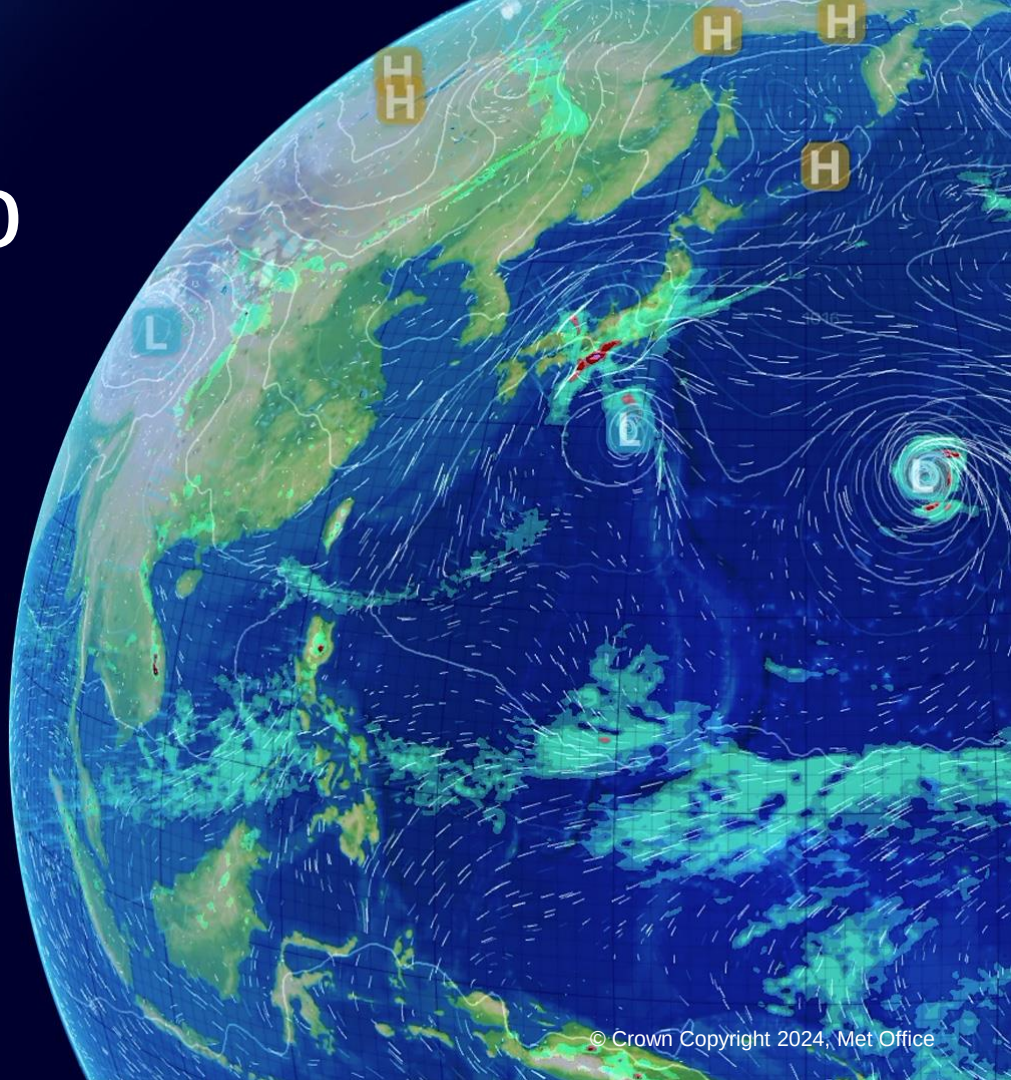
Using spectrum to support resilience and sustainability

Kirsty McBeath, Spectrum Policy Manager

2 May 2024



What does the Met Office do?

Met Office


Met Office
Public

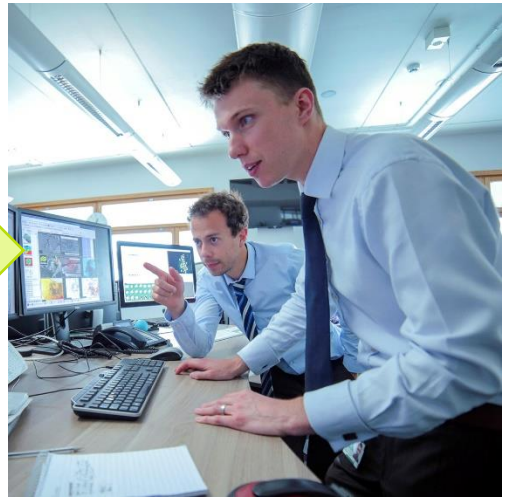

Met Office
Government


Met Office
Business

Weather forecast process

Observations

Modelling & Computing



Meteorologists

How we use Spectrum in the Met Office

Passive Sensing
(EESS (passive))

