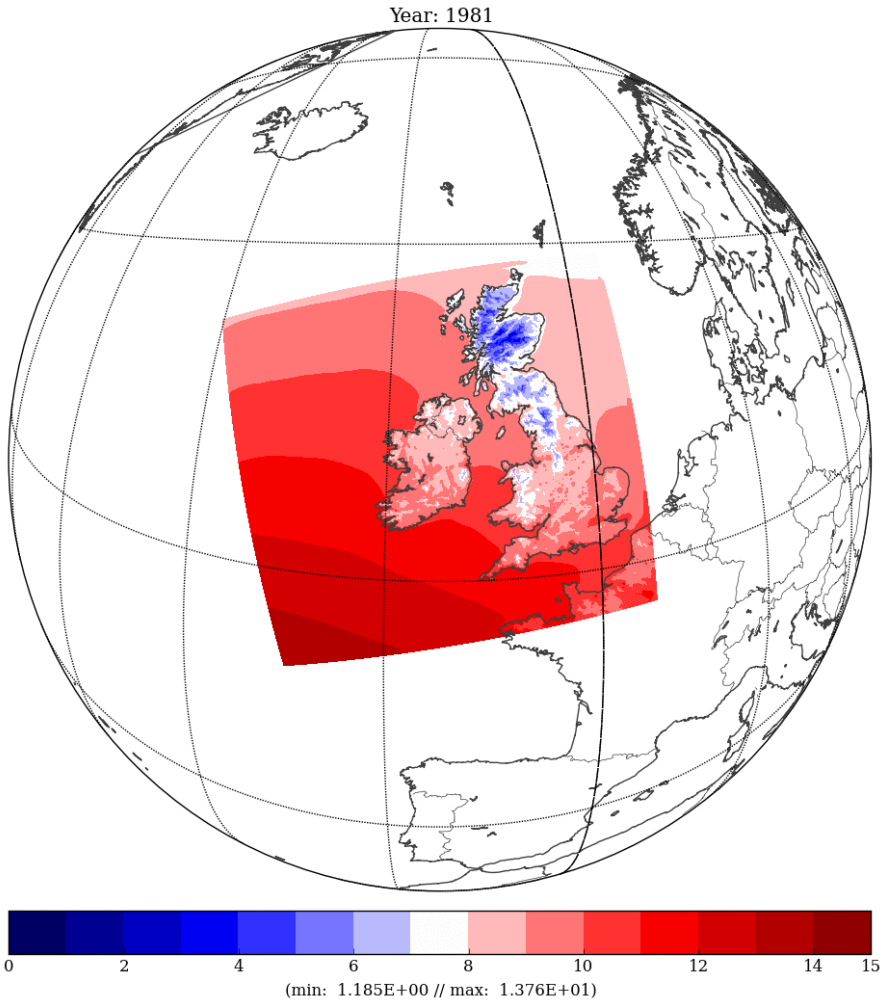
MÉRA Workshop

May 17th 2018

Dr Emily Gleeson, Met Éireann (emily.gleeson@met.ie)

