



ACCORD Management Group



Numerical Weather Prediction activities

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Outline

1-NWP at the National Institute of Meteorology

2- Main Research and development activities (consortium Contribution)

3-Program and projects contributions

4- Future plans and objectives

5- Discussions

1

NWP at the National Institute of Meteorology

National Institute of Meteorology

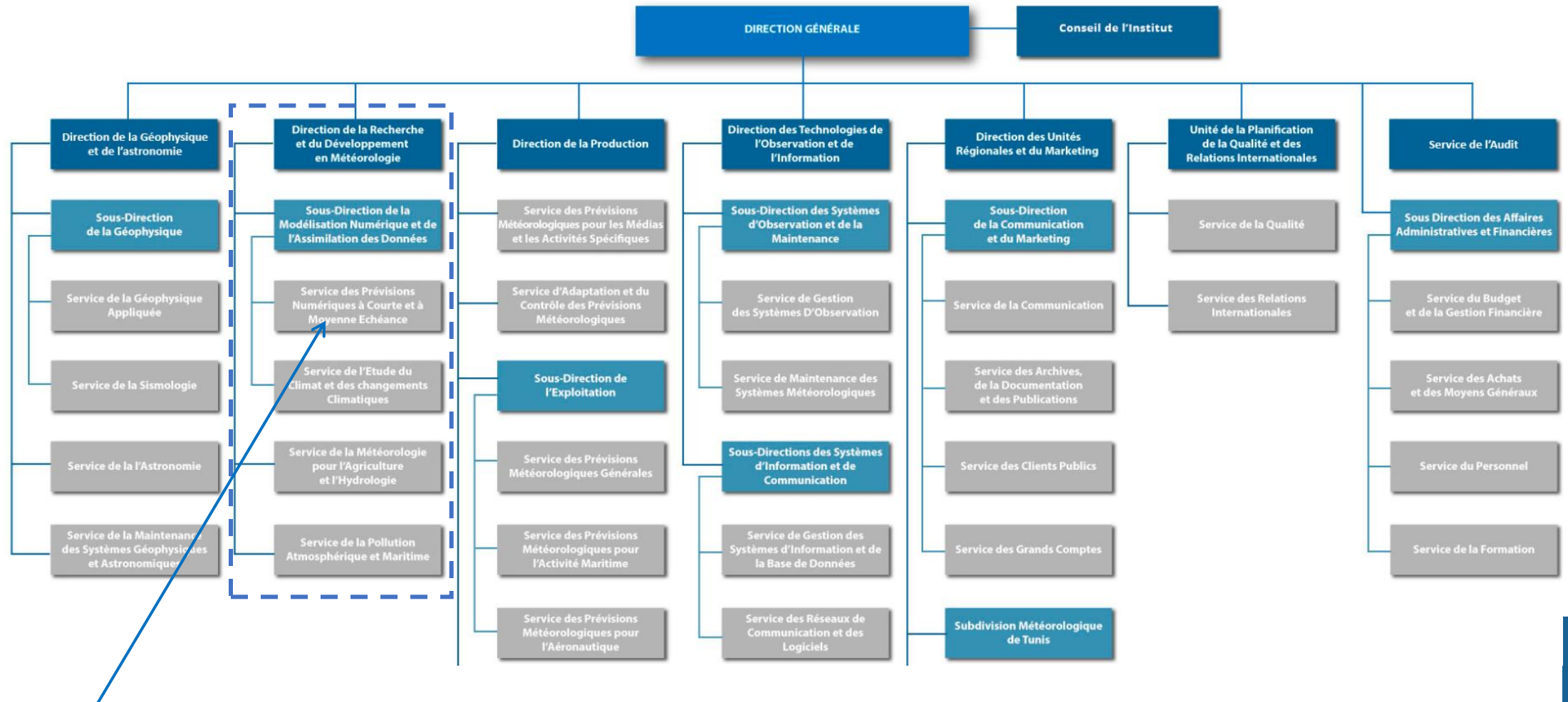
NATIONAL INSTITUTE OF METEOROLOGY

The National Institute of Meteorology is a non-administrative public body, with moral personality and financial autonomy. It is subject to the supervision of the Ministry of Transport.