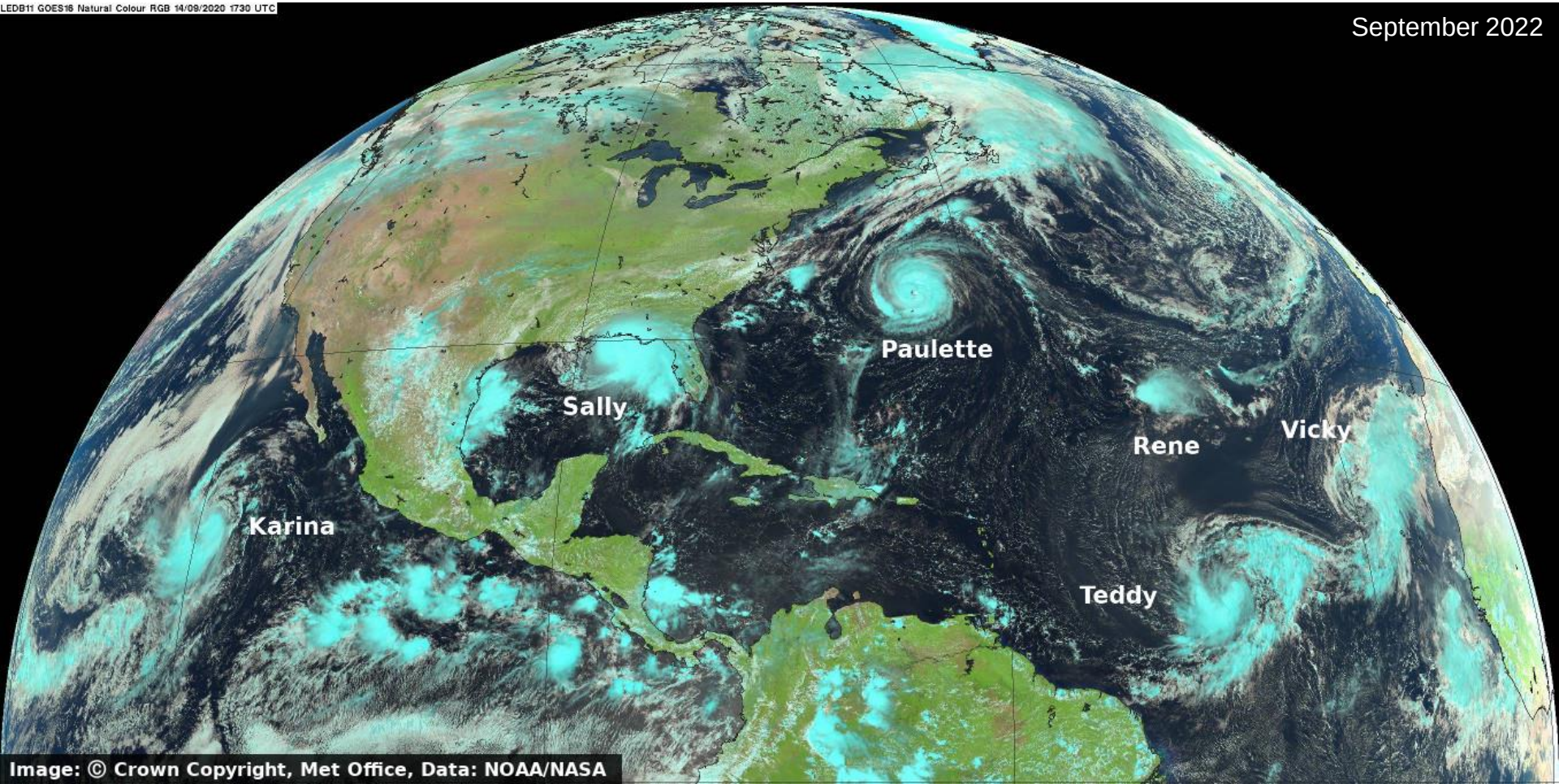
Active Sensing
(EESS (active))

Communications
(MetAids/MetSat/FSS)

Passive Sensing

Image of MetOp satellite, credit: ESA /AOES Medialab

Met Office


LEDB11 GOES16 Natural Colour RGB 14/09/2020 1730 UTC
September 2022
Paulette
Sally
Rene
Vicky
Karina
Teddy
Image: © Crown Copyright, Met Office, Data: NOAA/NASA

