



Australian VLab Centre of Excellence Regional Focus Group meeting 22nd January 2026

Resources from the presentation "A summary of the use of Artificial Intelligence (AI) in Satellite Meteorology as presented at Australian VLab CoE Regional Focus Group meetings during 2025".

Bodo Zeschke,
Bureau of Meteorology Training Centre
Australian VLab Centre of Excellence



Contents

1. AI presentations and information during AOMSUC-14 and 15
2. Using AI to predict convective hazards: the ProbSevere products
3. Familiarisation with near real time LightningCast data over the southern Pacific Ocean, from the SSEC Real Earth web page.
4. Examining the AIFS ECMWF forecasts on the ECMWF web page. Also, the MIMIC TPW and JAXA GSMap forecasts.
5. Instructions for rendering the AIFS ECMWF forecasts, with "future forecasts" that can be verified.





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AOMSUC-15 Conference Presentations: AI in Satellite Meteorology

Including useful web links

Direct observation prediction: AI-DOP

- Can we learn ML forecasts directly from observations?

AI-DOP. Utilising AI and Machine Learning to produce weather forecasts directly from observations

<https://www.ecmwf.int/en/newsletter/182/earth-system-science/update-ai-dop-skilful-weather-forecasts-produced-directly>

AOMSUC-15 FYSUC-2025

5. Opportunities in AI & Other Emerging Technologies

"AI-STORMVIS" using

AI-STORMVIS, which uses AI to automatically analyse Tropical Cyclone position and intensity

https://www.typhooncommittee.org/19IWS/docs/Technical%20Presentations/4.%20IWS19_2024_TechnicalPresentation_Hong_Kong_China_v1.pdf

Applications of Data-driven AI models

- At CMA, several **data-driven weather forecasting models including Fengqing** have been implemented. These models are now real-time providing forecasts and directly integrated into operational platform for use by forecasters.
- High-resolution Monitoring: Utilizes satellite, surface station, and gridded analysis data to support global weather monitoring.

CMA's Feng Series AI Model Matrix

http://www.nsmc.org.cn/conference/fysuc/assets/ppt/session6_03_GONG_Yu.pdf

Satellite Image Sequence Prediction

- Motivation 1: The blurry issue

CMA's Multiscale Time Conditioning Generative Adversarial Network for long-term satellite image sequence prediction (MSTCGAN).

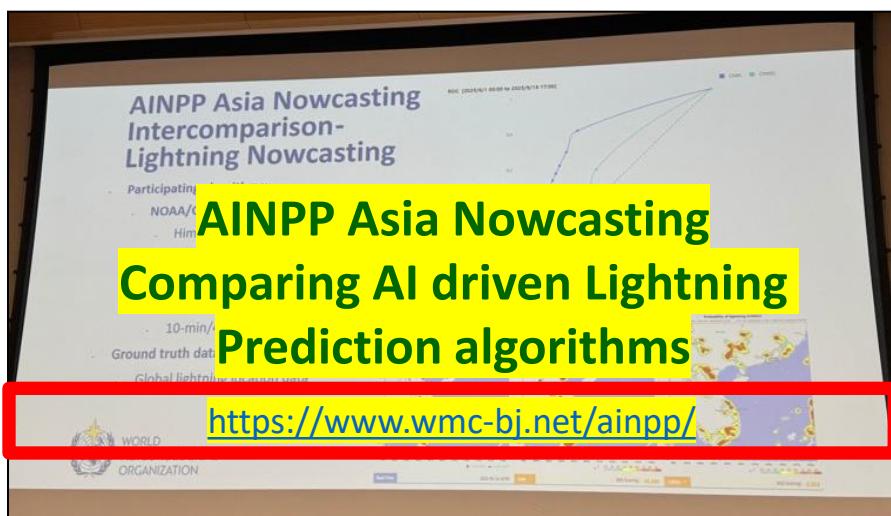
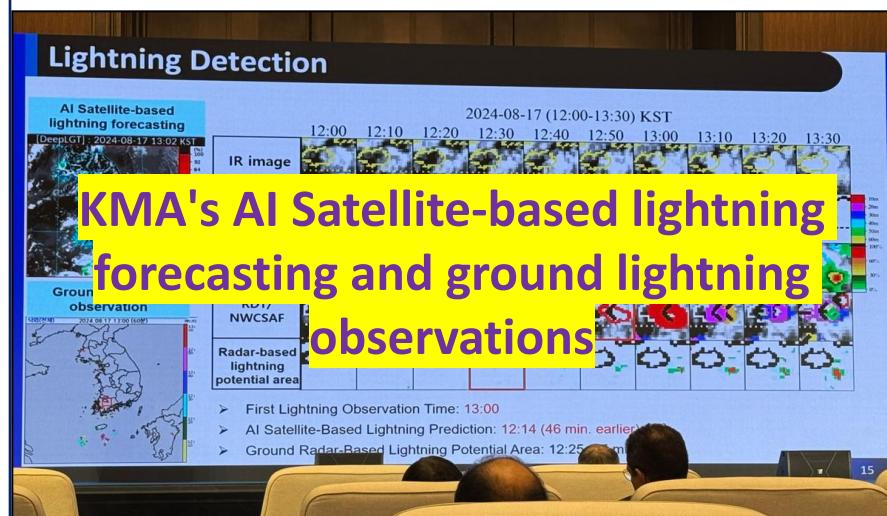
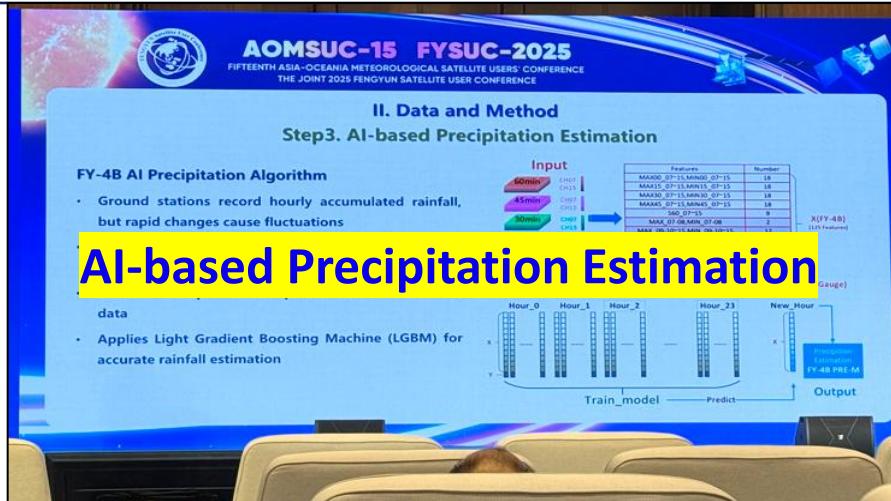
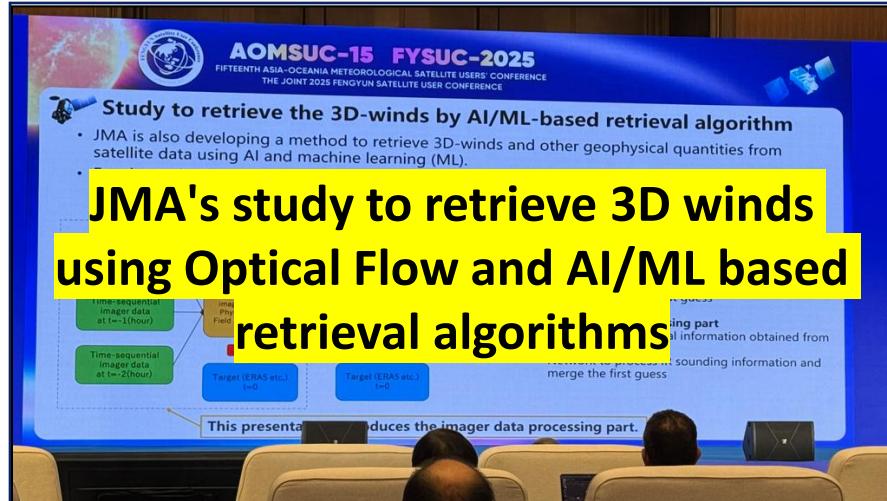
<https://ieeexplore.ieee.org/abstract/document/9791392>