As for its relation with third parties, the National Institute of Meteorology is subject to the commercial legislation. (Law No. 2009-10 dated February 9, 2009 – issued in the Official Gazette of the Tunisian Republic on February 20, 2009).



Research And Developpement NWP



Research And Developpement

1

Numerical Weather prediction

- Operational NWP
- Physical Parameterization
- Data Assimilation
- Model Evaluation

2

Study of Climate and Climate Change

- Climate Monitoring
- Seasonal Forecast
- Climate Change studies and projections

3

Atmospheric and marine pollution

- Atmospheric And marine Pollution
- Forest fires

NWP team participate and collaborate in national and international projects and programs



NWP History at the institute

2001: INM officially joins the ALADIN CONSORTIUM

2004: Operationalization of the model ALADIN-Tunisia locally at the institute

2012: Configuration of the AROME-Tunisia domain and installation on the machines of Météo-France

2015: Installation of a prototype AROME-Tunisia on the HP server of the INM

End of 2019: Pre-operationalization of the model AROME-Tunisia on the new computer ALKINDY

2020: Merge between ALADIN and HIRLAM to create The ACCORD Consortium

2022: Operationalization of the AROME-Tunisia as primary model for prediction in the institute

Tunisian Numerical Weather Prediction Team



BELGHRISSI Haythem

LTM-Tunisia
Head of Numerical Weather
prediction team



BEN ROMDHANE Rahma

Hydrometeorological Engineer
Microphysics Team



DHOUIOUI Hajer

Hydrometeorological Engineer
Microphysics Team



KHALFAOUI Wafa

Hydrometeorological Engineer
Data assimilation

Numerical Weather Prediction Suites

	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 - lately 46
Spatial Resolution	7.5 km	2.5 km	1.3 km	1.3 km	10km over Tunisia
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	hourly	Tri-hourly	Hourly	Hourly	-
Timestep	450 s	60 s	45 s	45 s	360s
Range	54h	48h	48h	48h	102h

Two daily times runs, 00h and 12h
Ongoing : adding 06h and 18h

HPC AI-Kindi



DELL HPC

Calcul :

- 16 Compute Nodes PowerEdge C6420
Each Node:
2 Processors Intel Xeon GOLD 6148 : 2.4 Ghz, 20 cores, 40 threads
- 2 Big Memory Nodes PowerEdge R640
- 2 Login Nodes PowerEdge R640
- 2 Master Nodes PowerEdge R640
- **Storage :**
- 2 BeeGFS servers
- 2 Storage Nodes Dell PowerEdge R740
- 2 storage Bay Dell PowerVault MD3460

Operating system : **Red Hat Linux**

Archiving system : **Isilon Cluster A200**

Performance

~600 To
CPU 12 cores
RAID6 disk

Arome Models outputs and Ecflo Suite

ecFlowUI (4.7.0) - (menu: User)

File Panels Refresh Servers Tools Help

arome

arome

arome_suite

- getibc
 - getibc_r0
- coupling_surf
 - /arome_suite/getibc/getibc_r0 eq complete
 - fetch
 - compute
 - fetch eq complete
 - save
 - compute eq complete
- coupling_alt
 - /arome_suite/getibc/getibc_r0 eq complete
 - fetch
 - compute
 - fetch eq complete
 - save
 - compute eq complete
- forecast
 - fetch
 - /arome_suite/coupling_alt/compute eq complete and /arome_suite/coupling_surf/compute eq complete
 - compute
 - fetch eq complete
 - save
 - compute eq complete

