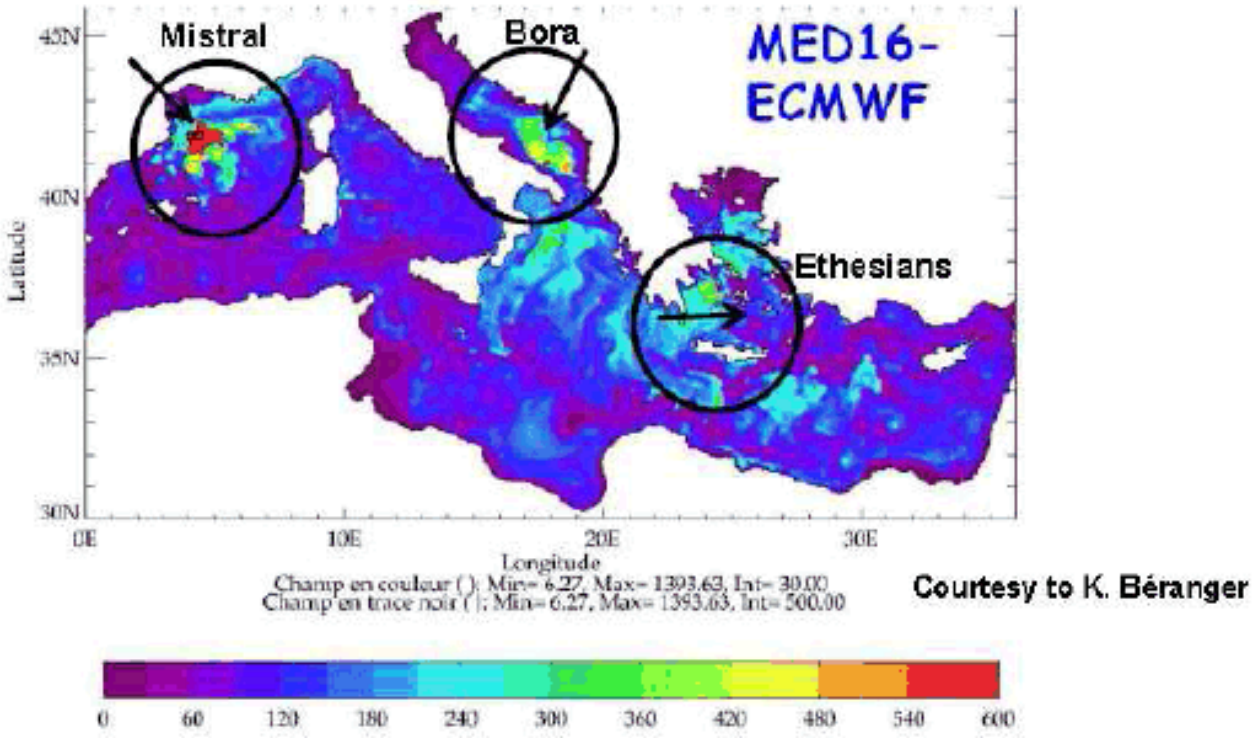
The Mediterranean countries represent:

5.7% of submerged land,
7% of the world's population,
13% of world GDP,
31% of international tourism

Environmental consequences

The highest mountain are rather located in the north and east of the basin, and its climatic and rainfall characteristics are also the most favourable to increase rainfall and snow and glaciers melting.

This mountain heights facilitate violent winds which reinforce the transport of industrial pollutants from the northern shore and northern Europe to the south.