AOMSUC-15 Conference Presentations: AI in Satellite Meteorology

Including a useful web link





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Using AI to predict convective hazards: the ProbSevere products

March 2025 RFG meeting.

Using AI to predict convective hazards

Australia VLab Centre for Excellence Regional Focus Group – 125th meeting
John Cintineo (NOAA/NSSL), Scott Lindstrom (CIMSS)
25 March 2025

Summary

- **ProbSevere v3** (gradient-boosted decision trees)
 - Uses multi-sensor storm tracking
 - Fuses radar, satellite, lightning, NWP data
 - Guidance used throughout U.S. NWS
- **IntenseStormNet** (convolutional neural network)
 - Stand-alone satellite-only convective nowcasting tool
 - Used within PSv3
 - Exploring utility for "convection reanalysis"
- **LightningCast** (convolutional neural network)
 - Satellite-only lightning prediction
 - Excels at lightning-initiation forecasts
 - GLM serves as the truth/target data
 - Available through CSPP-Geo

Contact:
 • john.cintineo@noaa.gov ←
 • scottli@asec.wisc.edu

Links at <http://www.virtuallab.bom.gov.au/archive/regional-focus-group-recordings/>

0100-0210 LightningCast Probabilities
First introduction: RFG meeting Dec 2022
Dr. Scott Lindstrom

Availability of LightningCast over the South Pacific on the SSEC web page
Dr. Scott Lindstrom

Real time use of LightningCast, BMTC Forecasting Day, April 2024
Dr. Scott Lindstrom

0300UTC 0310UTC 0320UTC 0330UTC 0340UTC 0350UTC

Region A: Storm over Viti Levu; an example where LightningCast has performed very well, Sandwich Product, 0300UTC to 0350UTC, 10th Oct 2024

10% LightningCast probability
25% LightningCast probability
75% LightningCast probability
GLM lightning signal (same time for the SSEC and CIRA SLIDER display)
Temperature (C)

LightningCast GOES-West American Samoa
Probability of lightning in next 60 minutes [Z]

10% 25% 50% 75%

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ProbSevere as a suite of different machine learning tools