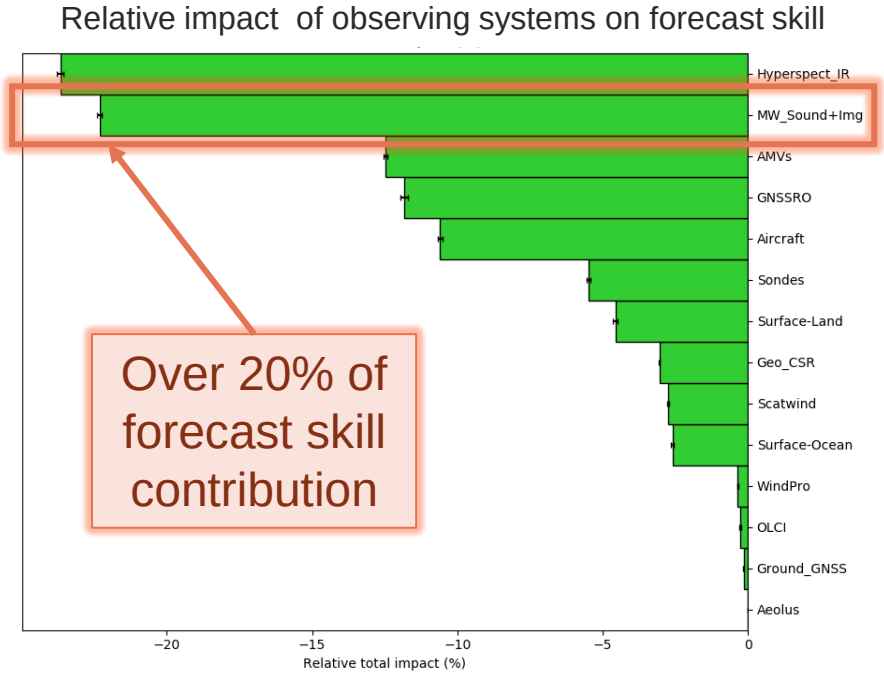
Passive remote sensing

Passive sensing uses highly sensitive instruments to measure differences in microwave radiation emitted by the Earth and atmosphere.

These signals are used to calculate temperature and humidity through the atmosphere. They provide valuable data over remote regions in a range of conditions.

Passive microwave sensing data make the 2nd largest contribution of any observing system to Met Office forecast skill.

In addition to supporting weather forecasts, satellites provide information about essential climate variables.



Bands being actively used or prepared for by NWP centres (green = protected by RR5.340, blue = EESS in Radio Regulations, Red = No protection)

Frequency GHz	*Instruments*	*Application area*
1.4-1.427	SMOS (ESA), SMAP (NASA), Aquarius (NASA) , CIMR (ESA)	Soil moisture, salinity, thin sea ice
6.425-7.25	AMSR-2 (JAXA) , CIMR (ESA)	SST
10.6-10.68 10.68-10.7	AMSR-2 (JAXA), GMI (NASA), MWRI (CMA) , CIMR (ESA)	Heavy Precipitation
18.6-18.8	AMSR-2 (JAXA), GMI (NASA), AMR (NOAA), MWRI (CMA) , CIMR (ESA) , MWI (EUMETSAT)	Ocean near surface wind,
23.6-24	AMSU-A (NOAA/EUMETSAT), ATMS (NOAA), SSMIS (DOD), GMI (NASA), AMR (NOAA), MTVZA-GY (Roscosmos), MWRI (CMA), MWS+I (EUMETSAT), AMSR-2 (JAXA)	Total column water vapour
31.3-31.8	AMSU-A (NOAA/EUMETSAT), ATMS (NOAA), GMI (NASA), MTVZA-GY (Roscosmos), MWS+I (EUMETSAT)	Total column cloud liquid
36-37	SSMIS (DOD), GMI (NASA), AMSR-2 (JAXA), MWRI (CMA), CIMR (ESA)	Liquid water path and cloud detection on GMI
50.2-50.4 52.6-54.25 54.25-59.3 59.3-59.5 60.40-61.15 63-63.5	AMSU-A (NOAA/EUMETSAT), ATMS (NOAA), SSMIS (DOD), MWTS-2 (CMA), MTVZA-GY (Roscosmos), MWS (EUMETSAT)	Temperature profile
86-92	AMSU-A (NOAA/EUMETSAT), ATMS (NOAA), SSMIS (DOD), MWHS-2 (CMA), MTVZA-GY (Roscosmos), MWRI (CMA), MWS (EUMETSAT), AMSR-2 (JAXA)	Precipitation
100-102 109.5-111.8 114.25-116 116-122.25	MWHS-2 (CMA), TROPICS (NASA), MWI (EUMETSAT)	Temperature profile, cloud
148.5-151.5 155.5-158.5 164-167	ATMS (NOAA), GMI (NASA), MHS (EUMETSAT), MWHS-2 (CMA), MTVZA-GY (Roscosmos), SSMIS (DOD) , MWS+I (EUMETSAT)	Precipitation, water vapour
174.8-182.0 182-185 185.0-190.0 190.0- 191.8	AMSU-B (NOAA), MHS (EUMETSAT), ATMS (NOAA), SSMIS (DOD), MWHS-2 (CMA), GMI (NASA), SAPHIR (CNES-ISRO), TROPICS (NASA), MTVZA-GY (Roscosmos), MWS+I (EUMETSAT)	Water vapour
200-209 226-231.5	TROPICS (NASA), MWS (EUMETSAT)	Ice cloud

