A satellite image of a cyclone over the Mediterranean region, showing a well-defined eye and spiral cloud bands. The landmasses of Europe, Africa, and Asia are visible in the background.

Building the MedCyclones community: Main research topics, achievements and perspectives

Emmanouil Flaounas¹, Silvio Davolio², Florian Pantillon³, Platon Patlakas⁴, Shira Raveh-Rubin⁵, Assaf Hochman⁶, Jonilda Kushta⁷, Samira Khodayar⁸, Maria Hatzaki⁴, Stavros Dafis⁹, Margarida Liberato¹⁰

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⁵Department of Earth and Planetary Sciences, Weizmann Institute of Science, Israel

⁶Fredy and Nadine Hermann Institute of Earth Sciences, The Hebrew University of Jerusalem, Sderot Magnes, Jerusalem, Israel

⁷Climate and Atmosphere Research Centre, The Cyprus Institute

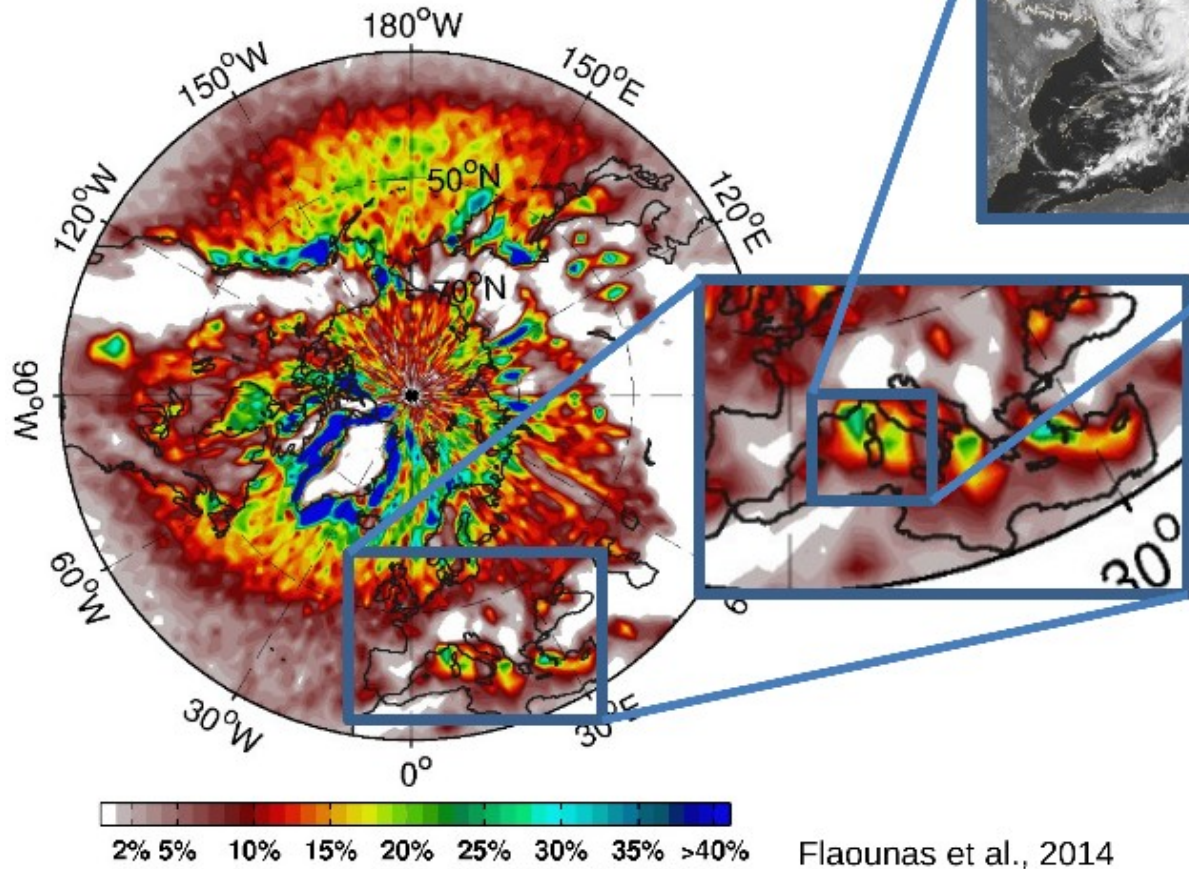
⁸Mediterranean Centre for Environmental Studies (CEAM), Spain

⁹National Observatory of Athens, Greece



A bit of history...

Tracks density for 20 winters (1989-2009)



Coordination of research:

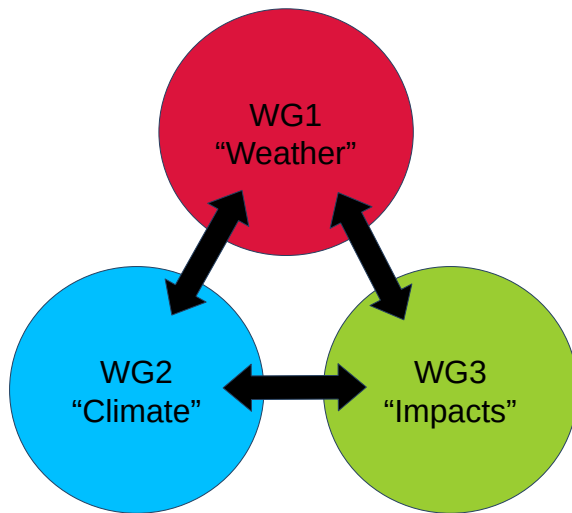
- **2000-2010:** *The Mediterranean Experiment (MEDEX): on Cyclones that produce High Impact Weather*
- **2010-2020:** *The Hydrological Cycle in the Mediterranean Experiment (HyMeX)*
- **2020-2024:** *MedCyclones COST Action*
- **2023-2027:** *FutureMed COST Action*

Challenges in community building...