Server statistics

```

Ecflow version(4.7.0) boost(1.53.0) compiler(gcc 4.8.3) protocol(TEXT_ARG)
Status RUNNING
Host alkindi1
Port 3141
Up since 2020-Jan-08 14:44:32
Job sub' interval 60s
ECF HOME /mnt/beegfs/oper/arome/ecflow
ECF_LOG /mnt/beegfs/oper/arome/ecflow/alkind11.3141.ecf.log
ECF_CHECK /mnt/beegfs/oper/arome/ecflow/alkind11.3141.ecf.check
Check pt interval 120s
Check pt mode CHECK_ON_TIME
Check pt save time alarm 20s
Number of Suites 1
Request's per 1,5,15,30,60 min 0.07 0.02 0.01 0.01 0.02

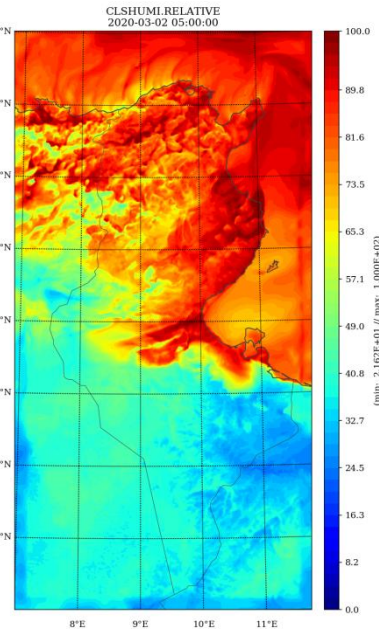
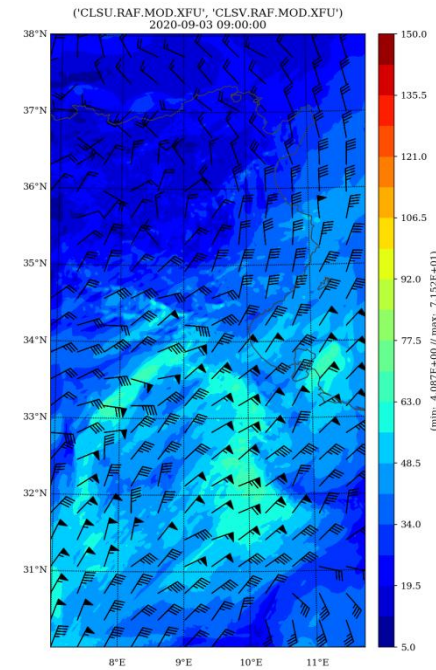
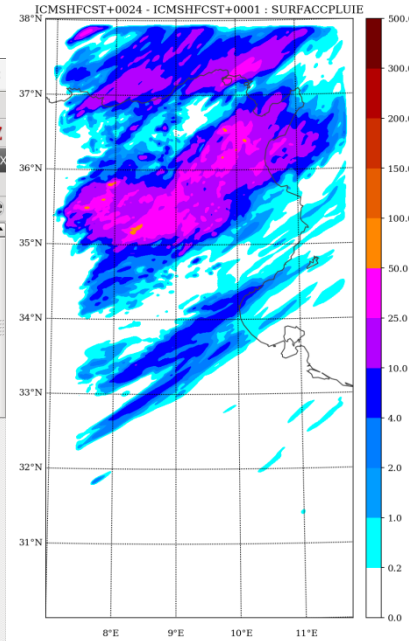
Restart server 1
Sync 1041
News 18641

Task init 673
Task complete 554
Task abort 109

Requeue 19
Node suspend 14
Node resume 12
Node edit history 4
Run 42
Replace 100
  
```

Node	Status	Type	Trigger	Label	Event	Meter	Status changed
/arome_suite/c	complete	task	compute eq co				2020-Feb-10 06:52:00
/arome_suite/c	complete	task					2020-Feb-10 06:46:00
/arome_suite/c	complete	task	fetch eq compl				2020-Feb-10 06:51:00
/arome_suite/c	complete	family	/arome_suite/ig				2020-Feb-10 06:52:00
/arome_suite	complete	suite					2020-Feb-10 07:40:00