Active Sensing

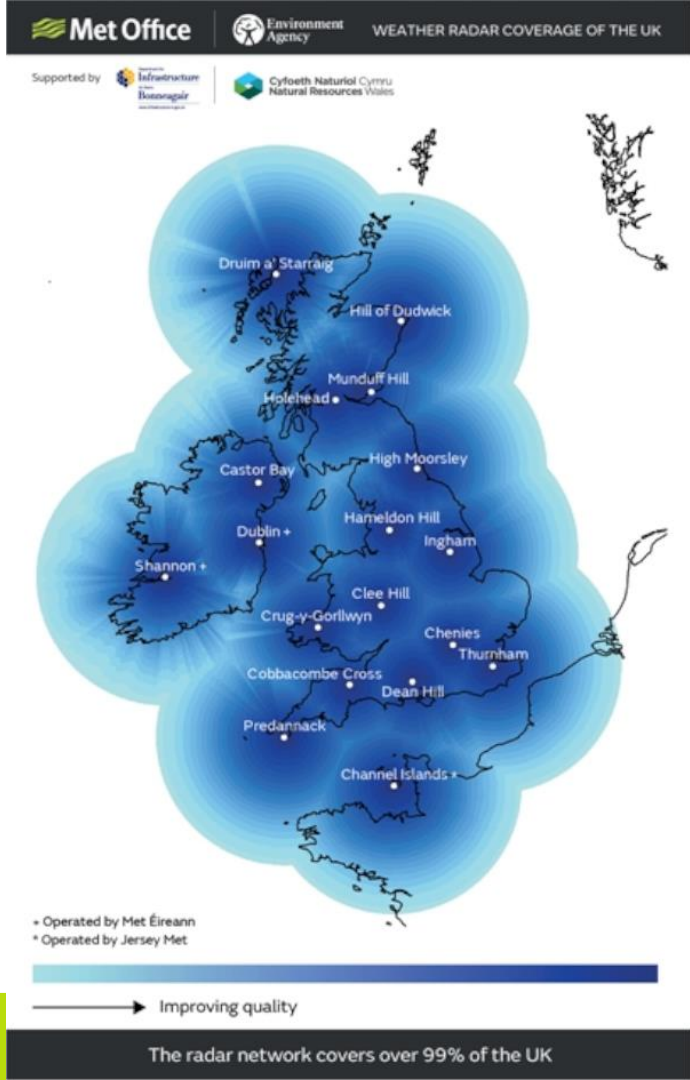
Met Office

Active remote sensing

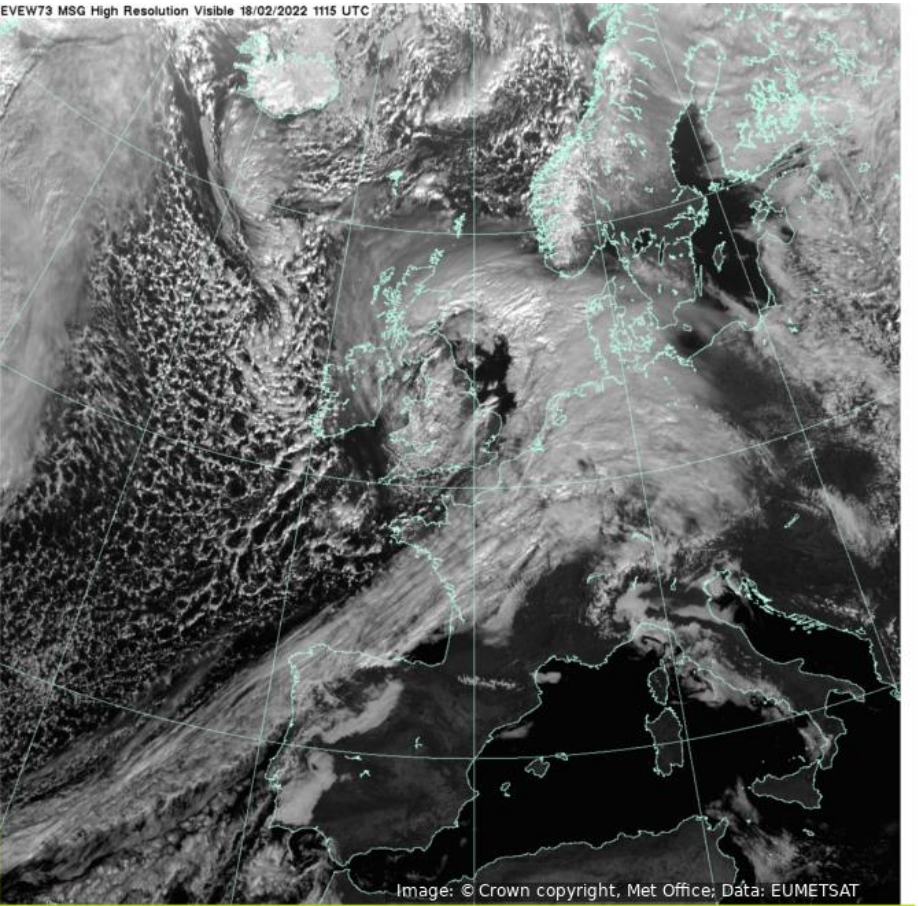
The Met Office weather radar network provides coverage across the UK.