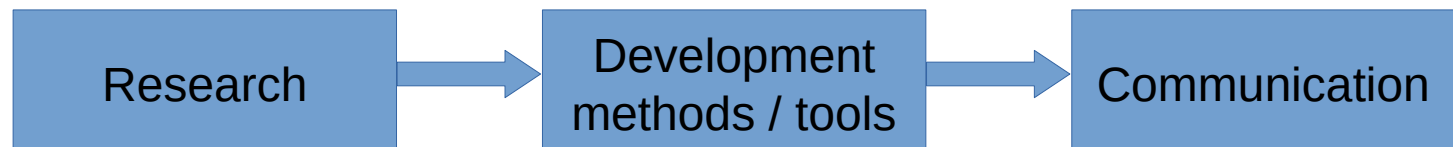
- *Coordination of existing research activities on national level*
- *Enhance visibility and collaboration with other storm track communities*
- *Address the lack of consensus on medicane definition*
- *Produce added value in forecasts through collaboration*

MedCyclones in a nutshell...

- **Period:** 2020-2024 (COVID-19 issues.. 2020-2022)
- **Members:** 200+ participants from ~30 countries
- **Stakeholders:** Weather services & private entities
- **Funding:** GP1: 49 kEuros, GP2: 160 kEuros, GP3: 176 kEuros, GP4: 180 kEuros...
- **Schemes:** Workshops, Training schools, STSMs, dissemination activities
- **Organisation:** Based on research initiatives: "one-paper" projects; these need to contribute to the topics of the working groups (WG) and to the overall objectives of the Action.
- **Three WGs:**



- WG1:** *Process-based understanding of Mediterranean cyclones at **weather** time scales*
- WG2:** *Process-based understanding of Mediterranean cyclones at **climate** time scales*
- WG3:** *Environmental and **socio-economic impacts** of Mediterranean cyclones*
- Floods
 - Windstorms
 - Transport of pollutants (dust)
 - Storm surges
 - High sea waves
 -