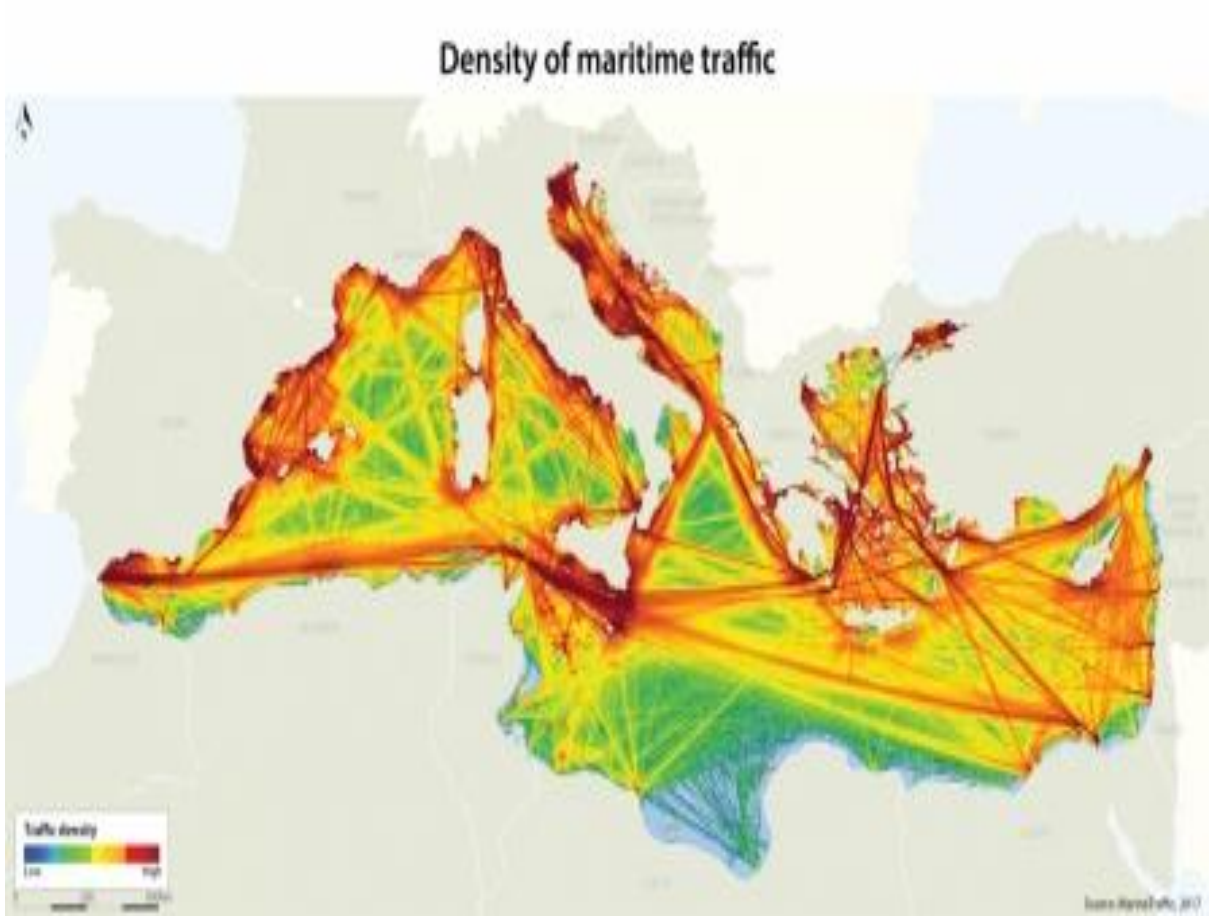


Courtesy to K. Béranger

Traffic Marine

The Mediterranean has very dense commercial traffic representing:

30%	of world traffic
305	commercial ports
28%	of world oil traffic
200 M	of passengers
2000	instant trade ships



The Effects of Climate Change

The Mediterranean climate is considered as temperate climate and characterized by hot, dry summers and relatively mild winters.

In the 20th century, the climate of the Mediterranean has recorded an increase in mean annual temperatures of 2°C with a more noticeable acceleration in the last thirty years of the century.

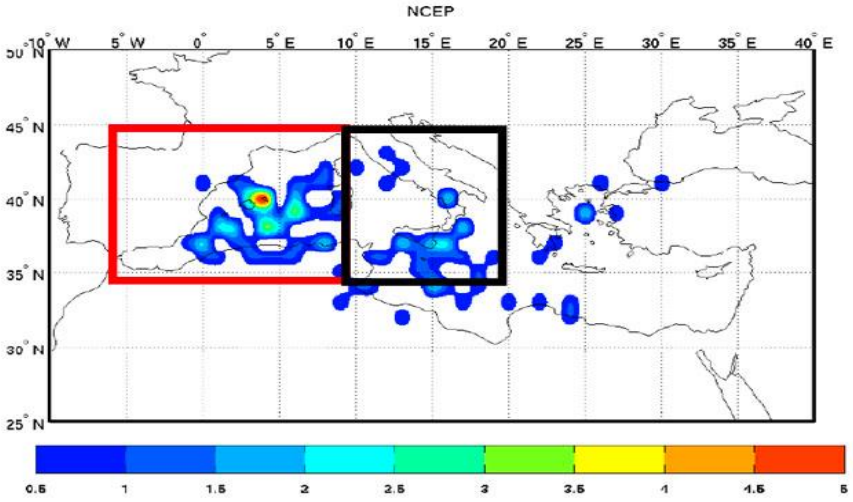
In addition, the total precipitation has decreased by 20% in certain southern regions of the basin.