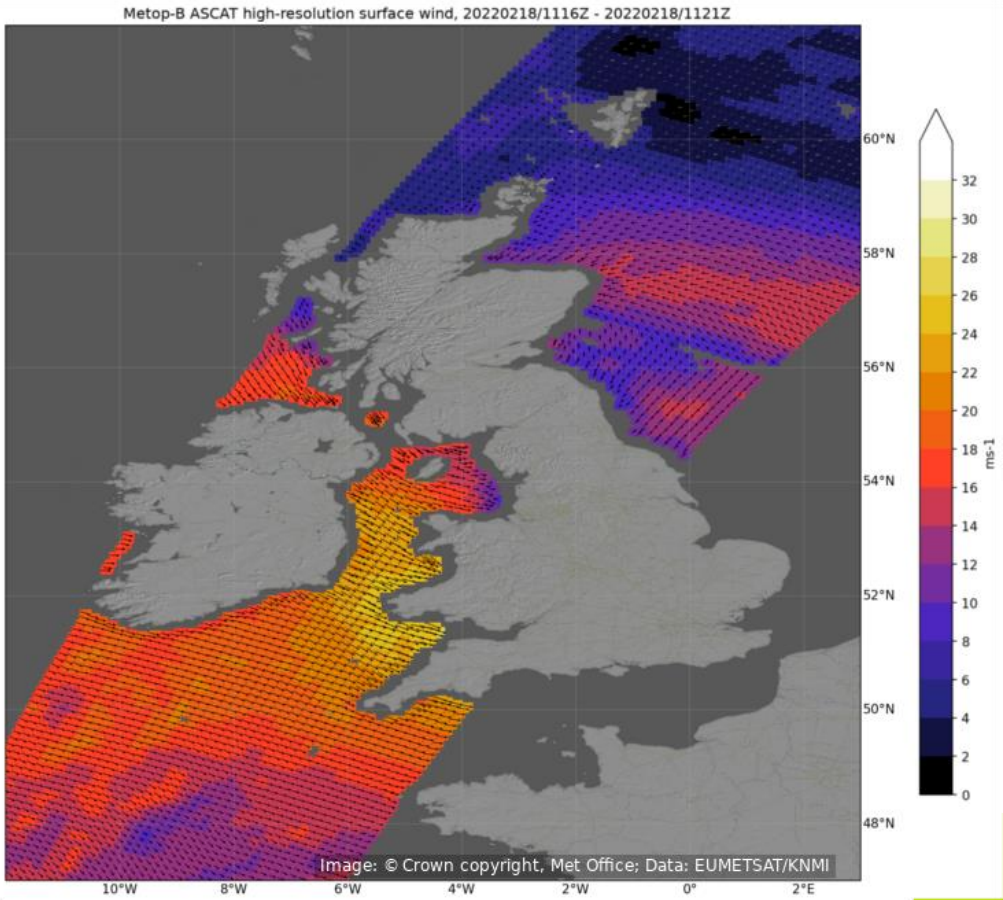
The network uses 5.6-5.65 GHz (C-band) to detect rain, snow and hail. This information is especially valuable for flood prediction.

We have also used X-band radar (8-12 GHz) as part of our support for specific events.