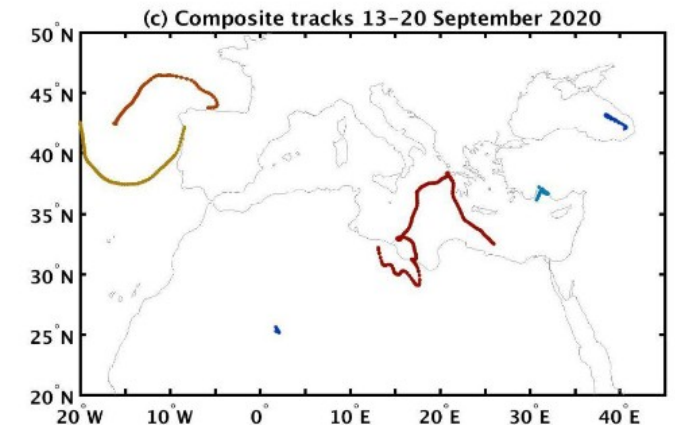
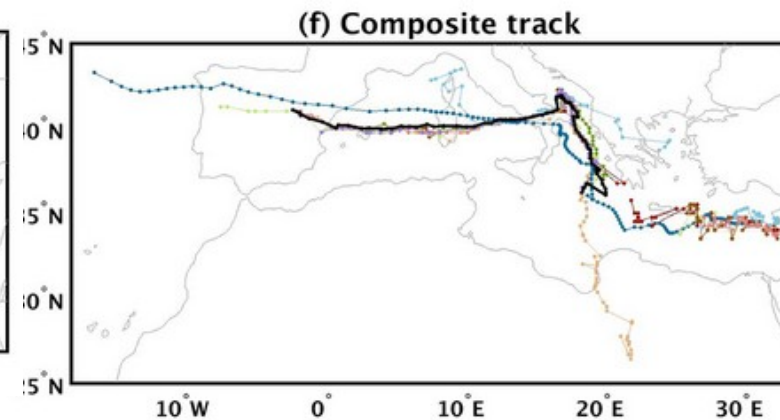
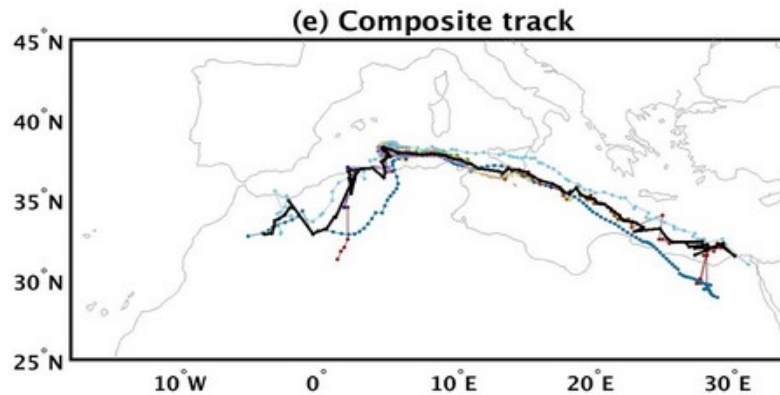
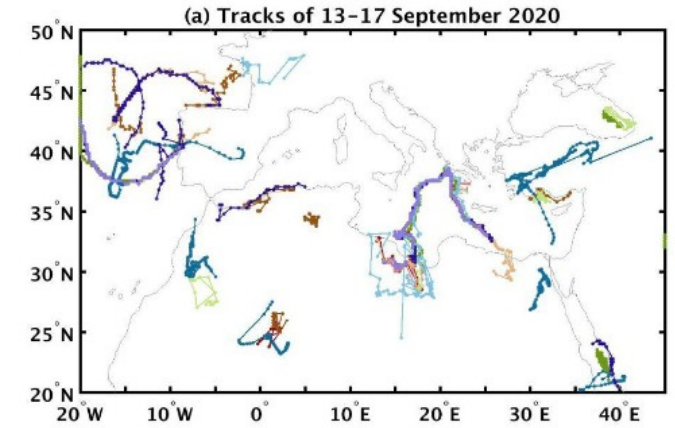
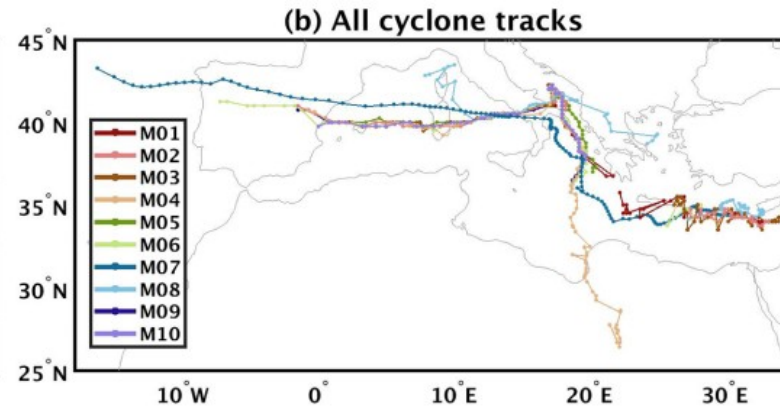
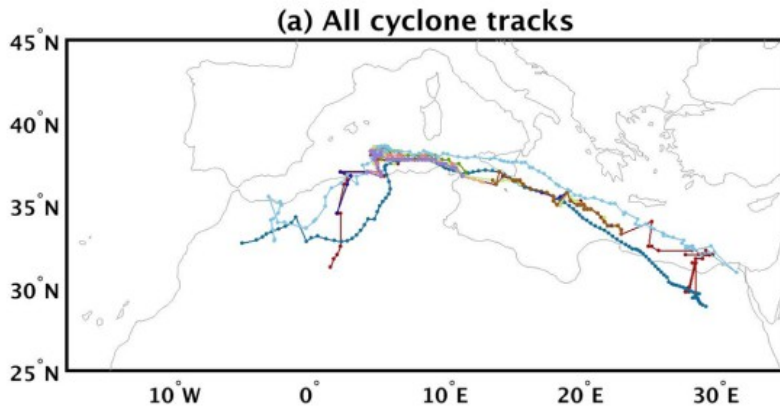
Example of collaborative work (Research): “Med best-tracks”

A composite approach to produce reference datasets for extratropical cyclone tracks: application to Mediterranean cyclones

Emmanouil Flaounas¹, Leonardo Aragão², Lisa Bernini^{3,23}, Stavros Dafis^{4,5}, Benjamin Doiteau^{6,7}, Helena Flocas⁸, Suzanne L. Gray⁹, Alexia Karwat¹⁰, John Kouroutzoglou^{8,11}, Piero Lionello¹², Mario Marcello Miglietta¹³, Florian Pantillon⁶, Claudia Pasquero³, Platon Patlakas⁸, María Ángeles Picornell¹⁴, Federico Porcù², Matthew D. K. Priestley¹⁵, Marco Reale^{16,17}, Malcolm J. Roberts¹⁸, Hadas Saaroni¹⁹, Dor Sandler¹⁹, Enrico Scoccimarro²⁰, Michael Sprenger²¹, and Baruch Ziv^{19,22}

Methodological Approach

- ERA5 1979-2020
- 10 tracking methods
- 1 year of meetings...