March 2025 presentation by Scott Lindstrom SSEC University of Wisconsin Madison

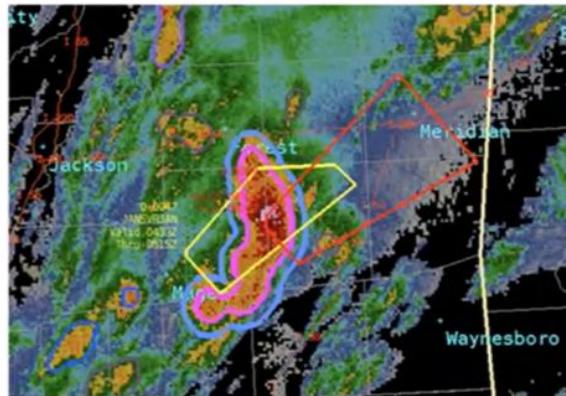
http://www.virtuallab.bom.gov.au/index.php/download_file/view/1831/227/



Overview of ProbSevere

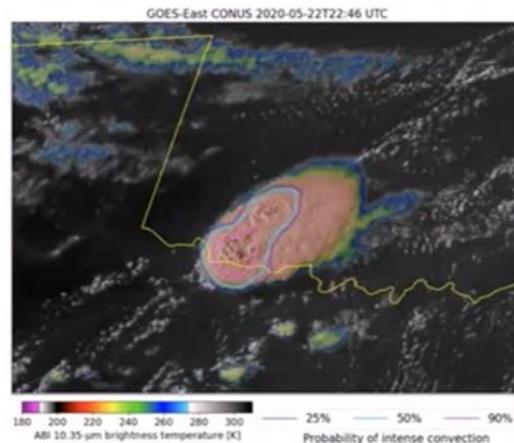
These are all machine learning tools that use ABI data from GOES-R satellites – and other data sources too. They give advance notice of Severe Weather, or of Lightning

1. ProbSevere v3



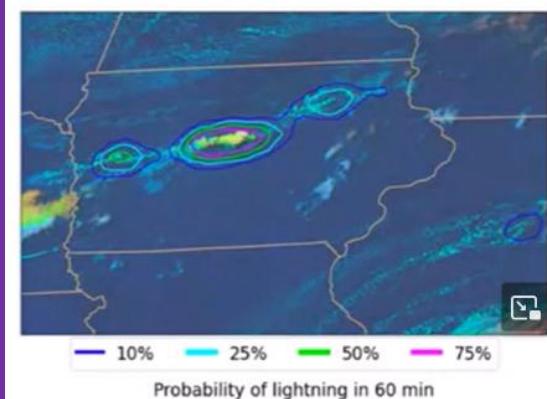
ML models for nowcasting large hail, wind gusts, and tornadoes

2. IntenseStormNet



Deep-learning model using only satellite images to detect “intense” parts of storms

3. LightningCast



Satellite-only deep-learning model for nowcasting lightning

Contact:

- john.cintineo@noaa.gov





Contents

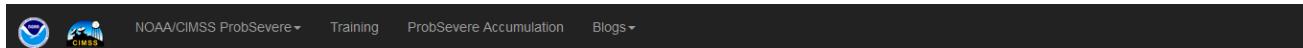
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Exercise 4a: From my AOMSUC -15 Training Event

1: Open the NOAA / CIMSS web resource over Fiji / Tonga / Samoa

https://cimss.ssec.wisc.edu/probsevere/lc_viewer/



LightningCast

The ProbSevere LightningCast model uses images of visible, near-infrared, and long-wave infrared channels aboard [GOES ABI](#) to predict the probability of lightning in the next 60 minutes.

2: Select sector

- On-demand dashboard request form (NOAA only)
- Training materials and GRLevelX placefiles

Select sector ▼

Tools ▼

Animation & Images

Show: 1 hours
Of: LightningCast GOES-W
Ending: Latest

Products & Layers +

Collection: RealEarth

Presets ▼

Displayed

- LightningCast GOES-West American Samoa (2023-10-28 08:30:22)
- Aviation - lightning dashboards (2023-09-08 17:40:19)
- Stadiums - lightning dashboards (2023-09-07 13:51:20)
- Current Fire Incidents: lightning dashboards (2023-10-28 08:30:02)

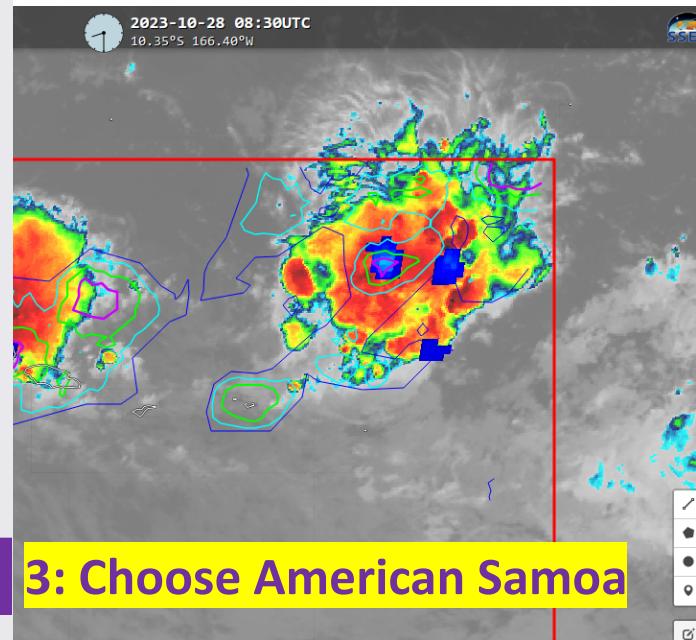
GOES-East

- CONUS
- Mesoscale-1
- Mesoscale-2
- OPC/TAFB

GOES-West

- PACUS
- Mesoscale-1
- Mesoscale-2
- Alaska-Canada
- American Samoa ▼
- Himawari-8
- Guam