In 2030, the projected effect of climate change on temperature in the Mediterranean area will increase by 0.5 to 1°C according to IPCC global modeling.

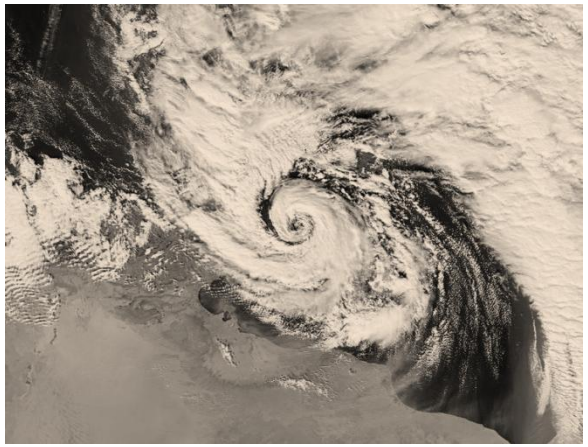
The mean sea level of the Mediterranean has risen by 6 cm over the past 20 years.

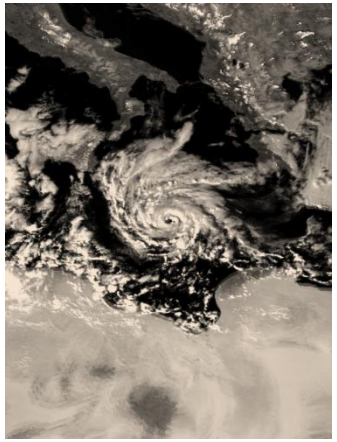
The Effects of Climate Change

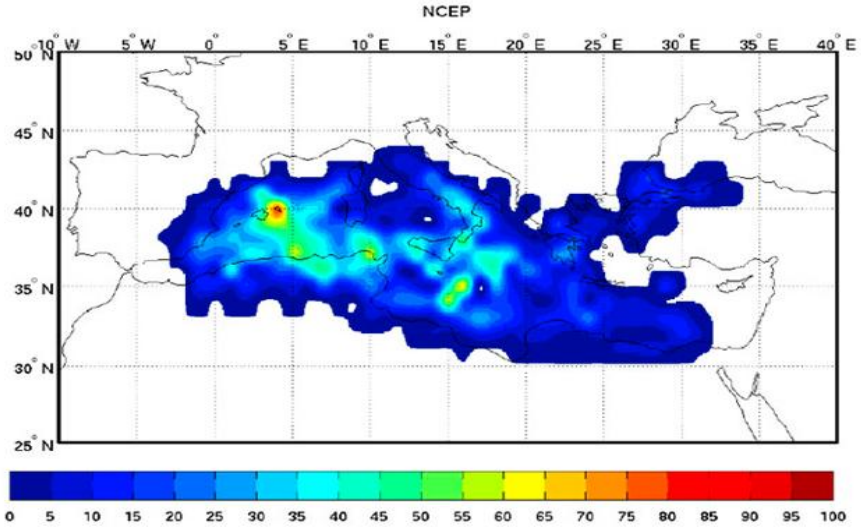
The Mediterranean region seems to be threatened by the resurgence of medicane prospective studies have already predicted this *(ROMERO and EMANUEL, 2013)*. In that regards the local societies must therefore face the resurgence of all the risks associated with these extreme events.