Notifications: Aborted Late Restarted



Internal and External Relation

1. Internal Customers

1

General Forecast Service

Specific weather forecasts

Vigilance maps

Press releases and bulletins

2

Marine Forecast Service

Coasts forecasts

Offshore forecast

Special Bulletin

3

Air navigation Forecast Service

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

4. Statistical adaptation and verification service

Internal and External Relation

2 External Initiatives

-Universities: Research and collaboration (Convention with ENIT,...)

Developing tool for Forest fires forecast using Arome outputs

Developing of IA tool for improving Arome model predictions at station level

-Ministry of agriculture: DGRE (coupling for Floods forecast)

-Ministry of Energy: STEG (development of a yield forecasting tool for photovoltaic stations using the of the Arome model outputs)



2

Main Research and development (consortium Contribution)

Data Assimilation at INM : Scheme & observations

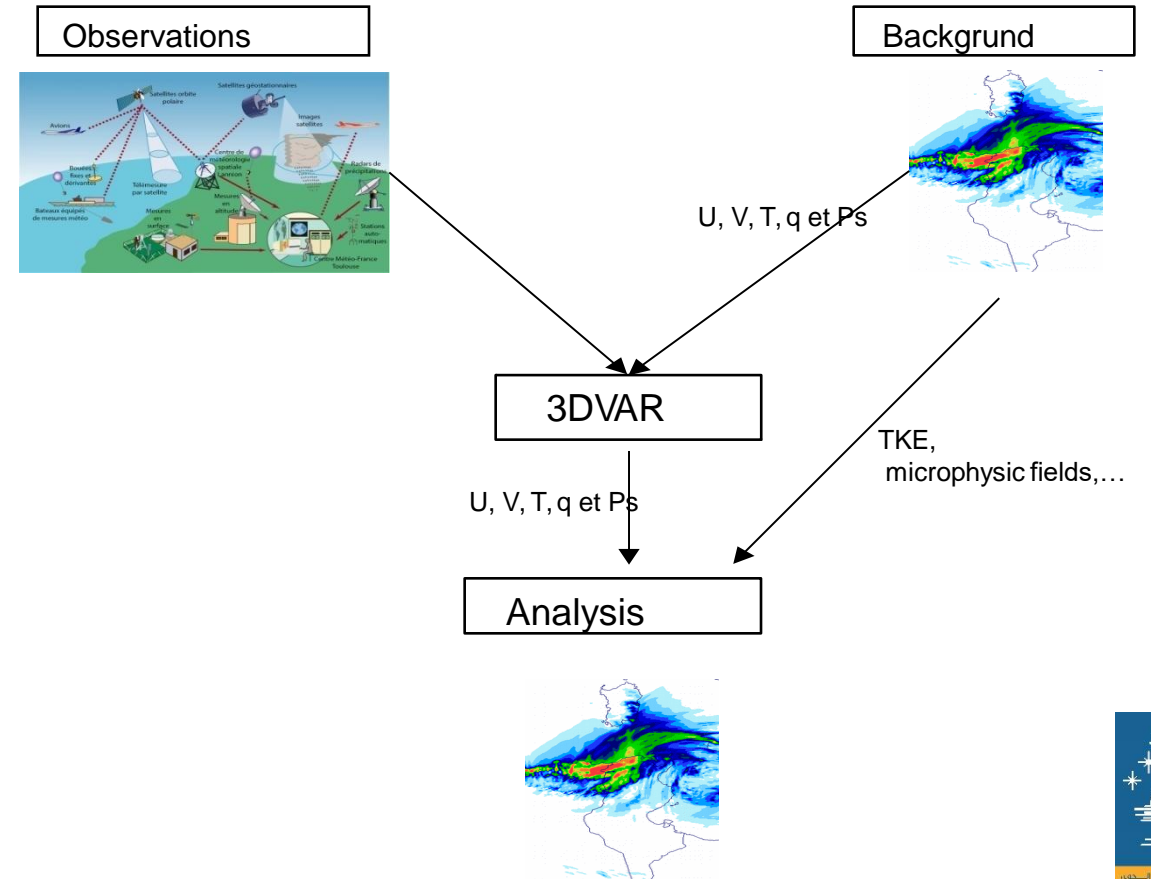
ALADIN-Tunisie DA Configuration

- 3DVAR scheme
- 6H cycling
- Local: Synop, Temp

AROME-Tunisie DA Configuration

- 3DVAR scheme
- 3H cycling
- Synop, Temp, Amdar, Buoy
- Satellite: Seviri, AMSU-A, AMSU-B, IASI

Data Assimilation Scheme



Microphysics at INM

Configuration AROME-Tunisia

Resolution : 1.3Km

Vertical levels : 90

Number of points in the domain :
---*---

Domain coordinates :

SW (lon ° - lat °)

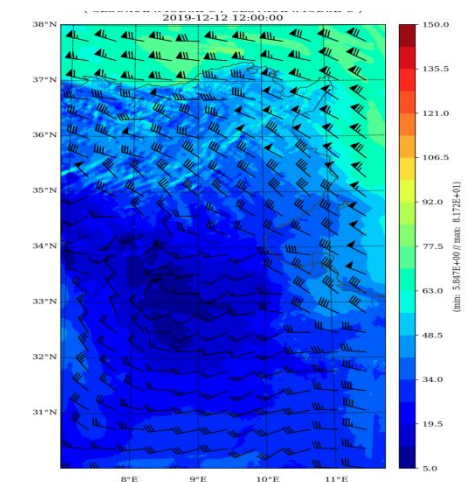
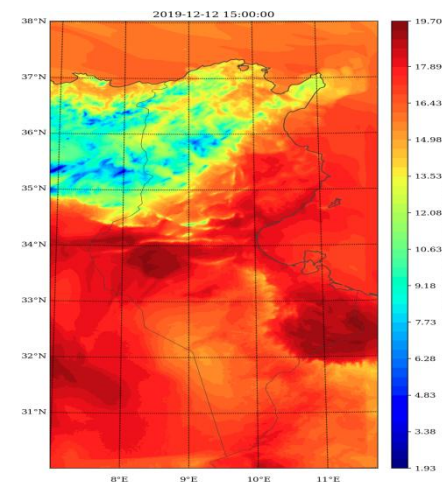
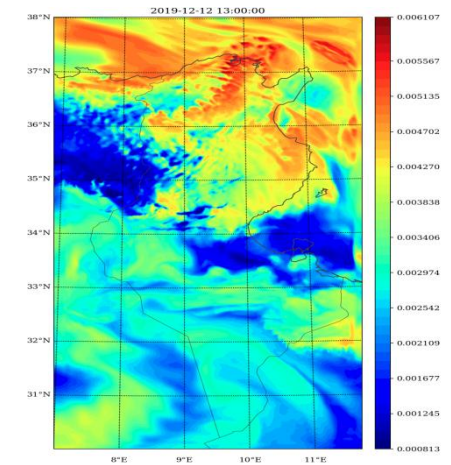
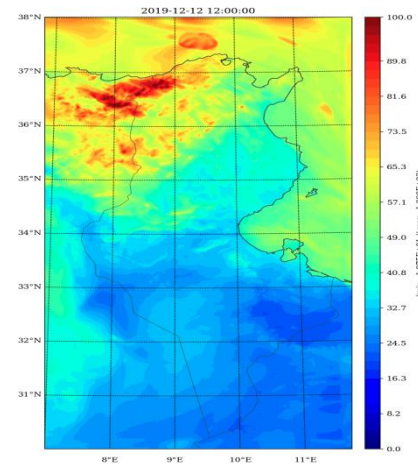
NE (lon ° - lat °)