4: Play the loop



3: Choose American Samoa



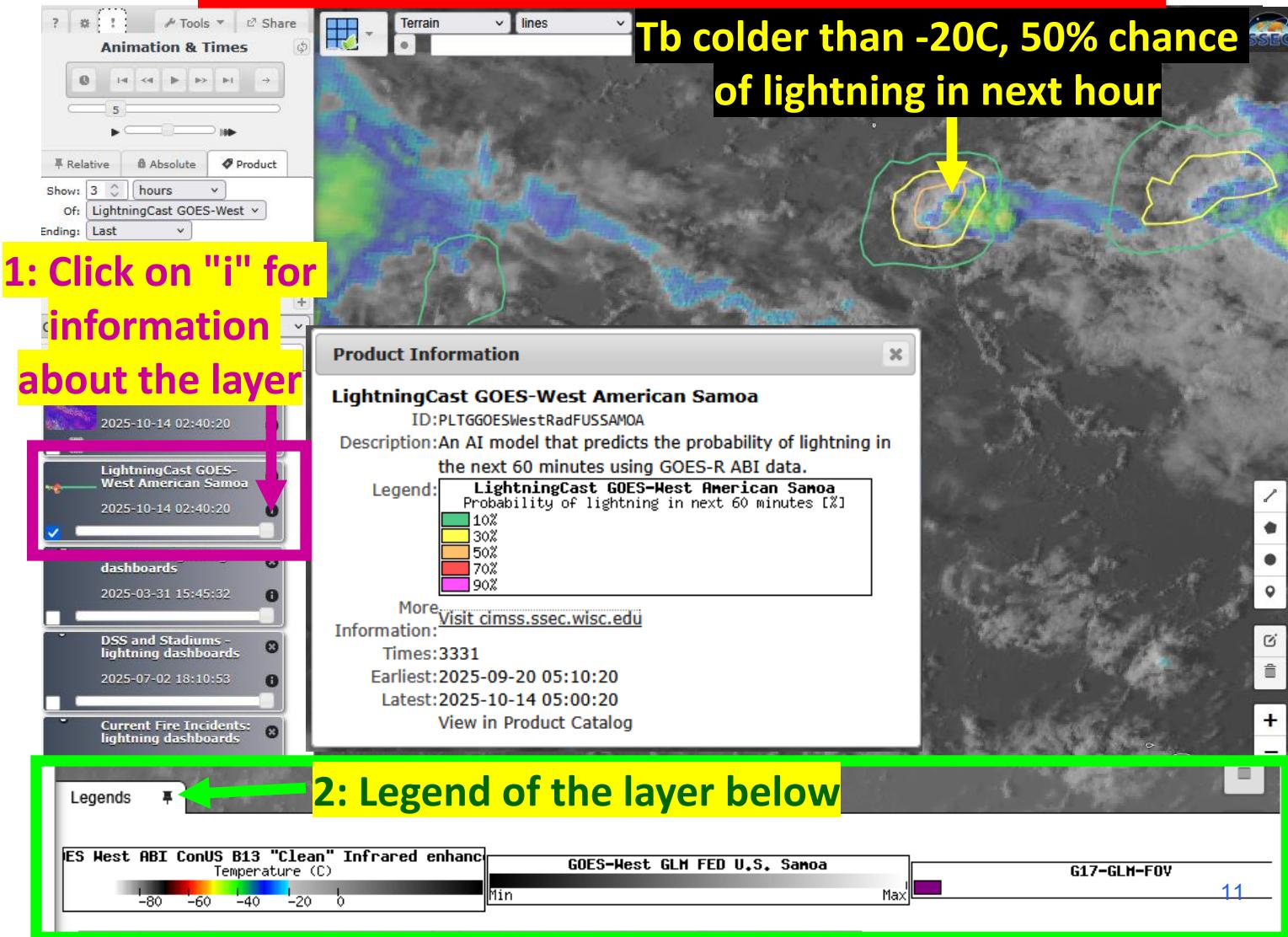
Exercise 4b

Interpreting LightningCast

using the NOAA / CIMSS web resource at

https://cimss.ssec.wisc.edu/probsevere/lc_viewer/

image courtesy
NOAA / CIMSS



SSEC Real Earth also renders LightningCast over the Micronesian area, including Guam