Position of the starting point on the trajectory of the considered medicane



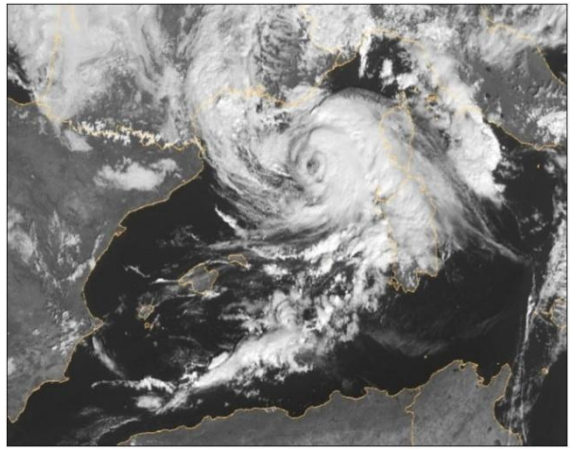


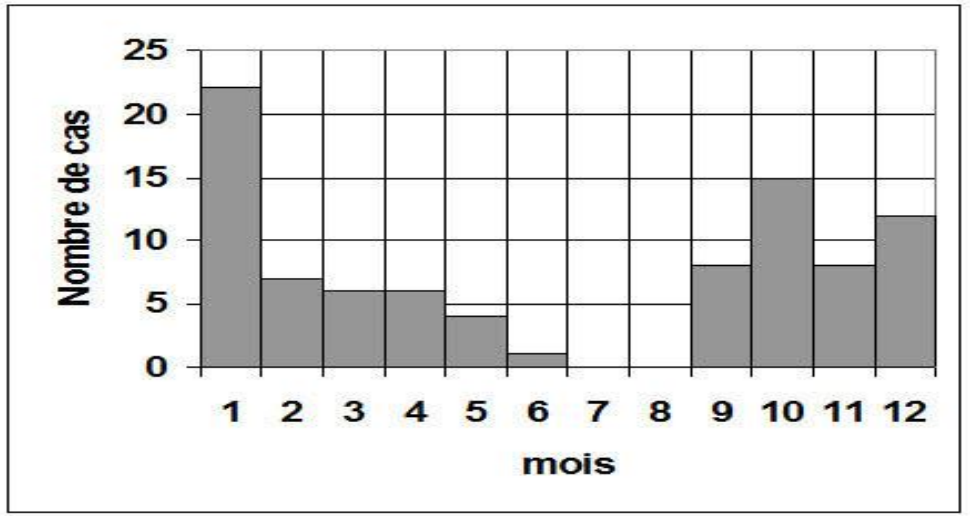


frequencies (%) of trajectories of medicans cells

The last registered Medicanes

November 18 to 21, 2013, the storm Cleopatra floods Sardinia;
from September 30 to October 2, 2015, a system occurred off Corsica;
October 28 to October 31, 2016, a system started from Calabria and moved towards Malta to the west causing damage in the city of Valletta.
September 28 to 30, 2018, Zorbas (also called Xenophon), happened in the southern Ionian Sea, moved up towards the Peloponnese, which it crossed.
September 15, 2020, a persistent convective system called Ianos was born in the Ionian Sea, whose surface temperature fluctuated between 26 and 27°C, while a cold drop overhung the region. On September 17, at its center at 1004 hPa an eye appeared characteristic of a tropical cyclone. The subtropical storm wreaked havoc on the island of Kefalonia on September 18.
October 28, 2021 the Mediterranean cyclone Apollo occurred in the southern Mediterranean Sea and moved up towards the Ionian Sea and the Sea of Sicily. Heavy rains from the cyclone and its precursor caused flooding in Tunisia, Algeria, southern Italy and Malta, killing 5 people and leaving 2 others missing.





Total absolute monthly frequencies of medicanes (1948-2011)

02

The National Institute of Meteorology

Missions of NIM

As defined by Law n° 2009-10 of February 16, some of missions of the National Institute of Meteorology are:

1- Satisfying general meteorological, geophysical and climatological needs of interest to the various economic sectors of the country and in particular meteorological assistance to air navigation, maritime navigation, agriculture and tourism.
2- Contribute to the protection of people and property against the risks caused by natural and industrial disasters and to the mitigation of their negative effects with coordination with concerned organizations.