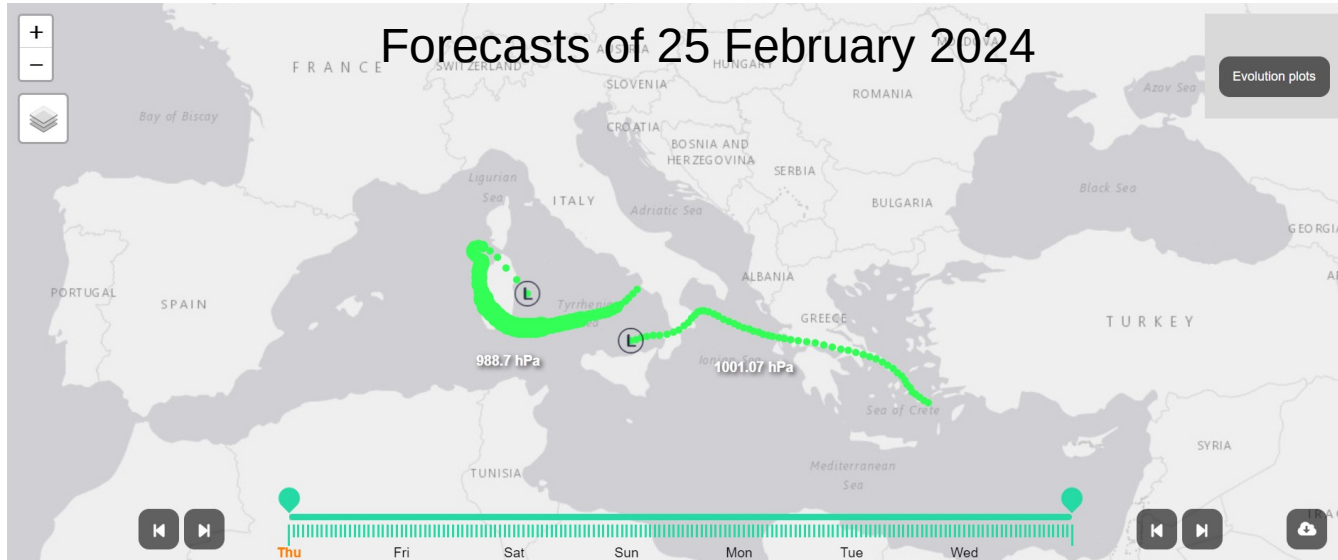


Example of collaborative work (Tools): “Med best-tracks”

Research

Development
methods / tools

Communication



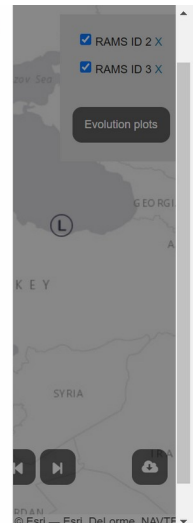
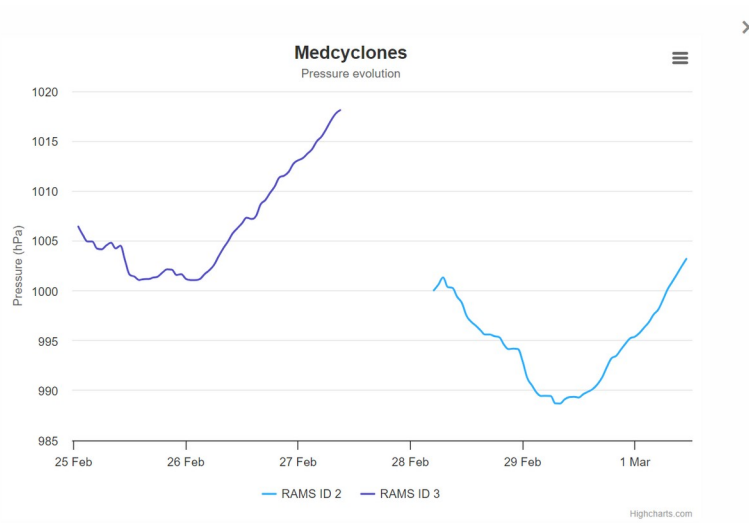
Forecasts, collected daily:

- BOLAM (GFS)
- WRF (GFS; 3 configurations)
- ICON (DWD, IMS)
- Arpege (Meteo-France)

Objective: Implementation of “similar tracks” diagnostic to operational forecasts

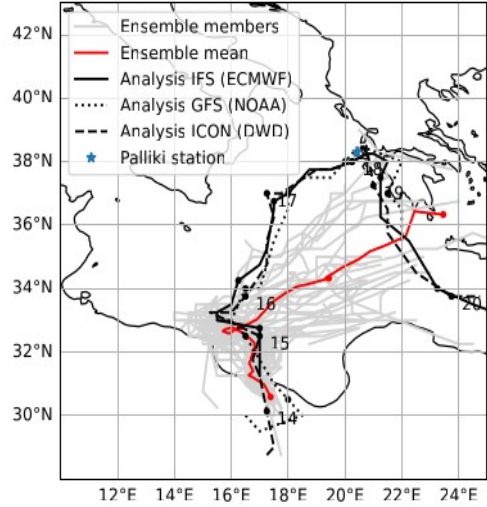
Challenges:

- Lack of -strong- commitment by members
- Implementation of the tool..
- Coordination of parties involved