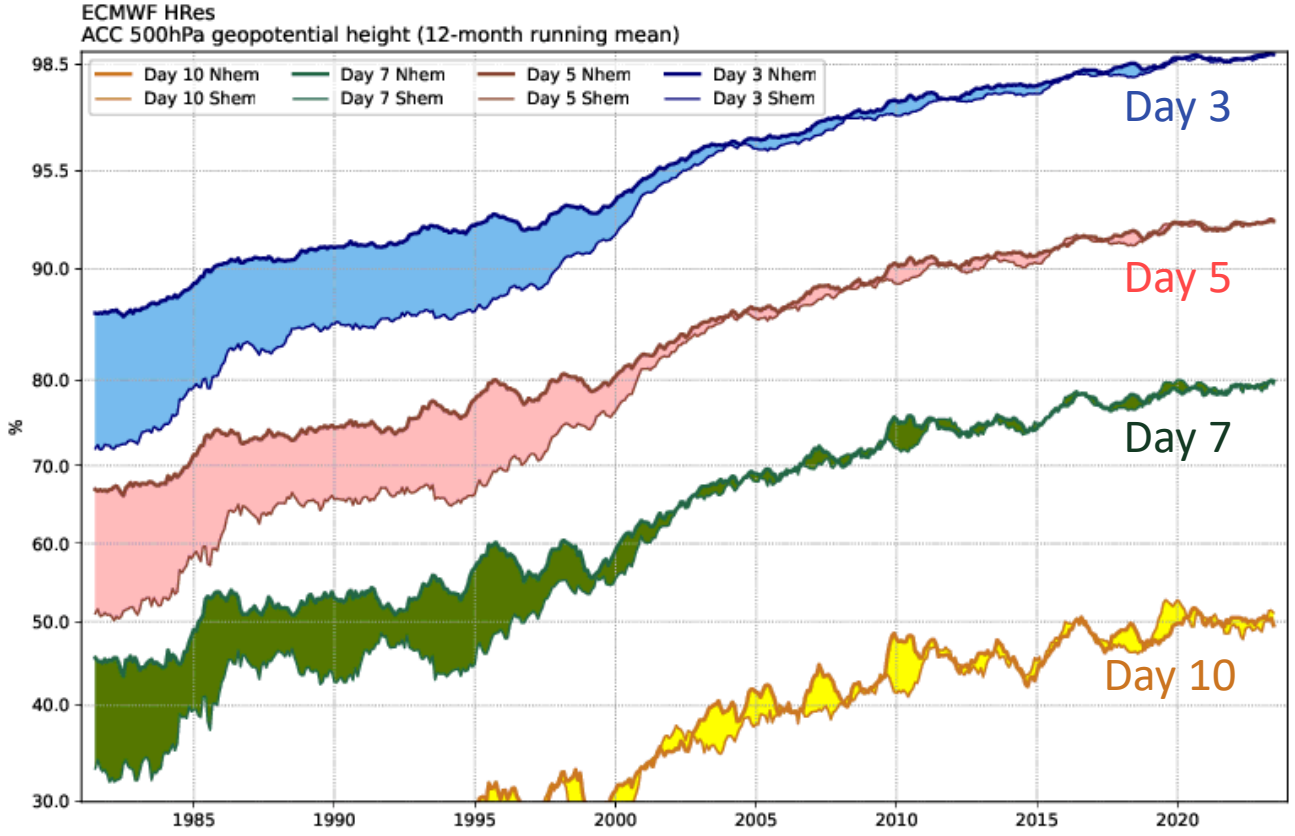


Space-based active remote sensing





Weather forecast skill in the satellite era



Forecast skill has improved by 1 day per decade.

Improvement is greatest in Southern hemisphere, where skill was very low before the satellite era.

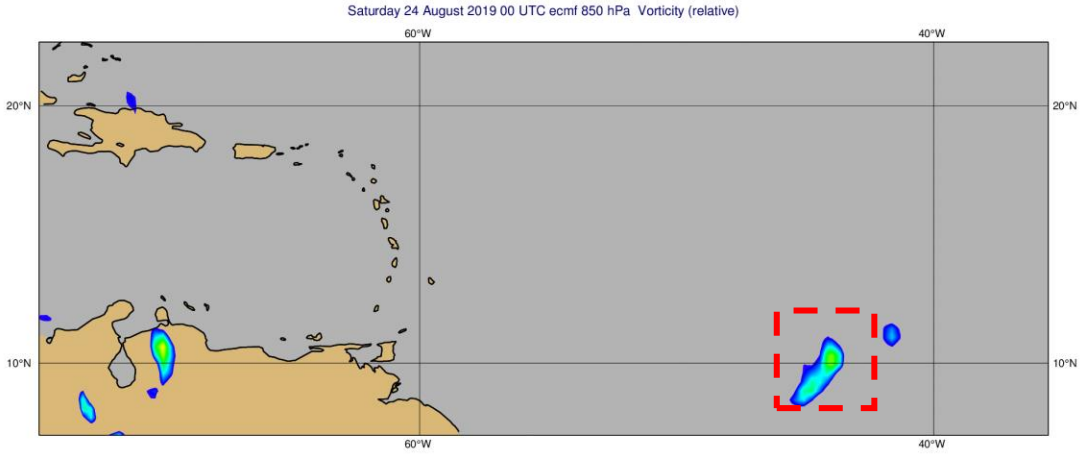
ECMWF
EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

Met Office

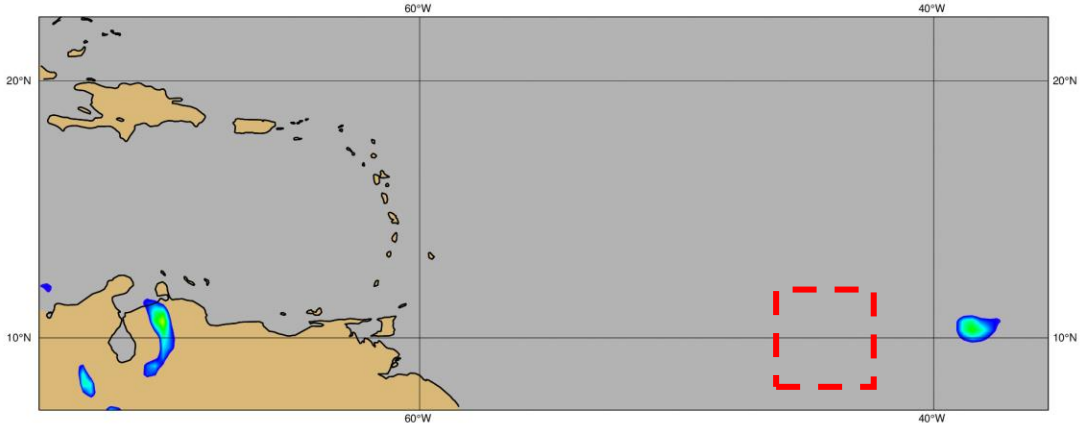
What happens if we don't have satellite observations?