Production and forecasts Services

Marine Forecast Service

Coasts forecasts
Offshore forecast
Special Bulletin

General Forecast Service

Specific weather forecasts
Vigilance maps
Press releases and bulletins

Aeronautic Forecast Service

Supplying operators, flight crew members, air traffic services units,…

Statistical adaptation and verification service

Marine Forecast service Missions

The Marine forecasts service is attached the production department. It is mainly responsible for:

- Analysis of weather conditions,
- Expertise of numerical forecasting and the development of general guidelines for the development of meteorological conditions,
- Production of marine weather forecasts,
- Simulate the drift of pollutant slicks
- Production of press releases and bulletins to monitor marine weather conditions.
- Production of Gales

The Marine forecasts service is mainly responsible for producing tailored weather bulletin to:

- Fishing Sector, Maritime transport, Oil Platforms, Tourist Activities, etc…

Marine Forecast Products

Coasts and offshore Bulletins

MARINE WEATHER BULLETIN (OFFSHORE)
Morning

Issued on 26 July 2022		
Warning	Warning of near gale : None	
General Synopsis : Low gradient of atmospheric pressure over our areas		
Forecasts for today and tonight		
North of Tunisia	Morning	**Wind:** West-north-west 10-15 **Sea:** Smooth to Slight **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Afternoon	**Wind:** West-north-west 15-20 locally 25 **Sea:** Slight becoming locally Moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Night	**Wind:** West-north-west 15-25 **Sea:** Moderate becoming Very moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good to Moderate
East Tunisia	Morning	**Wind:** North-west 15-20 **Sea:** Slight to Moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Afternoon	**Wind:** West-north-west 15-20 locally 25 **Sea:** Moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Night	**Wind:** North-west 15-20 locally 25 **Sea:** Moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
Gulf of Gabes	Morning	**Wind:** West-north-west 5-15 **Sea:** Smooth to locally Slight **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Afternoon	**Wind:** North-west turning South-east 5-15 **Sea:** Slight to locally Swelled **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Night	**Wind:** South-east turning West 5-15 **Sea:** Slight **Weather:** Sunny intervals/Mostly clear **Visibility:** Good

Issued on 26 July 2022

Page 1/2

B. P. n°156 - 2035 - Tunis Carthage - ص.ب. عدد 156 - 2035 - تونس قرطاج
(+216) 71 773 400 (+216) 71 772 609 8840 0000 www.meteo.tn 85012

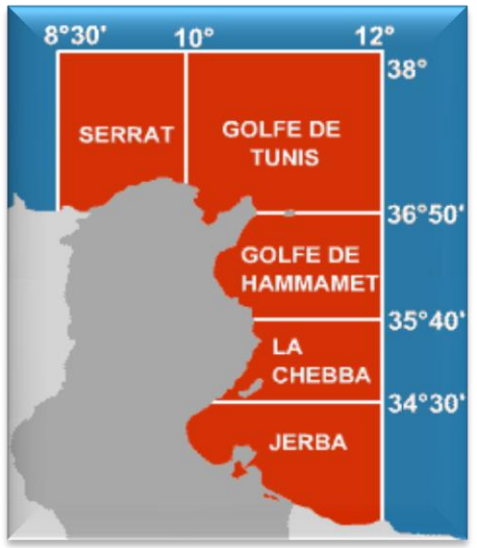
MARINE WEATHER BULLETIN (OFFSHORE)
Morning