Time Step : 45s

Forecast range : 48h

LBCs : ARPEGE

Cycle : Cy45t1_main





3

Projects and Programs Contribution

Atmospheric and Marine Pollution : NETTUNIT Project

Framework: IEV program Tuniso-Italian cooperation 2014-2020

Themes: Protection of the environnement et CC adaptation

Objective : Development of an operational numerical platform with the use of meteorological alerts, alerts on atmospheric and marine pollution intended in particular for the services of the Civil Protection, local health and other intervention services in Tunisia and Italy.

Participants : INM (Leader), HAMa (Ariana), CRNS (Sfax), CNR (Palermo, biomédecine), IES (Catania, environnement & sécurité), ASP (Caltanissetta, sanitaire);
L' ANPE & DGMM (parteners)

Duration: 30 Months

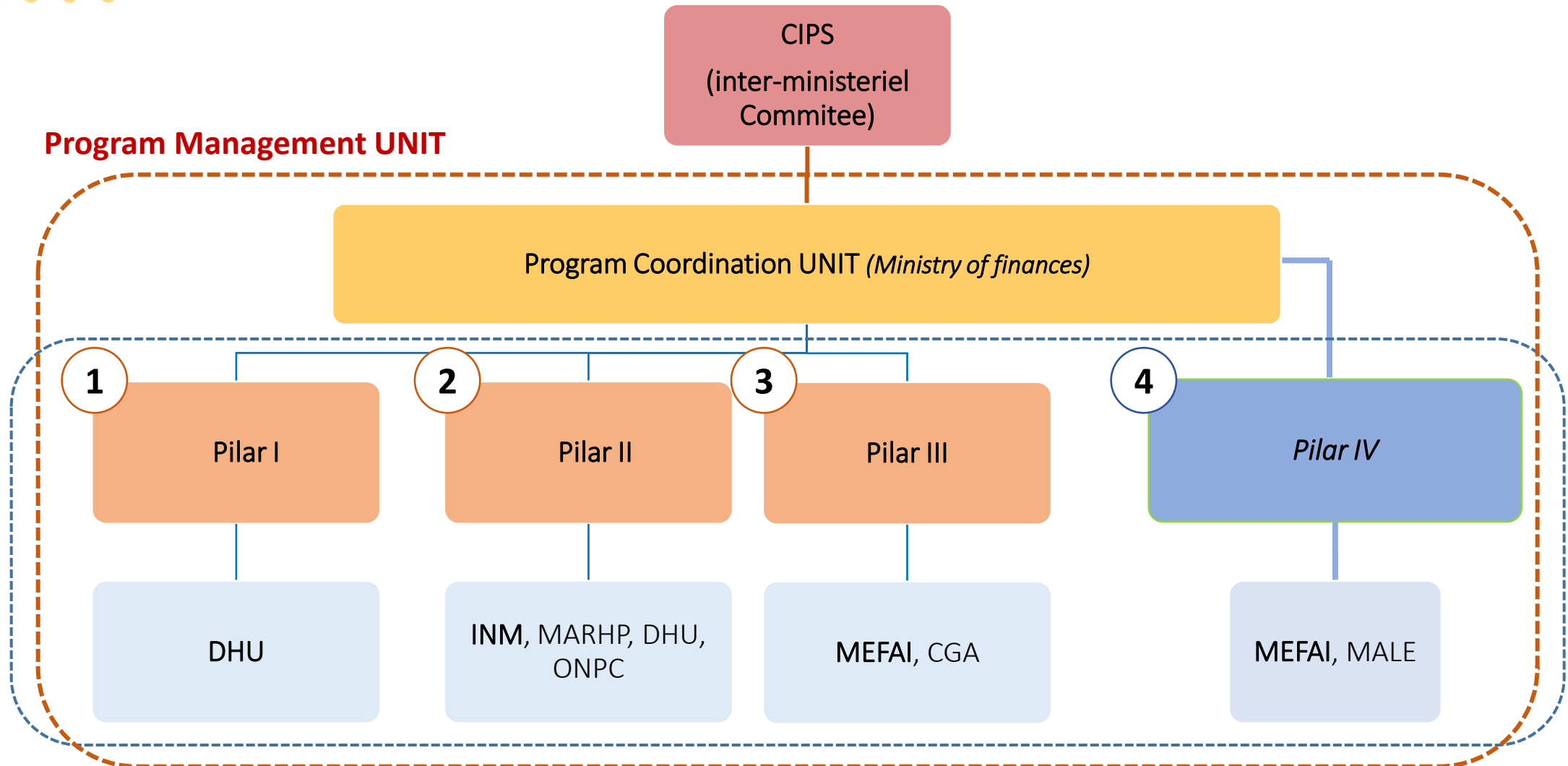
Budget : 1.2 millions euros (about 90 % EU contribution)