Hurricane Dorian August 2019

Control system with satellites identifies storm genesis on 24 August and provides **4 days warning** of direct strike on Windward Islands



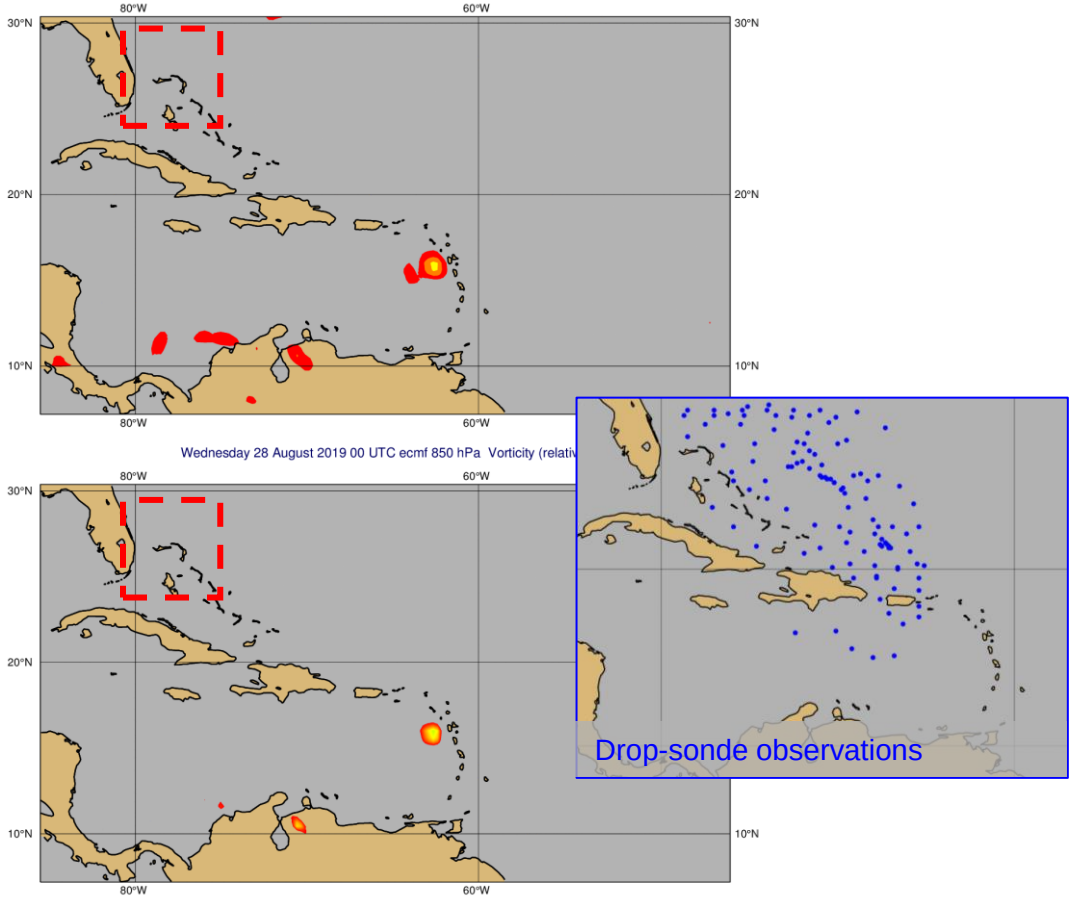
System with satellites denied for 36hrs prior to forecast misses the storm genesis and provides no warning of strike on Windward Islands



Hurricane Dorian August 2019

Control system with satellites correctly predicts the storm's transition to landfall on the Bahamas 4 days later

System with satellites denied wrongly predicts a near miss for the Bahamas, despite the availability of extensive drop-sonde observations.



Communications

Communications

Observation data needs to be shared quickly to provide the starting conditions for our computer simulations.