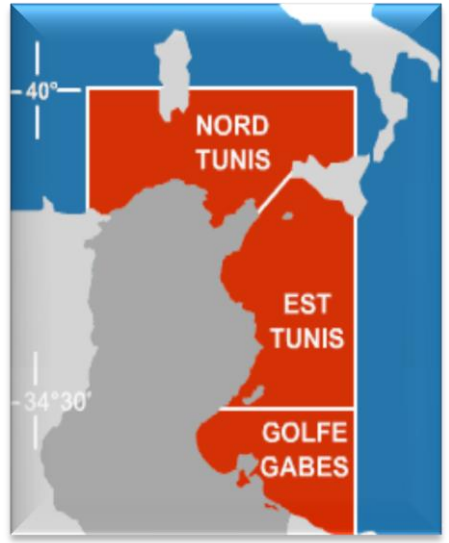
Outlook for the next 24 hours		
North of Tunisia	Morning	**Wind:** West-north-west 15-25 **Sea:** Very moderate to Moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good to Moderate
	Afternoon	**Wind:** North-north-west 15-25 **Sea:** Moderate to Very moderate **Weather:** Partly cloudy **Visibility:** Good to Moderate
	Night	**Wind:** West-north-west 15-25 **Sea:** Moderate to Very moderate **Weather:** Sunny intervals/Mostly clear **Visibility:** Good to Moderate
East Tunisia	Morning	**Wind:** North-north-west 15-20 locally 25 **Sea:** Moderate **Weather:** Partly cloudy **Visibility:** Good
	Afternoon	**Wind:** North-north-west 15-20 locally 25 **Sea:** Moderate to locally Very moderate **Weather:** Partly cloudy **Visibility:** Good
	Night	**Wind:** North-north-west 15-25 **Sea:** Moderate to locally Very moderate **Weather:** Partly cloudy **Visibility:** Good to Moderate
Gulf of Gabes	Morning	**Wind:** West-north-west 5-15 **Sea:** Slight to locally Swelled **Weather:** Sunny intervals/Mostly clear **Visibility:** Good
	Afternoon	**Wind:** North-west turning East 5-15 increasing locally 15-25 **Sea:** Swelled **Weather:** Partly cloudy **Visibility:** Good
	Night	**Wind:** North-east North-west 15-20 **Sea:** Swelled **Weather:** Partly cloudy **Visibility:** Good

Visibilité	Très mauvaise/brume	mauvaise	moyenne	bonne
	inférieur à 0,5 mille	De 0.5 à 2 milles	De 2 à 5 milles	Supérieur à 5 milles
Visibilité en Mille Marin (1 Mille = 1,852 Km)	Force en Noeud (1 noeud = 1,852 Km)			

Page 2/2

B. P. n°156 - 2035 - Tunis Carthage - ص.ب. عدد 156 - 2035 - تونس قرطاج
(+216) 71 773 400 (+216) 71 772 609 8840 0000 www.meteo.tn 85012





- **Coasts Bulletin:** Updated 3 times a day and if the weather situation requires updating according to the model outputs
- **Offshore Bulletin:** Updated twice a day and if the weather situation requires updating according to the model outputs