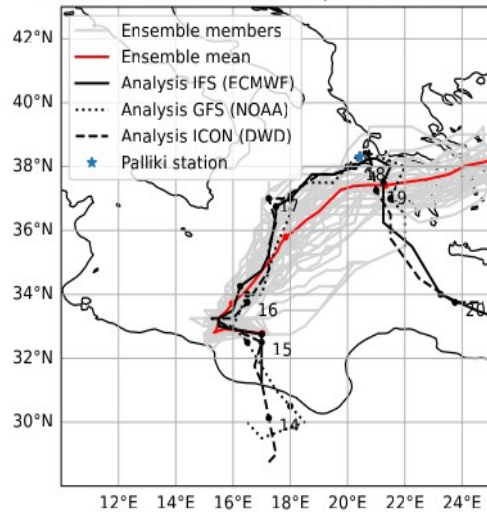
WG1: Process-based understanding of Mediterranean cyclones at weather time scales

ECMWF-EPS initialized Mon Sep 14 00:00:00 2020



(c) Ensemble from 00 UTC 15 Sep 2020

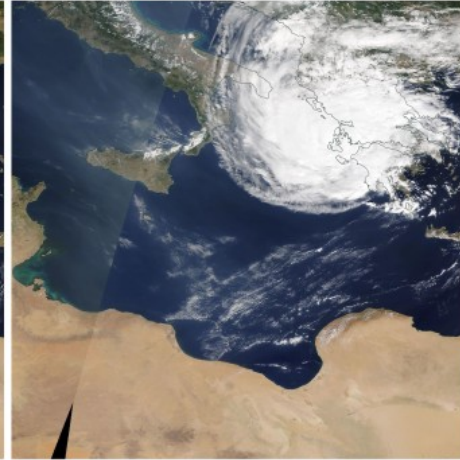
ECMWF-EPS initialized Tue Sep 15 00:00:00 2020



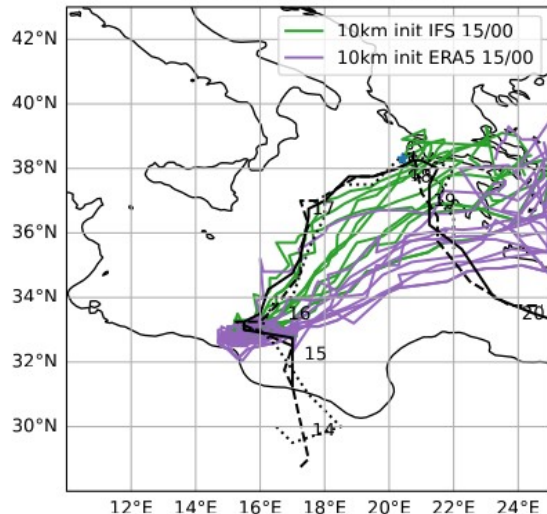
(d) 1145 UTC 17 Sep 2020



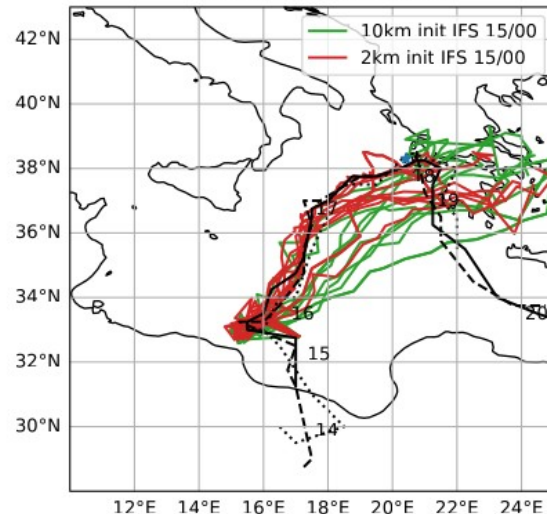
(e) 0910 UTC 18 Sep 2020



Track of Mediane Ianos



Track of Mediane Ianos



Model intercomparison

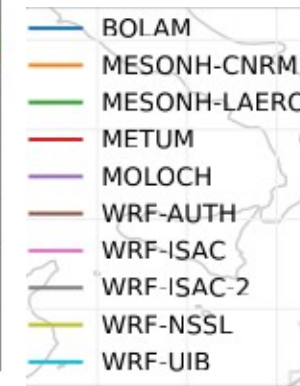
(Florian Pantillon & Silvio Davolio)

Motivation: Use “best” and “worst” models to understand key elements in cyclones development

Paper is out (2024):

The crucial representation of deep convection for the cyclogenesis of mediane lanos

Florian Pantillon, Silvio Davolio, Elenio Avolio, Carlos Calvo-Sancho, Diego S. Carrió, Stavros Dafis, Emmanouil Flaounas, Emanuele Silvio Gentile, Juan Jesus Gonzalez-Aleman, Suzanne Gray, Mario Marcello Miglietta, Platon Patlakas, Ioannis Pytharoulis, Didier Ricard, Antonio Ricchi, and Claudio Sanchez



WG2: Process-based understanding of Mediterranean cyclones at climate time scales

A MEDITERRANEAN TROPICAL STORM?

By J. A. ERNST¹ and M. MATSON²

¹NOAA/National Weather Service, USA

²NOAA/National Earth Satellite, Data, and Information Service, USA

AT times Mother Nature does her best to deceive us. One such occasion occurred near the start of 1982 and is depicted in Fig. 1, a portion of the NOAA-7 visible band spectrum satellite image taken at 1236 GMT 26 January 1982. The superimposed arrows point to several features of meteorological interest that, when seen together in the same image, are perplexing.