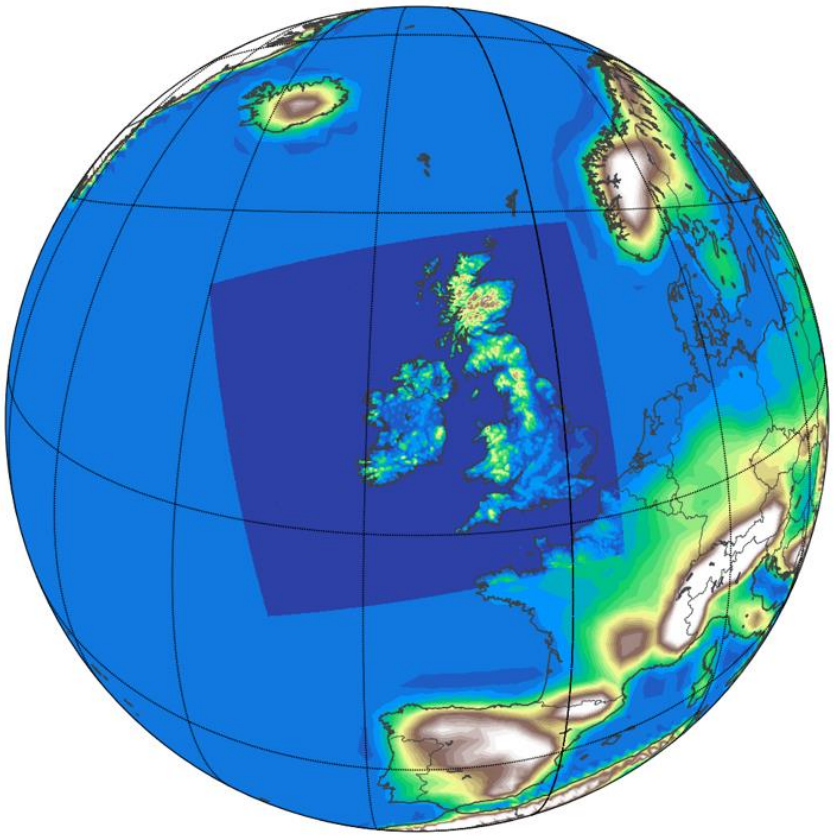
What is MÉRA?

- **M**et **É**ireann climate **R**e**A**nalysis.
- Used HARMONIE-AROME Numerical Weather Prediction system (forecast model, data assimilation system, conventional observations)
- From 1981 – 2017
- Currently at Sept. 2017 but will continue while ECMWF ERA-Interim boundaries are available
- > 900 TB data ~ 1.3 million audio CDs
- > 12.5 million computer hours



Advantages of MÉRA?

- Extend the knowledge gained from observations
- Parameters that are physically consistent and often not routinely observed
- Important for climate monitoring, climate services and adaptation
- Validation of the model



- To understand future climate and to be climate change ready, past weather and climate needs to be understood more comprehensively
- Highest resolution reanalysis dataset available for Ireland (2.5 km grid) – first of its kind in the world

Met Éireann

HARMONIE-AROME Configuration

Model version	HARMONIE-AROME 38h1.2
Domain	540 x 500 grid points (Δx =2.5 km)
Vertical levels	65 levels up to 10 hPa, first level at 12 m
Forecast cycle	3 hours
Data assimilation	Optimal interpolation for surface parameters 3DVAR assimilation for upper air parameters
Observations	Pressure from SYNOP, SHIP and DRIBU Temperature and winds from AIREP and AMDAR Winds from PILOT Temperature,winds and humidity from TEMP
Forecast	3 hour forecasts, but a 33-hour forecast at 00 Z

Met Éireann

Summary of Model Output

Level type	Parameters	Levels
Pressure	Temperature, wind, cloud, relative humidity, geopotential	100, 200, 300, 400, 500, 600, 700, 800, 850, 900, 925, 950, 1000 hPa
Height above ground	Temperature, wind, relative humidity	30, 50, 60, 70, 80, 90, 100, 125 150, 200, 300, 400 m
Sub-surface	Temperature, moisture, ice	0, 20, 300 cm (below the surface)
Surface	Radiative and non-radiative fluxes	Surface
Top of atmosphere	Radiative and non-radiative fluxes	Nominal top of atmosphere
Surface	Precipitation diagnostics	Surface
Diagnostic	Screen level parameters	2m, 10m for winds and gusts
Diagnostic	Other model diagnostic parameters	-