Late data won't be included in the forecast

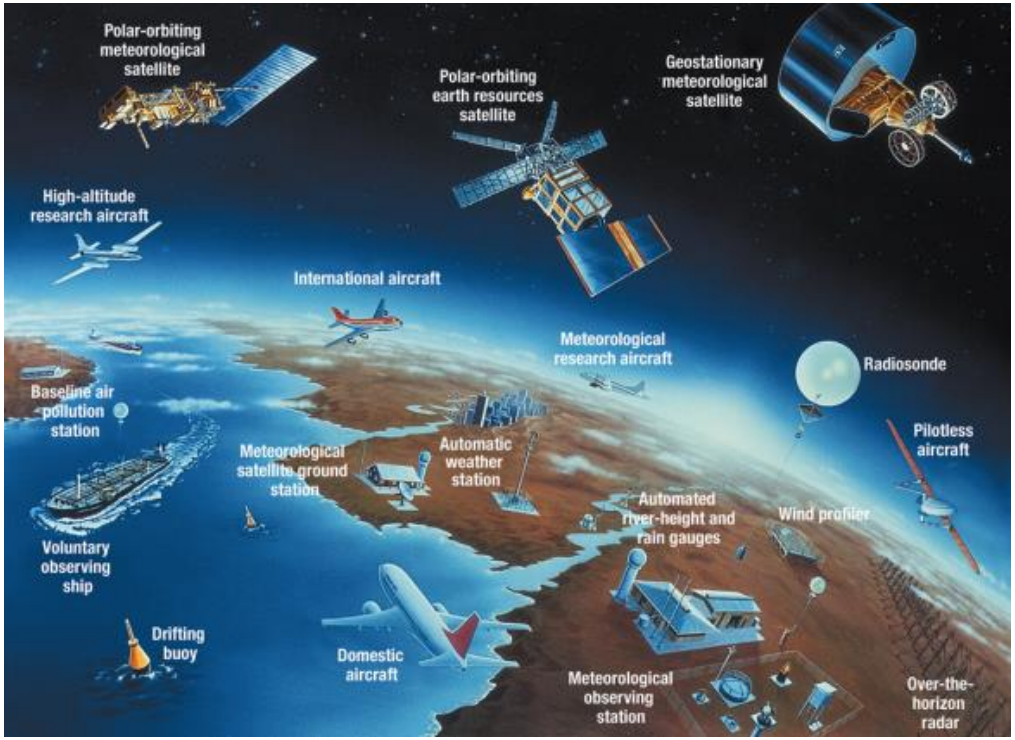


Image credit: WMO

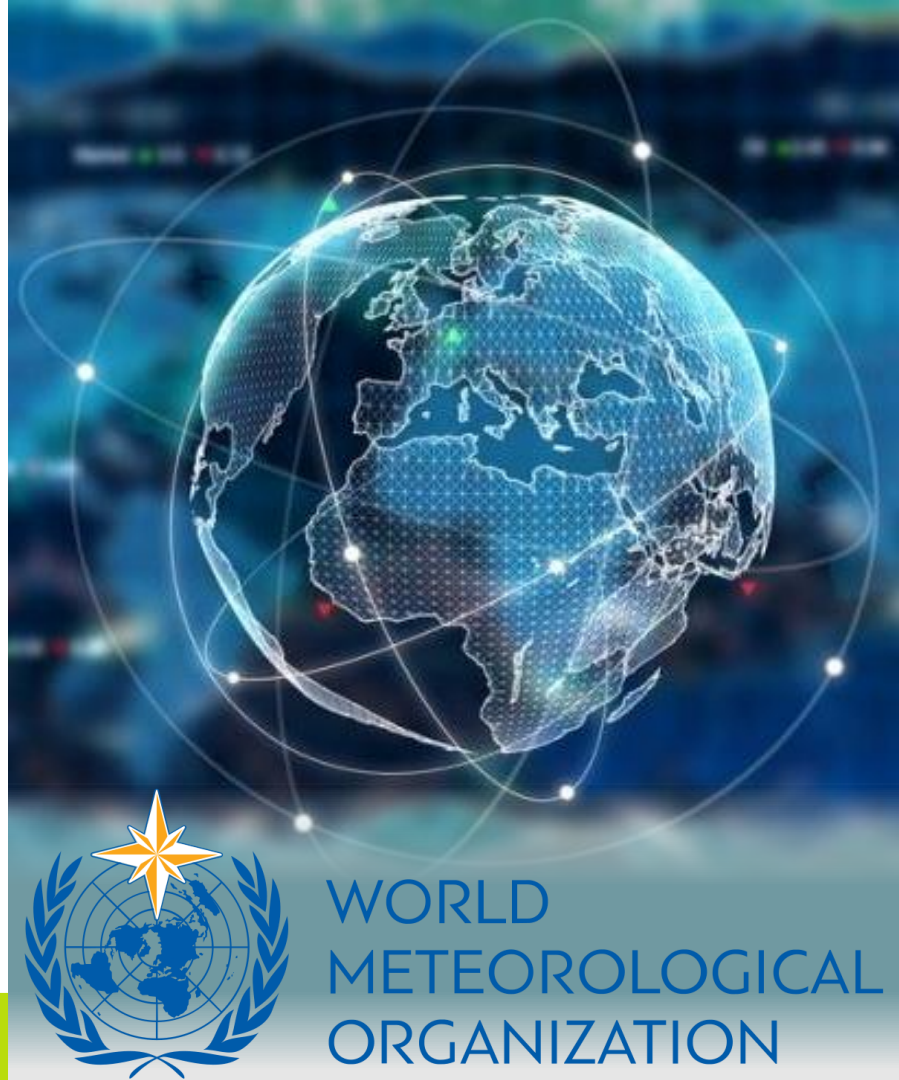
Met Office

Communications

Weather prediction beyond 3-4 days for any location on the globe requires exchange of observations world-wide.

The Met Office exchange weather observations with international partners and customers.

We represent the UK in the World Meteorological Organization and EUMETSAT



Met Office

Met Office Spectrum Priorities for WRC-27

Protecting existing usage

(Agenda Items 1.7 and 1.13)

Space Weather

(Agenda Item 1.17)

Protection of passive sensors in bands over 76 GHz

(Agenda Item 1.18)

Image credit: ESA /AOES Medialab

Sea Surface Temperature Measurements

(Agenda Item 1.19)

Image Credit: EUMETSAT/ NOAA


Met Office
Helping you make better decisions
to stay safe and thrive

Questions

For more information please contact


www.metoffice.gov.uk


kirsty.mcbeath@metoffice.gov.uk


Kirsty McBeath | LinkedIn