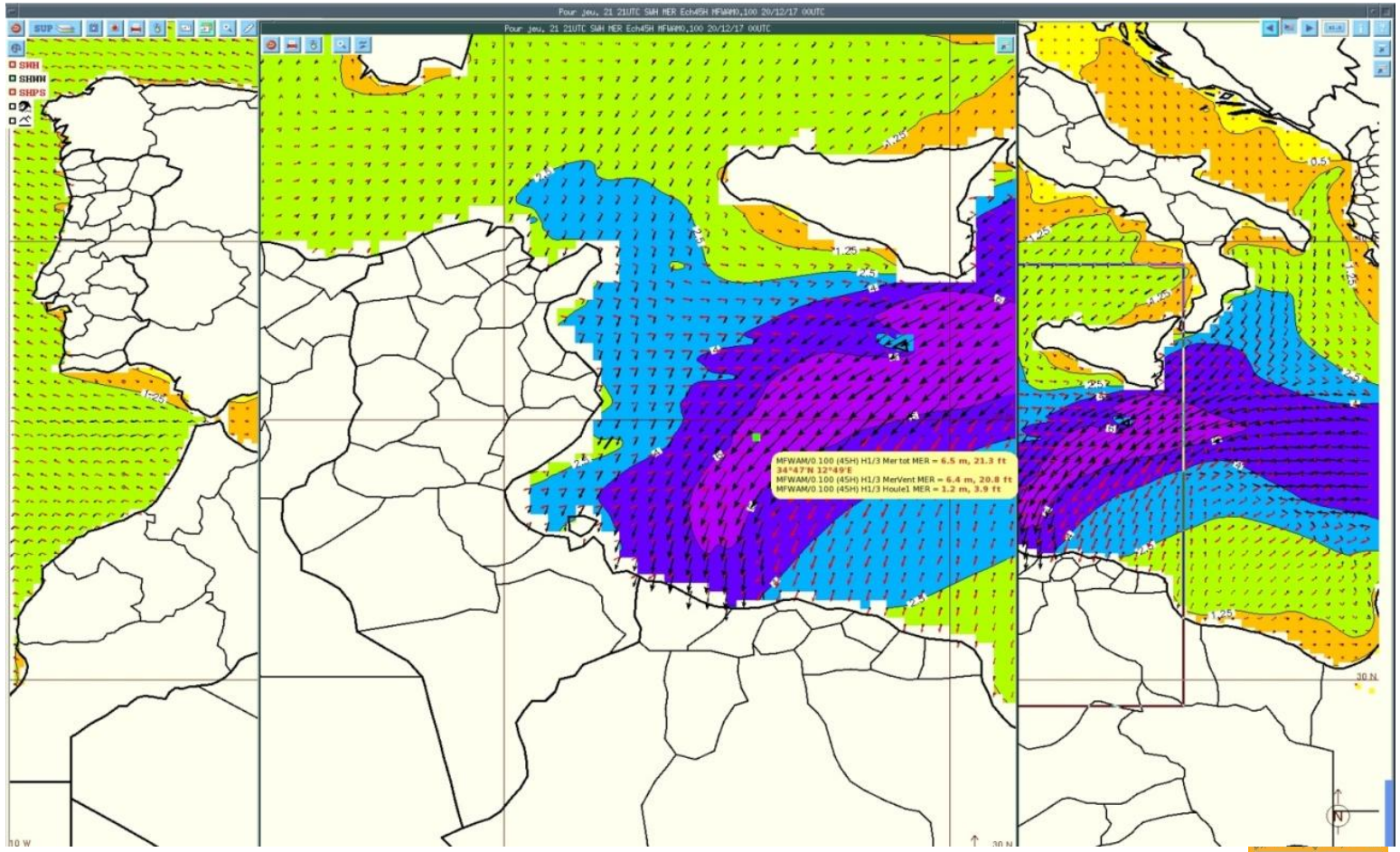
NWP Capacities

	ALADIN 7.5 km	AROME-TUNISIE 2.5 km	AROME-TUNISIE 1.3 km	AROME-TUNISIE 1.3 km	ARPEGE
Version	CYCLE 38	CYCLE 40	CYCLE 42	CYCLE 43	CYCLE 43
Spatial Resolution	7.5 km	2.5 km	1.3 km	1.3 km	10km sur la Tunisie
Grid points	205 x 259	550*400	687*352	687*352	Global
Vertical Levels	70	60	90	90	105
Coupling model	ARPEGE 10km	ARPEGE 10km	ARPEGE 10km	ARPEGE 10km	-
Coupling frequency	horaire	Tri-horaire	Horaire	Horaire	-
Timestep	450 s	60 s	45 s	45 s	360s
Range	54h	48h	48h	48h	102h

Numerical Oceanic Model

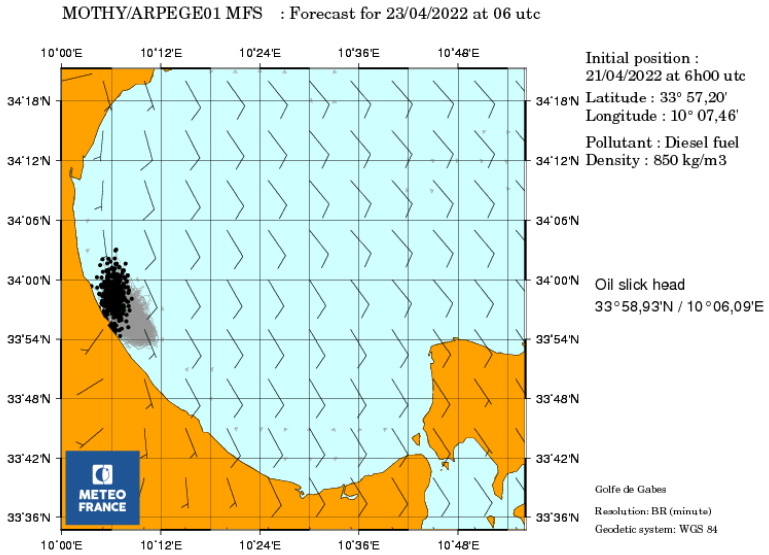
2018: Acces to the MFWAM as primary wave model for large area in the institute

- This model is “forced” as input by 10M winds output from numerical weather prediction models: Arpege and Arome.
- Spatial, altimetric and spectral observation data, via radars on board satellites, are assimilated by global and regional MFWAM models.