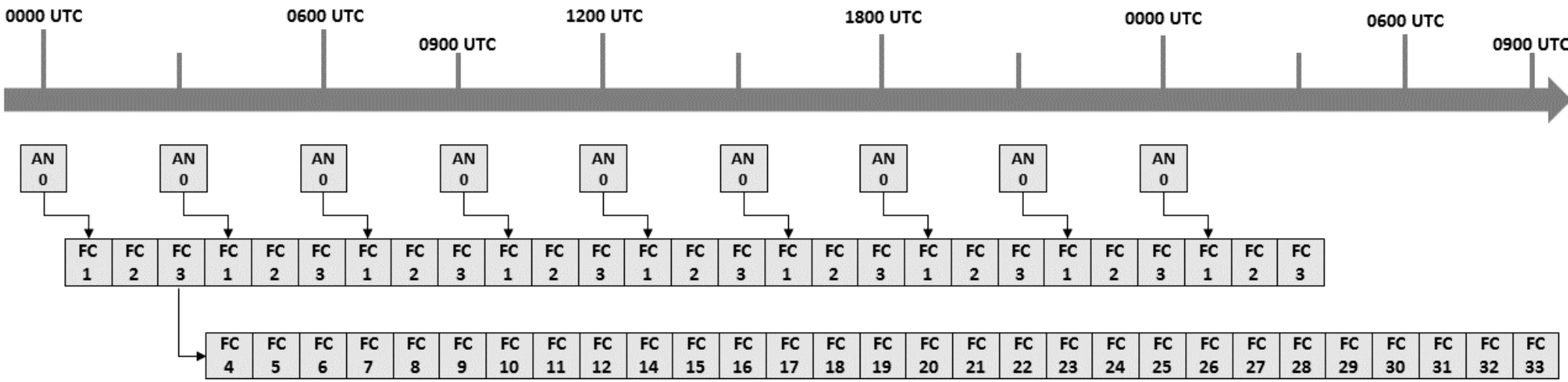
Variables available publicly

- Mean sea level pressure
- Surface pressure
- Temperature (2, 50, 70, 80,100,125, 200 m)
- Tmin & Tmax @ 2 m
- Relative humidity (2, 50, 70, 80, 100, 125, 200 m)
- U & V winds (10, 50,100,200 m)
- U & V 10 m gusts
- Precipitation
- Cloud cover (total, low, medium, high)
- Integrated cloud water , ice
- Global radiation (i.e. shortwave)
- Longwave radiation
- Net shortwave, net longwave
- Direct normal irradiance
- Soil moisture, soil temperature
- Mixed layer depth
- Snow depth
- Hail diagnostic

Sample files and other information available at:
https://www.met.ie/climate/available-data/mera