1: https://cimss.ssec.wisc.edu/probsevere/lc_viewer/

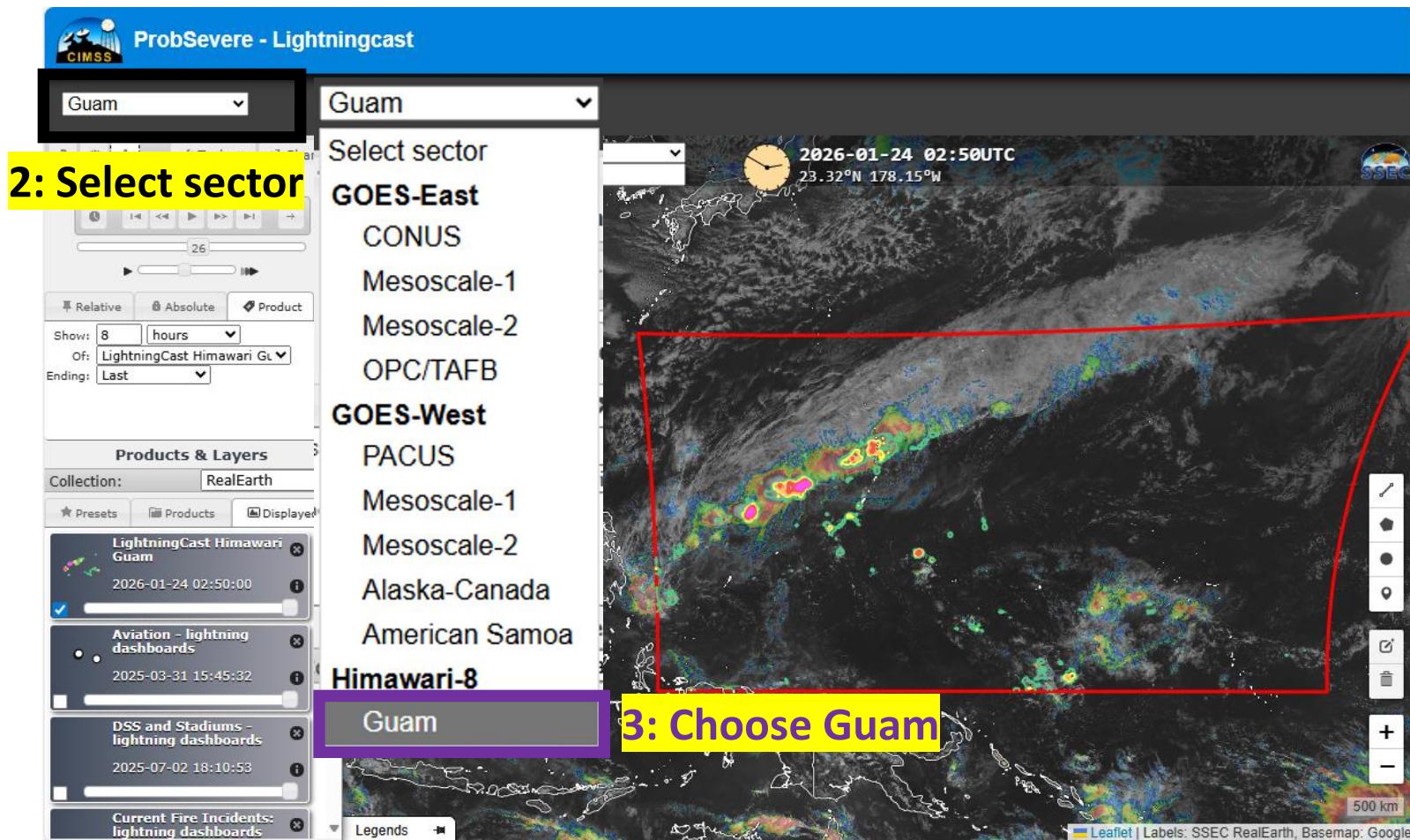


image courtesy NOAA / CIMSS
12



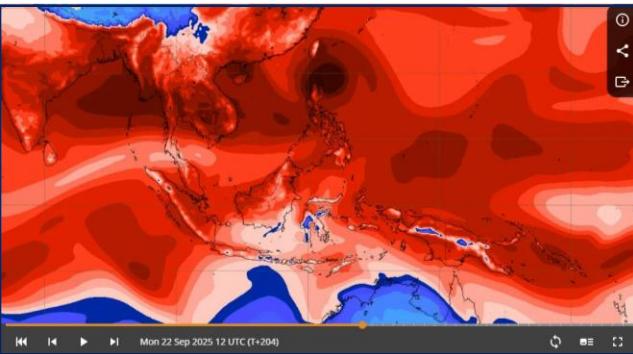
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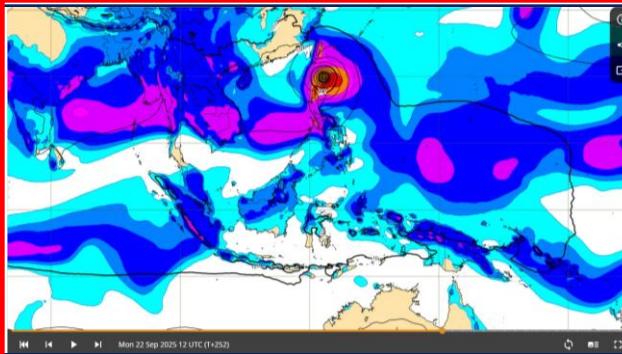


Comparison between ECMWF AIFS Experimental forecasts, and Satellite Data Products (September 2025 Regional Focus Group meeting)

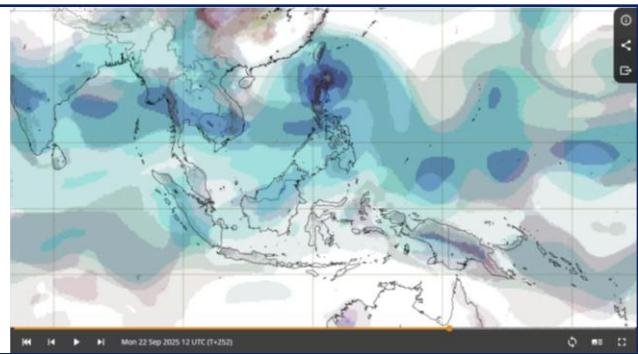
http://www.virtuallab.bom.gov.au/index.php/download_file/view/1845/227/