ResCat Program

- **Program:** Integrated Program for Disaster Resilience in Tunisia (PIRC)
- **Objective:** Strengthen disaster management and financing and to improve the protection of target populations and assets against climate hazards and disasters.
- **Budget:** 125 M\$ (350 MDT)
- **Domaines de Résultats:** The program is structured around 4 pillars (outcome areas)
 1. **Improve flood risk reduction (investment in flood protection infrastructure),**
 2. **Improve disaster preparedness (modernization of hydrometeorological services and strengthening of early warning systems),**
 3. **Strengthen financial protection (establishment of disaster insurance mechanisms),**
 4. **Promote institutional coordination and a sound regulatory environment for disaster risk management**
- 4. **Promote institutional coordination and a sound regulatory environment for disaster risk management (establishment of DRM coordination mechanisms and the creation of a disaster resilience unit)**

ResCat Program

EQUIPES OPERATIONNELLES



ResCat Projects and activities related to NWP

Type Activités	Budget Total (K\$)	Description activités
MS 6	250	Membership to ECMWF
MS 7	350	SC NWP (higher resolution and data assimilation)
MS 8	200	SC Nowcasting and flash flooding system
MS 9	100	SC coupling Meteorological and hydrological modelisation
MS 10	10000	Acquisition et installation of 5 C-Band radars
MS 11	600	HPC Extension



4

Future Plans and objectives



Future Objectives

Objective 1: Operational Excellence

Objective 2: DATA ASSIMILATION

Objective 3: NEW PARTENERSHIPS, NEW CUSTOMERS

Objective 4: REINFORCE COLLABORATION WITH UNIVERSITIES

Objective 5: OPTIMAL HUMAIN AND COMPUTING RESSOURCES





Future Priorities

1. Improve the availability and reliability scores of the operational numerical weather prediction model Arome.
2. Implement and put in operational the data assimilation cycle for Arome.
3. Increase the number of periodic meetings with our internal customers to improve internal communication and to solicit feedback and recommendations.
4. Run the Arome operational model for four different times 00H, 06H, 12H and 18h.
5. Develop a Nowcasting model to better track extreme situations and provide forecasters with additional information of high added value.

Future Priorities

6. To multiply partnerships and collaborations and to strengthen links with the academic community and the various users of meteorological information.
7. To provide students with internship opportunities and staff with mentoring opportunities, especially in the fields of artificial intelligence and machine learning.
8. To increase the contribution of the institute in the ACCORD consortium and to respect the commitments of the consortium.
9. Strengthen the team and guarantee their commitments and invest even more in their continuous training and supervision.
10. Continuous improvement of the Institute's computing resources to better meet the specific needs of our internal and external customers

Thank you

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Discussions



Discussions

- CMR: NWP contribution
- Local Team System Representatives (LTSR)
- Use of SPFRACCO projects au ECMWF
- Use of github