Interpreting the output files

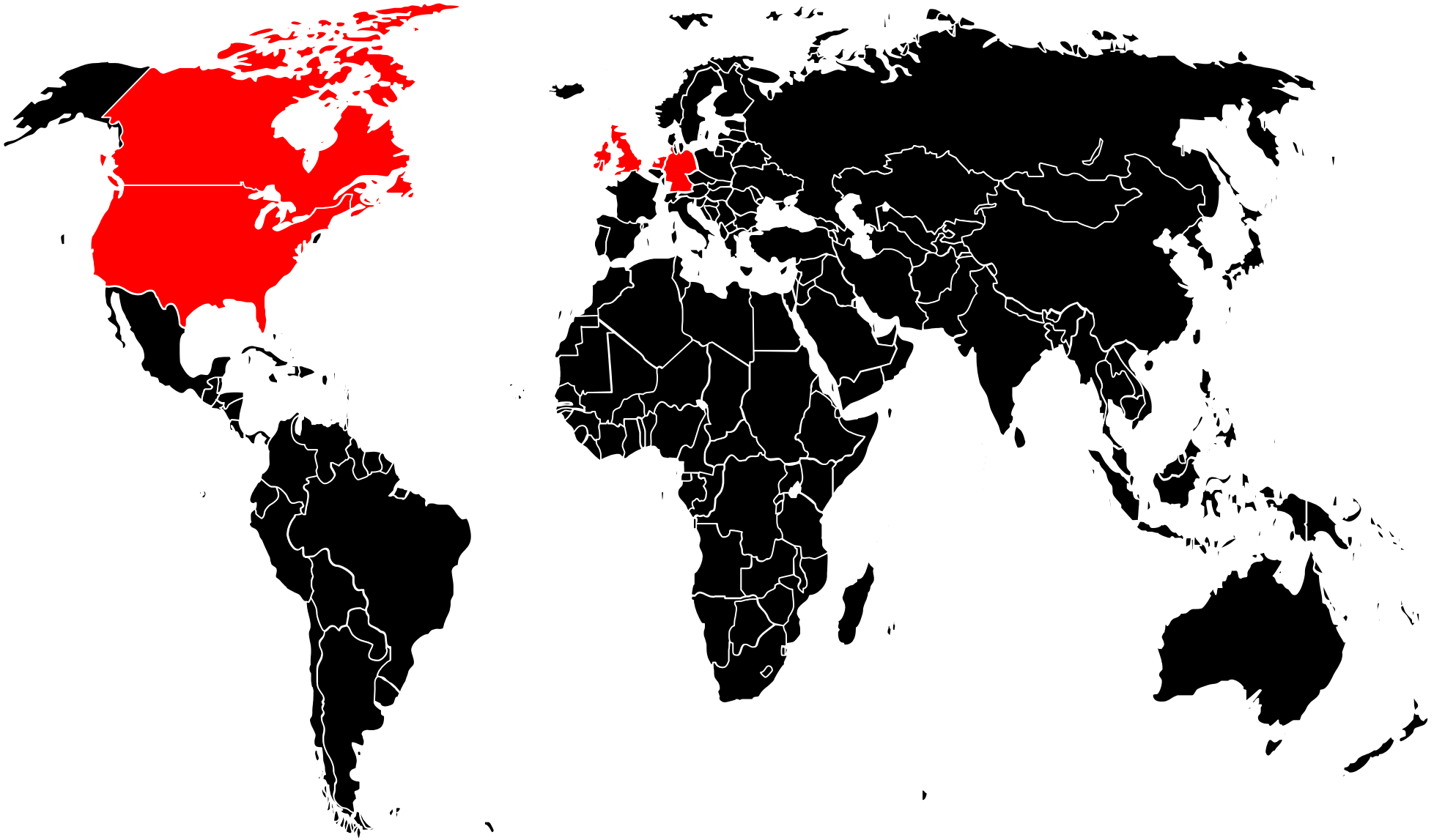
- Analysis files
- 3h
- 33hr



How to get the Data?

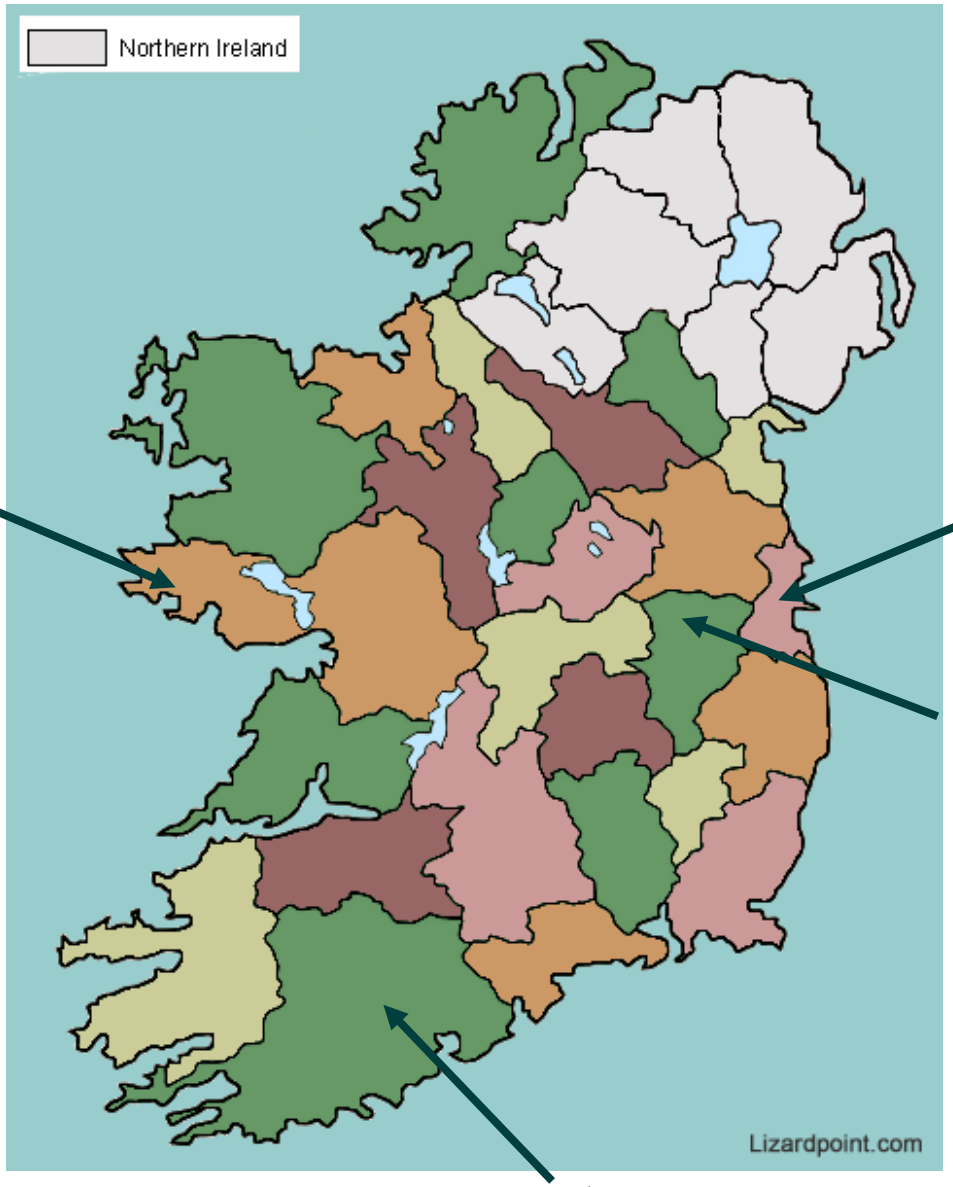
- e-mail mera@met.ie
- Drop in with an external hard drive and collect it.
- Or post us a hard drive and we will return it to you.
- Bear in mind it's approximately 500 GB per parameter for the full time-series