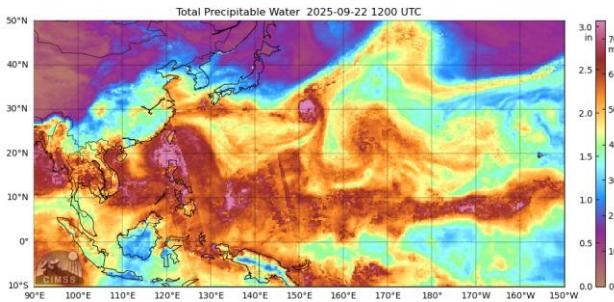
Total Column Water



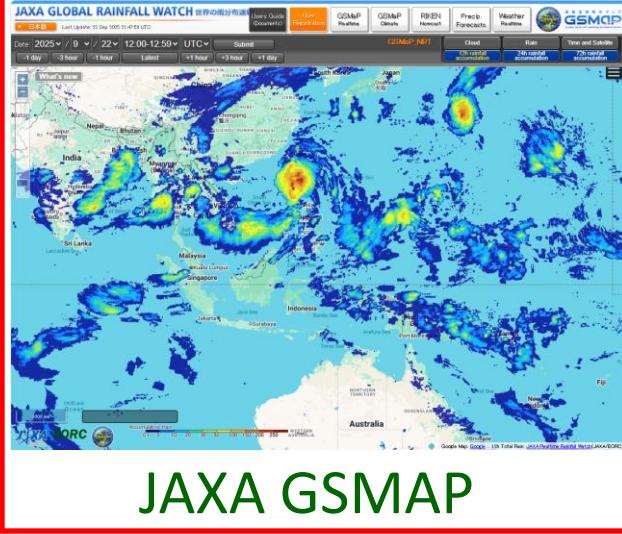
Rain and MSLP



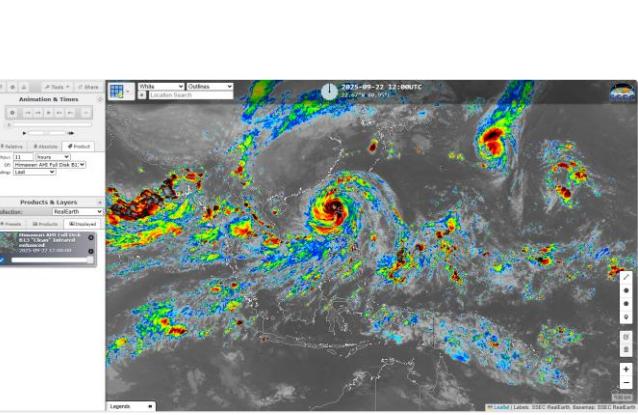
Total Cloud Cover



MIMIC-TPW



JAXA GSMAP

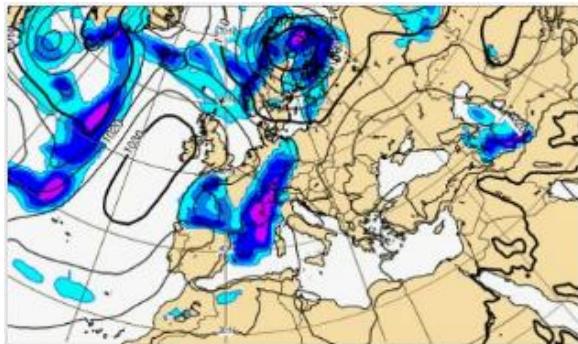


SSEC Real Earth



ECMWF Experimental forecasts, including the Artificial Intelligence Forecasting System (AIFS). Including useful web links.

<https://charts.ecmwf.int/>

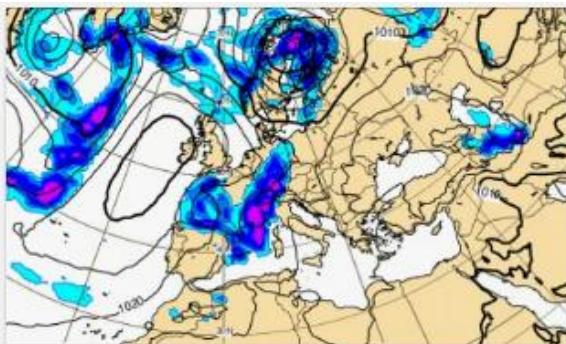


Latest forecast

AIFS Single: Rain and mean sea level pressure

Precipitation totals include all precipitation types (rain, snow etc.) (in mm of rainfall or rainfall equivalent) falling in 6 hour or 12 hour periods using colour shading...

[jupyter](#) [github](#) [launch binder](#) [Open in Colab](#)

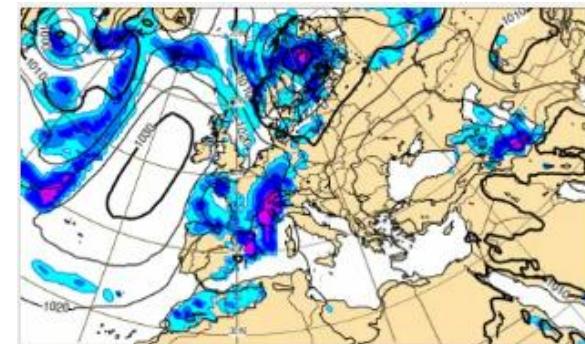


Latest forecast

AIFS ENS Control: Rain and mean sea level pressure

Precipitation totals include all precipitation types (rain, snow etc.) (in mm of rainfall or rainfall equivalent) falling in 6 hour or 12 hour periods using colour shading...