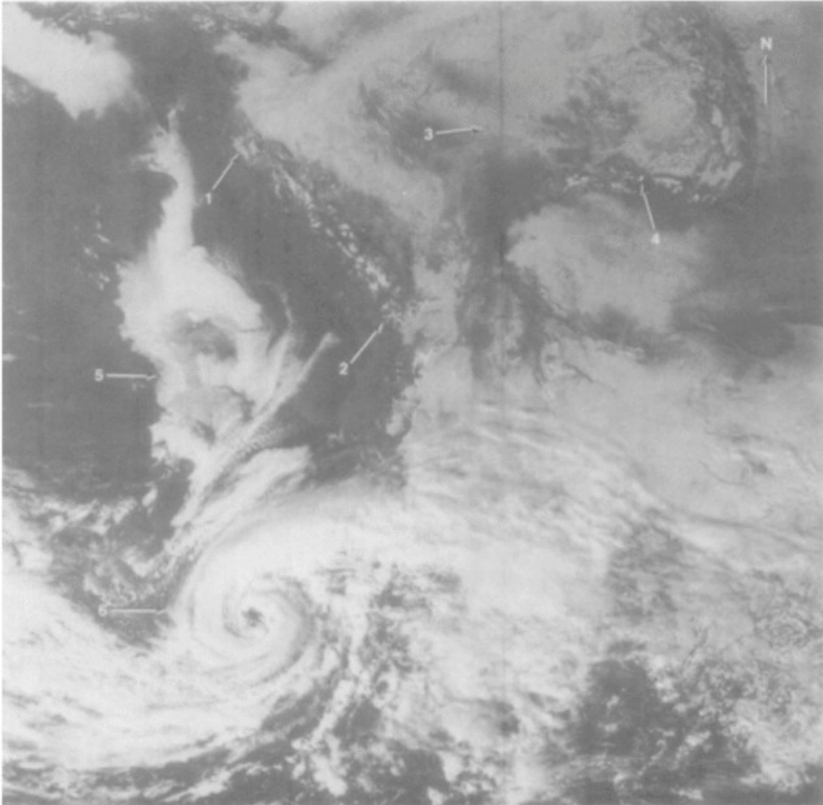


Fig. 1 NOAA-7 visible band satellite image of the eastern Mediterranean Sea area taken on 26 January 1982 at 1236 GMT. Resolution is 1-1 km. Numbered arrows are identified in the text

The “medicane” issue..

- Known “weather system” since long ago..
- Emanuel (2005) → “Medicane” concept
- Climatology based on phenomenological criteria (1-3 systems per year)
- Pluralism in the definition criteria (CPS diagnostics, winds speed criteria...)
- Much of systems defined as such (usually by the media)
- Operational implications...

- New definition paper

Miglietta M. M., González-Alemán J. J., Gaertner M. A., Panegrossi G., Pantillon F., Pasquero C.CP, Schultz D. M., D’Adderio L. P., Dafis S., Husson R., Ricchi A., Carrió D. S., Cavicchia L., Conte D., Davolio S., Ferretti R., Fita L., Flocas H., Gutiérrez-Fernández J., Hatzaki M., Homar Santaner V., Jansà A., Patlakas P., Picornell M. A., Pytharoulis I., Bernini L., Raveh-Rubin S., Scoccimarro E., Flaounas E.

“A medicane is a mesoscale cyclone that develops over the Mediterranean sea. A medicane displays tropical-like cyclone characteristics: a deep warm core, an eye-like feature in its center, a nearly windless center surrounded by symmetric maximum 10-m wind speed within a few tens of km afar”

→ **New ESA project “MEDICANES”**

Building a community...

Foundations:

Collaborative work

Networking:

Frequent meeting points

“Med-labelled” products: Export concepts / methods

Review paper

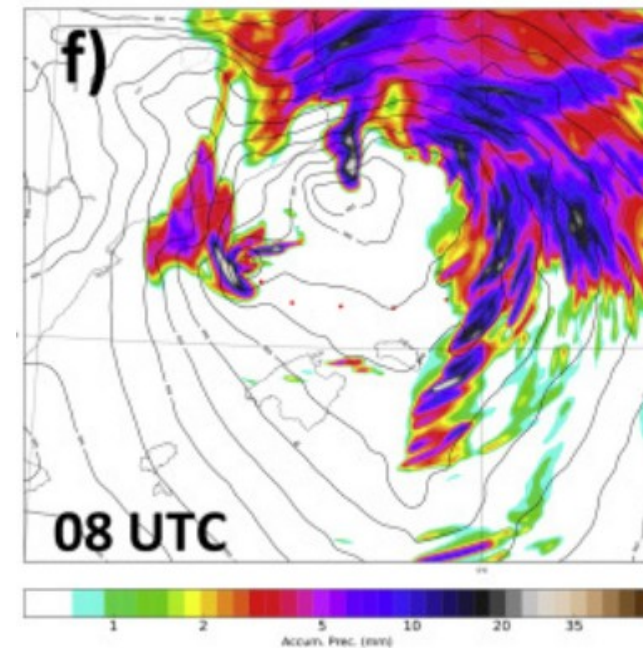
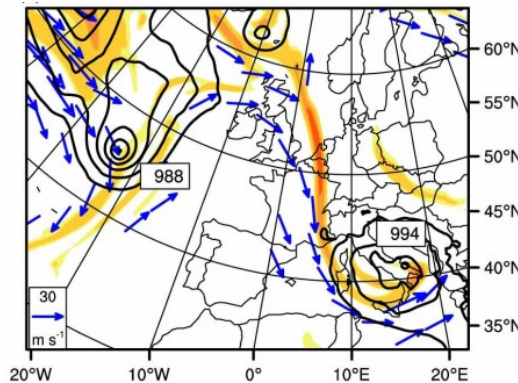
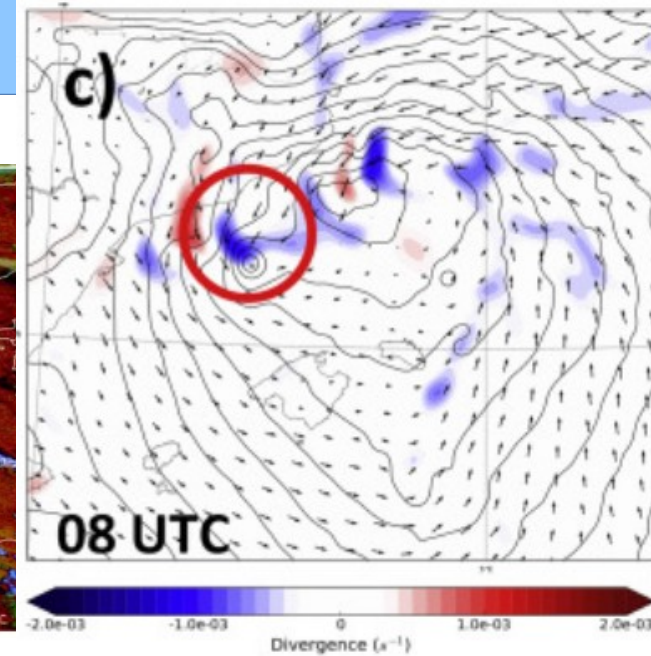
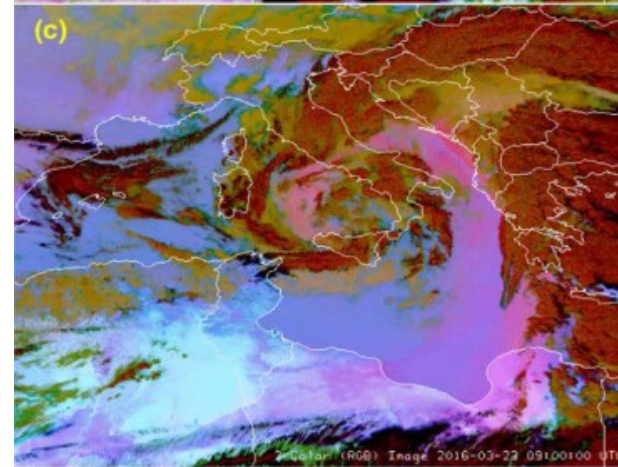
- Climatology
- Atmospheric dynamics
- Predictability
- Impacts

Research priorities

- 1) Disentangling Mediterranean cyclone dynamics across spatial scales
- 2) Identifying the specific characteristics of medicanes
- 3) Understanding coupled processes in Mediterranean cyclones
- 4) Solving resolution and parameterisation issues for cyclone modelling
- 5) Enhancing the use of observations and diagnostic tools
- 6) Reducing error and uncertainty in numerical weather prediction
- 7) Extending the scope of climatological studies for Mediterranean cyclones
- 8) Assessing the various impacts of Mediterranean cyclones
- 9)

Mediterranean cyclones: current knowledge and open questions on dynamics, prediction, climatology and impacts

Flaounas, E., Davolio, S., Raveh-Rubin, S., Pantillon, F., Miglietta, M. M., Gaertner, M. A., Hatzaki, M., Homar, V., Khodayar, S., Korres, G., Kotroni, V., Kushta, J., Reale, M., and Ricard, D.