MÉRA Users



Met Éireann

MÉRA Users - Ireland



- ✓ GMIT
- ✓ ICHEC
- ✓ NUI Galway
- ✓ Marine Institute

- ✓ Dept. Agriculture, Food and the Marine
- ✓ Teagasc
- ✓ RPSgroup

- ✓ GSI
- ✓ UCD

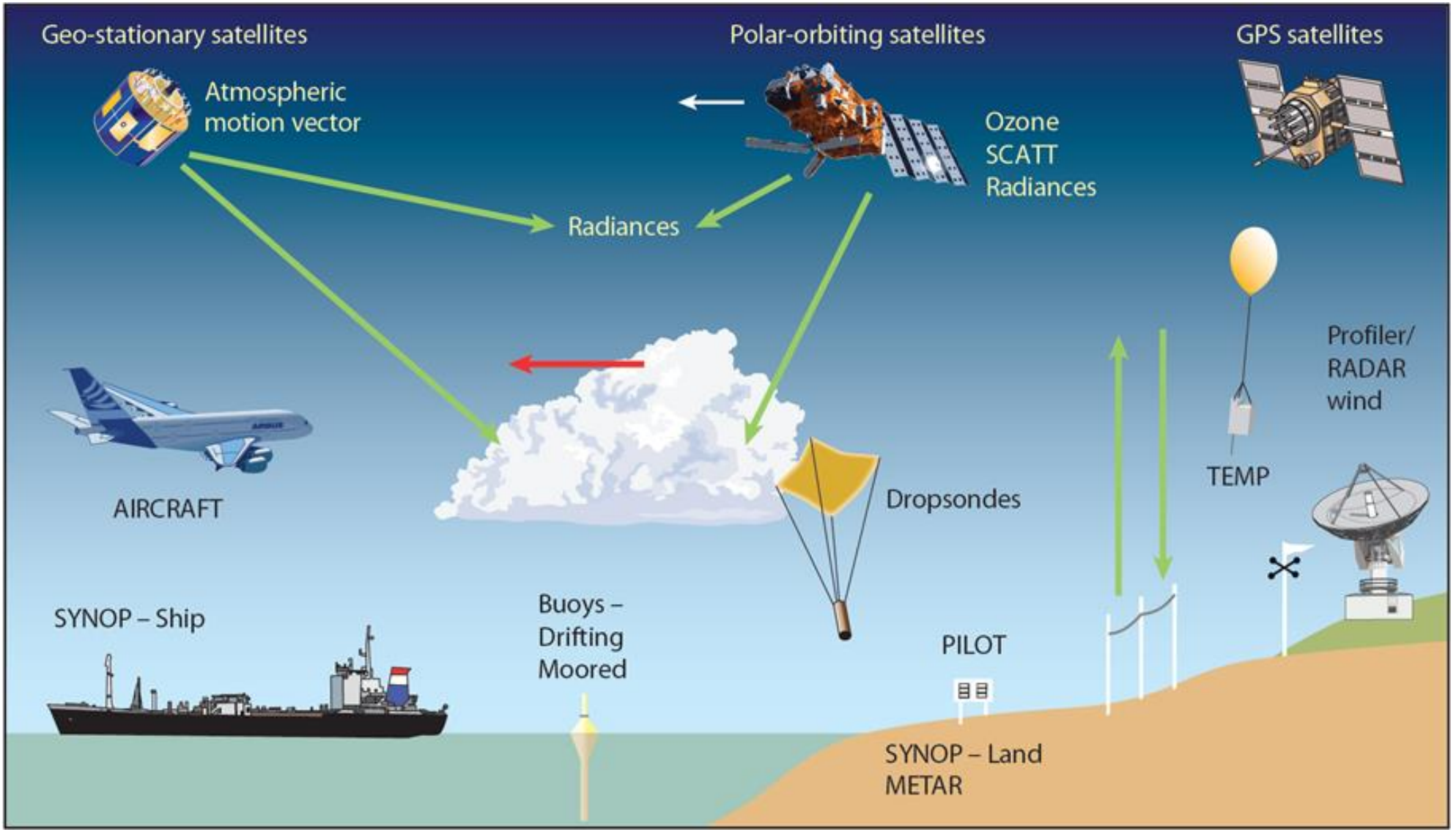
- ✓ Maynooth University

- ✓ UCC
- ✓ Blightlink

What's next for MÉRA

- Continue to run with ERA-Interim boundaries
- Will run tests with ERA-5 boundary data from ECMWF (~ 30 km grid)
- An Arctic Reanalysis, CARRA, is in preparation – also using HARMONIE-AROME but with greater use of observations.
- MÉRA can be tested with satellite and other observational data.
- Operationally we run a newer version of HARMONIE-AROME now over a larger domain

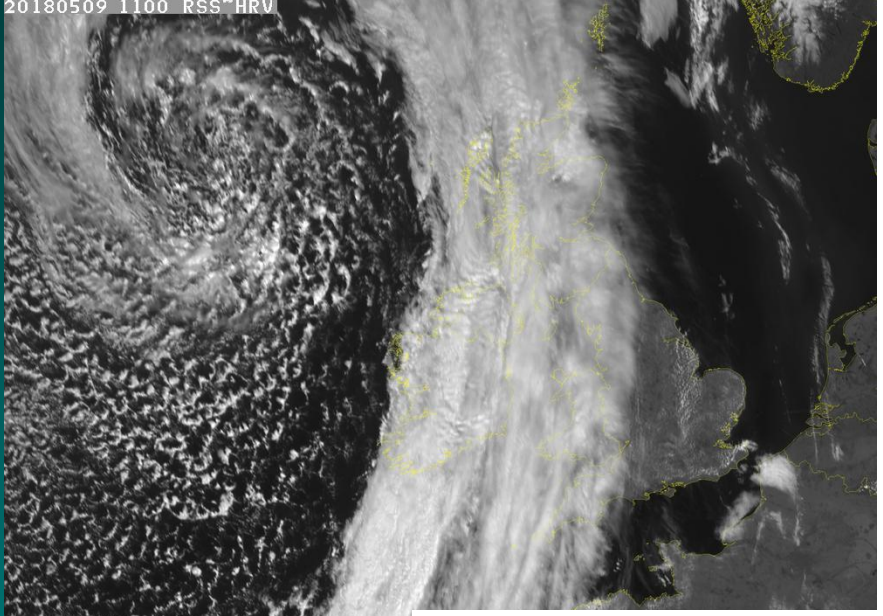
Met Éireann


Geo-stationary satellites
Atmospheric motion vector
Polar-orbiting satellites
Ozone
SCATT
Radiances
GPS satellites
Radiances
Profiler/
RADAR
wind
TEMP
AIRCRAFT
Dropsondes
SYNOP – Ship
Buoys –
Drifting
Moored
PILOT
SYNOP – Land
METAR