[jupyter](#) [github](#) [launch binder](#) [Open in Colab](#)



Latest forecast

Rain and mean sea level pressure

Precipitation totals include all precipitation types (rain, snow etc.) (in mm of rainfall or rainfall equivalent) falling in 6 hour or 12 hour periods using colour shading...

[jupyter](#) [github](#) [launch binder](#) [Open in Colab](#)

ECMWF AIFS Single Forecast

<https://confluence.ecmwf.int/display/FUG/Section+2.2.3+AIFS+Single++The+Deterministic+Model>

ECMWF AIFS ENS Control Forecast

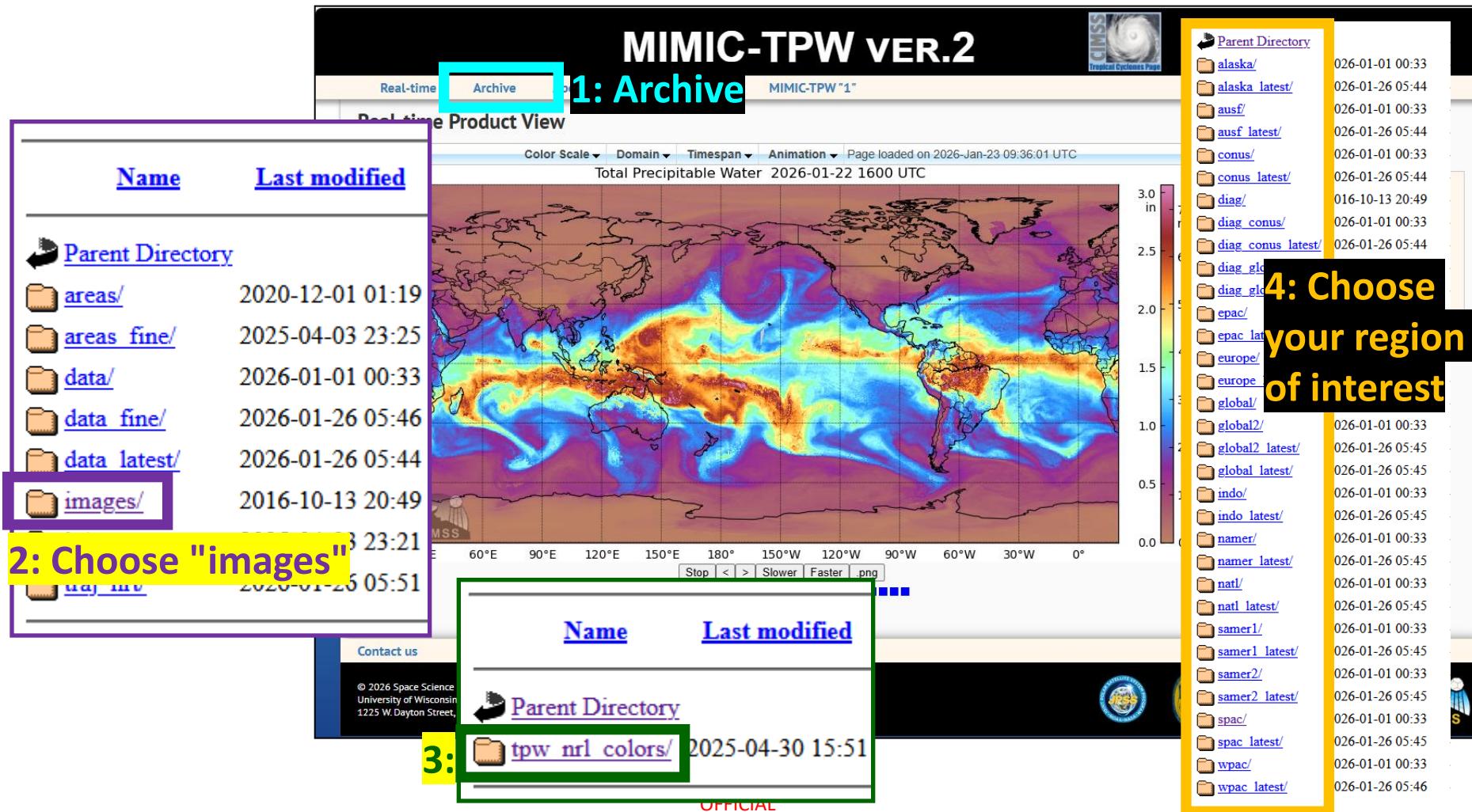
<https://confluence.ecmwf.int/display/FUG/Section+2.2.4+AIFS+ENS++The+Ensemble+Model>

ECMWF Control Forecast (ex-HRES)

<https://www.ecmwf.int/en/forecasts/documentation-and-support/medium-range-forecasts>