Numerical Pollution Model

2021: Access to the Marine Pollution Model's "MOTHY"



Oil drift from XELO incident in Tunisia, in April, 2022

Observation Network - NIM

Two operational coastal stations,

Upgrading the seven marine stations, however the coastal stations always remain insignificant heights of the waves.

➔ We need observation points much more advanced in the coasts and the open sea

SXTS45 DTTB 010700
DONNEE **BIZERTE PORT** DE 0800 LOC
==========
ETAT DU CIEL : NUAGEUX
ETAT DE LA MER: PEU AGITEE
VENT : SSE 04 KT
T AIR: 24.7
T MER: 24.2
HR : 78
P MER: 1015.5
VISI : 4 MILLES
PHNOMNES:NIL=

SXTS45 DTTA 010700
STATION **GOULETTE PORT**:

ETAT DU CIEL:TRES NUAGEUX
PHENOMENE :NIL
RR:NEANT
DD:S
FF:06KT
TEMPERATURE:24.9°C
HUMIDITE:86%
VISIBILITE :2MILES
PRESSION : 1016HPA
ETAT DE LA MER:PEU AGITEE=

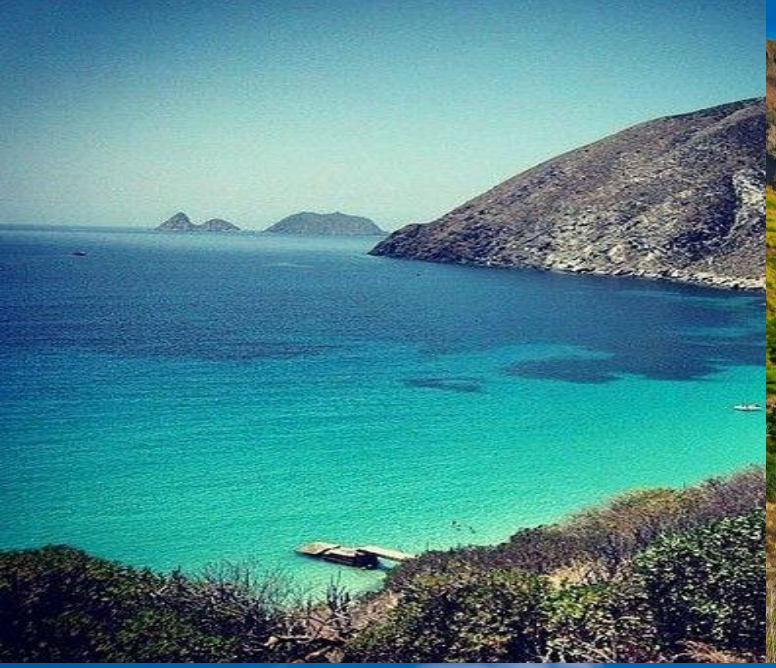
SXTS49 DTMB 010900
PORT DE SOUSSE
ETAT DE CIEL :COUVERT
ETAT DE LA MER:PA
T°C DE L'AIR :25.6
T°C DE LA MER :25.2

SXTS49 DTMB
PORT DE MON
ETAT DE CIEL :TN
ETAT DE LA MER:PA
T°C DE L'AIR :25.0
DDD/FF VENT :00010KT
HUMIDITEE :100%
PRESSION :1016.0HPA

Potential collaboration

Faced with all these climate impacts, and in order to be able to improve natural disasters management as well as strenghthening resilience against the harmful consequences of climate effects on socio-economic sectors of the country, we need to maintain and improve our technical and operational capacities through development of our marine weather forecast services by:

- Installing HF radar on the coast of Tunisia,
- Extending the observation network by more bouys system on open sea,
- Following a training and courses on Oceanography and Marine forecast.
- Developing of automated marine weather forecast services,
- Developing new verification system for marine forecast,
- Using of a marine wave propagation model for coastal area,
- Using Satellite marine observation (wave height, wind direction and force): to create a local database to help monitor the submersion wave in order to integrate it later into the NIM vigilance maps,



Thank you

www.meteo.tn