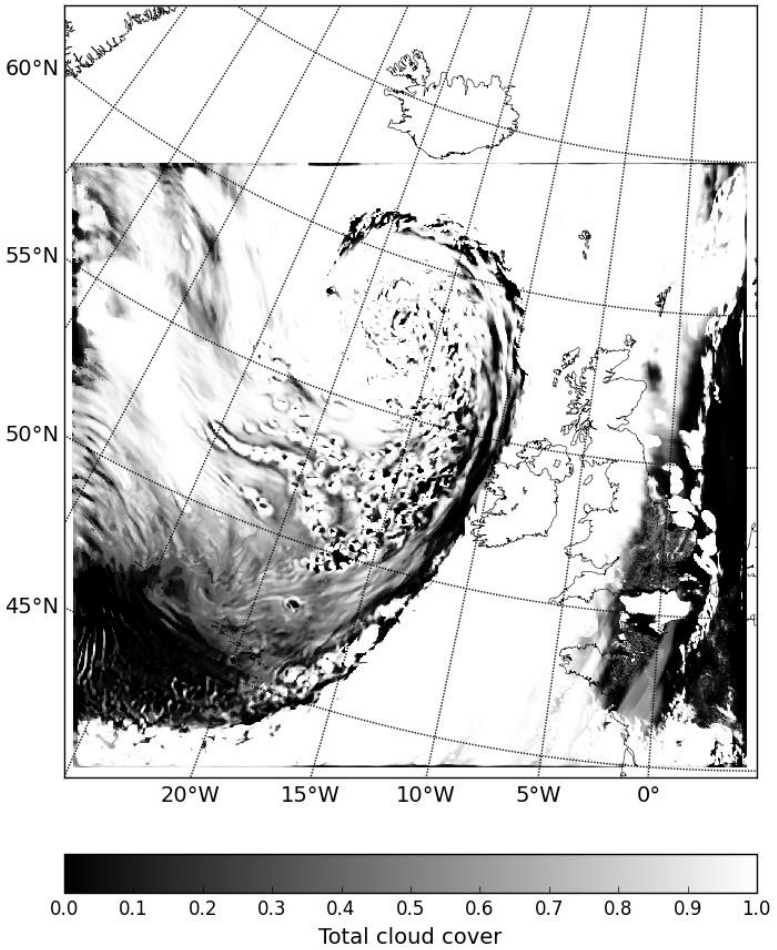
What's next for MÉRA

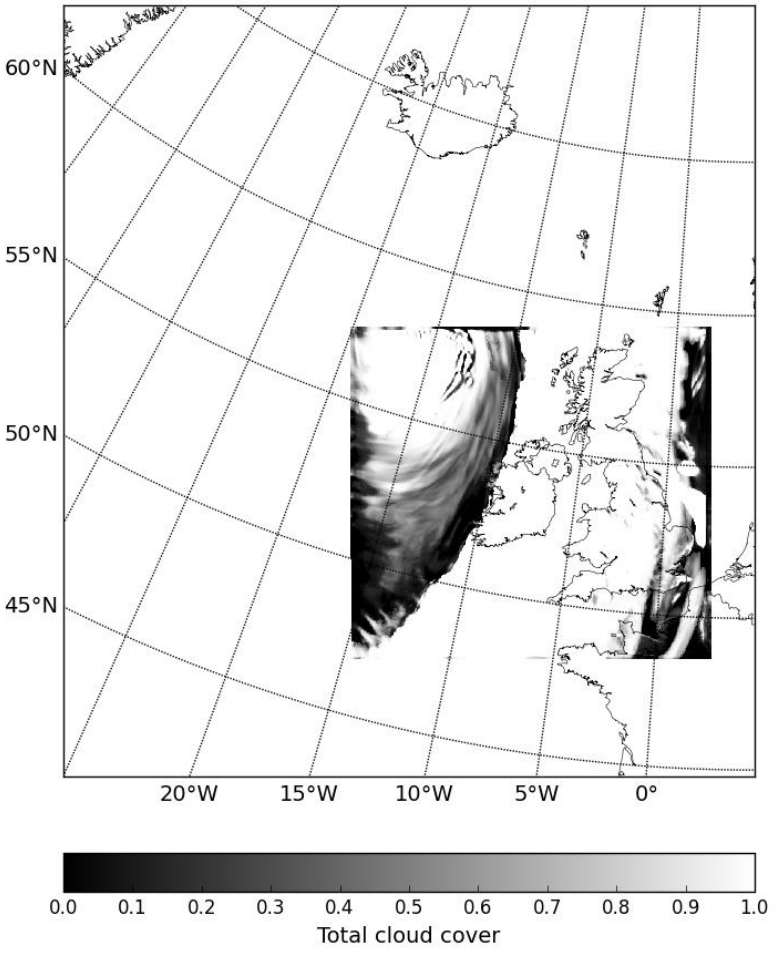
- Continue to run with ERA-Interim boundaries
- Will run tests with ERA-5 boundary data from ECMWF (~ 30 km grid)
- An Arctic Reanalysis, CARRA, is in preparation – also using HARMONIE-AROME but with greater use of observations.
- MÉRA can be tested with satellite and other observational data.
- Operationally we run a newer version of HARMONIE-AROME now over a larger domain

Met Éireann

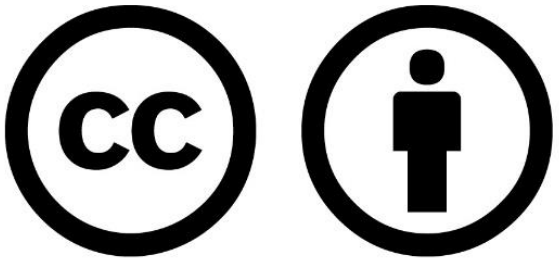


From Rónán Darcy, Met Éireann





CC BY 4.0



MÉRA Data Licence

- The data are available under the creative commons Attribution 4.0 International
- (CC BY 4.0) license: https://creativecommons.org/licenses/by/4.0/
- You are free to:

Share - copy and redistribute the material in any medium or format

Adapt - remix, transform, and build upon the material for any purpose, even commercially.

Attribution - You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

MÉRA Papers

- **Gleeson, E., Whelan, E., and Hanley, J.**: Met Éireann high resolution reanalysis for Ireland, Adv. Sci. Res., 14, 49-61, https://doi.org/10.5194/asr-14-49-2017, 2017.