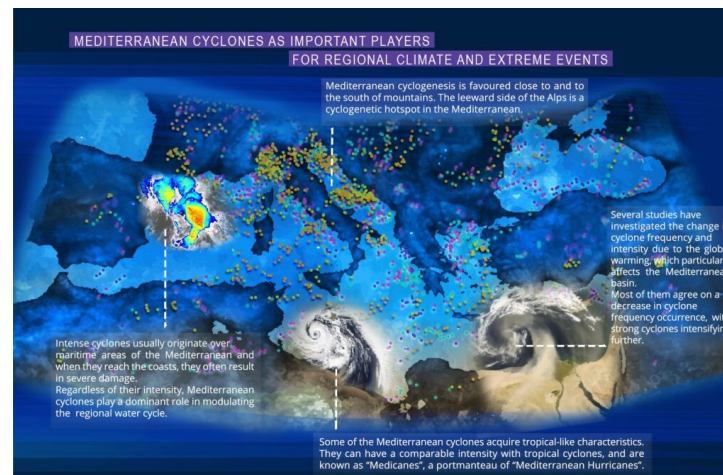
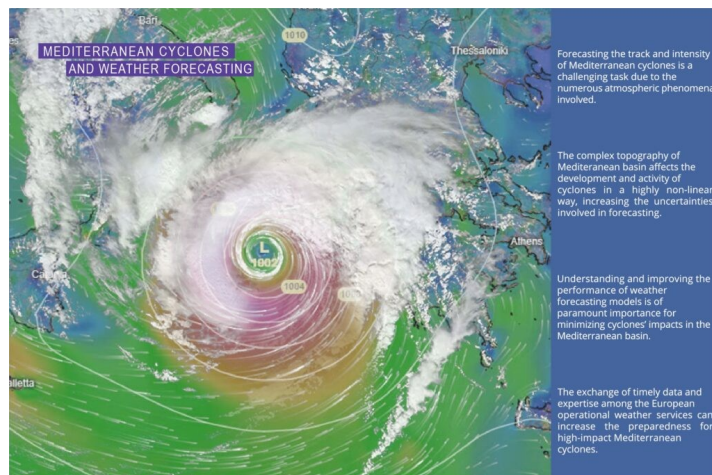
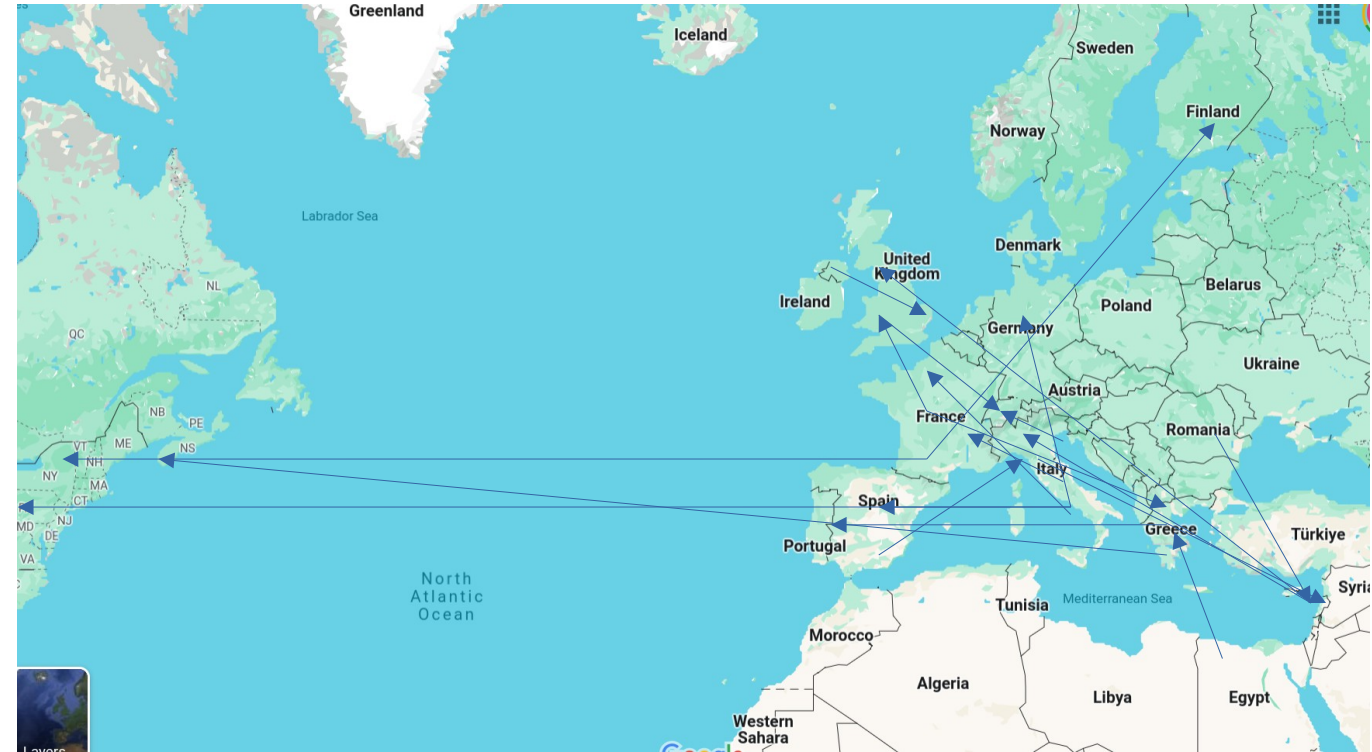
Last year of MedCyclones... (to end in November 2024)

Tasks to take care of..

- Finalize the forecast website
- Produce final communication material
- Publish last collective papers

Keep the community alive..

- Momentum of ongoing collaborations
- Collaboration with a new COST Action (FutureMed 2023-2027)
- Transition from what the weather will **BE** → **DO**
- Climate change / weather context
- MedCyclones will be part of the story...



Countless thanks to the core group



Core group

- Silvio Davolio (IT)
- Florian Pantillon (FR)
- Platon Patlakas (GR)
- Shira Raveh-Rubin (IS)
- Assaf Hochman (IS)
- Jonilda Kushta (CY)
- Samira Khodayar Pardo (ES)
- Margarida L. R. Liberato (PT)
- Stavros Dafis (FR)
- Maria Hatzaki (GR)
- .. me

Special Thanks for multiple teaching participation

- Suzanne L. Gray (UK)
- Jeniffer Catto (UK)
- Davide Faranda (FR)