- Nielsen, K.P.; **Gleeson, E.** Using Shortwave Radiation to Evaluate the HARMONIE-AROME Weather Model. Atmosphere 2018, 9, 163.
- **Whelan, E., Gleeson, E. and Hanley, J.,** An evaluation of MÉRA a high resolution mesoscale regional reanalysis, submitted to JAMC, 2018
- **Eoin Whelan, John Hanley, Emily Gleeson**, 'The MÉRA Data Archive', [report], Met Éireann, 2017-08-04, Met Éireann Technical Note, 65, 2017-08-04

Work commencing on:

- **Gleeson, E.,** Nielsen, K.P., Sweeney, C., Doddy, E., Amstrup, B. An Evaluation of Integrated Cloud Condensate in the HARMONIE-AROME NWP Model, EMS ASR
- **Zubiate., L., Gleeson, E., Whelan, E.** Characterisation of extreme wind speeds in a new high resolution reanalysis dataset for Ireland. EMS ASR

- **Over 30% of the global economy is weather and climate dependent**
- MÉRA dataset has uses in energy management, food and agriculture, fisheries, weather insurance, planning, and coastal and flooding risk management which will result in positive socio-economic impacts

MÉRA Workshop

- Launched the dataset on May 26th 2017
- This is our first workshop for users
- 4 sessions – 15 talks
- Deadline for submitting extended abstracts for publication: **end of June 2018**

  - Please use the templates sent by Eoin Whelan via e-mail