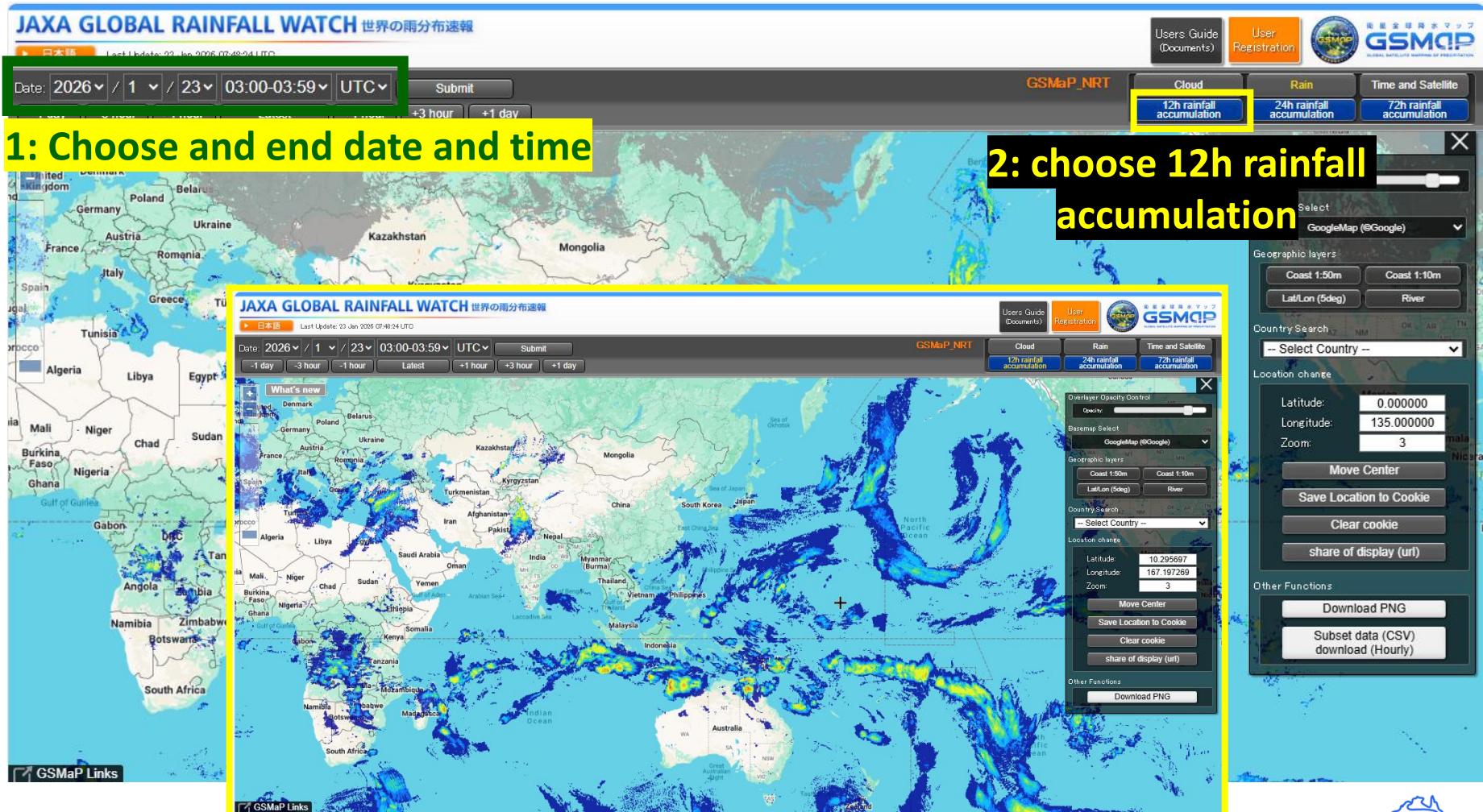
Satellite Data Product for comparison: MIMIC TPW, and archive

https://tropic.ssec.wisc.edu/real-time/mtpw2/product.php?color_type=tpw_nrl_colors&prod=global2×pan=24hrs&anim=html5



Satellite Data Product, for comparison: JAXA GSMap

<https://sharaku.eorc.jaxa.jp/GSMaP/>





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Exploring the ECMWF Experimental forecasts, including the Artificial Intelligence Forecasting System (AIFS).

<https://charts.ecmwf.int/>

https://charts.ecmwf.int/

ECMWF | Charts

Home / Charts catalogue

Search products...

Range

- Medium (15 days)
- Sub-seasonal
- Seasonal

Type

- Forecasts
- Verification

Component

- Surface
- Atmosphere

Product type

- Control Forecast (ex-HRES)
- Ensemble forecast (ENS)
- Extreme forecast index
- Point-based products

ECMWF Control Forecast (ex-HRES)

ECMWF AIFS Single Forecast

ECMWF AIFS ENS Control Forecast

ECMWF

Choosing 12-hour precipitation and MSLP forecast from the AIFS ECMWF Single model

1: <https://charts.ecmwf.int/>

https://charts.ecmwf.int/?facets=%7B"Product%20type"%3A%5B"AIFS%20Single"%5D%7D

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- AIFS Single

Parameters

Latest forecast

AIFS Single: Mean sea level pressure and 850 hPa wind speed

Wind speeds near the surface are roughly proportional to the distance between isobars so closely packed isobars mean strong surface winds...

Latest forecast

AIFS Single: 500 hPa geopotential height and 850 hPa temperature

The 850 hPa level is usually just above the boundary layer and at this level the day-night variation in temperature is generally negligible...

Latest forecast

AIFS Single: 100 m wind and mean sea level pressure

These charts show surface pressure patterns. Areas of high pressure (anticyclones) are usually associated with settled weather...

Latest forecast

AIFS Single: Mean sea level pressure and 200 hPa wind

Wind speed at 200 hPa highlights the jet stream (areas of strong winds in the upper troposphere) which can help identify movement and development of depressions...

Latest forecast

AIFS Single: Rain and mean sea level pressure

Precipitation totals include all precipitation types (rain, snow etc.) (in mm of rainfall or rainfall equivalent) falling in 6 hour or 12 hour periods using colour shading

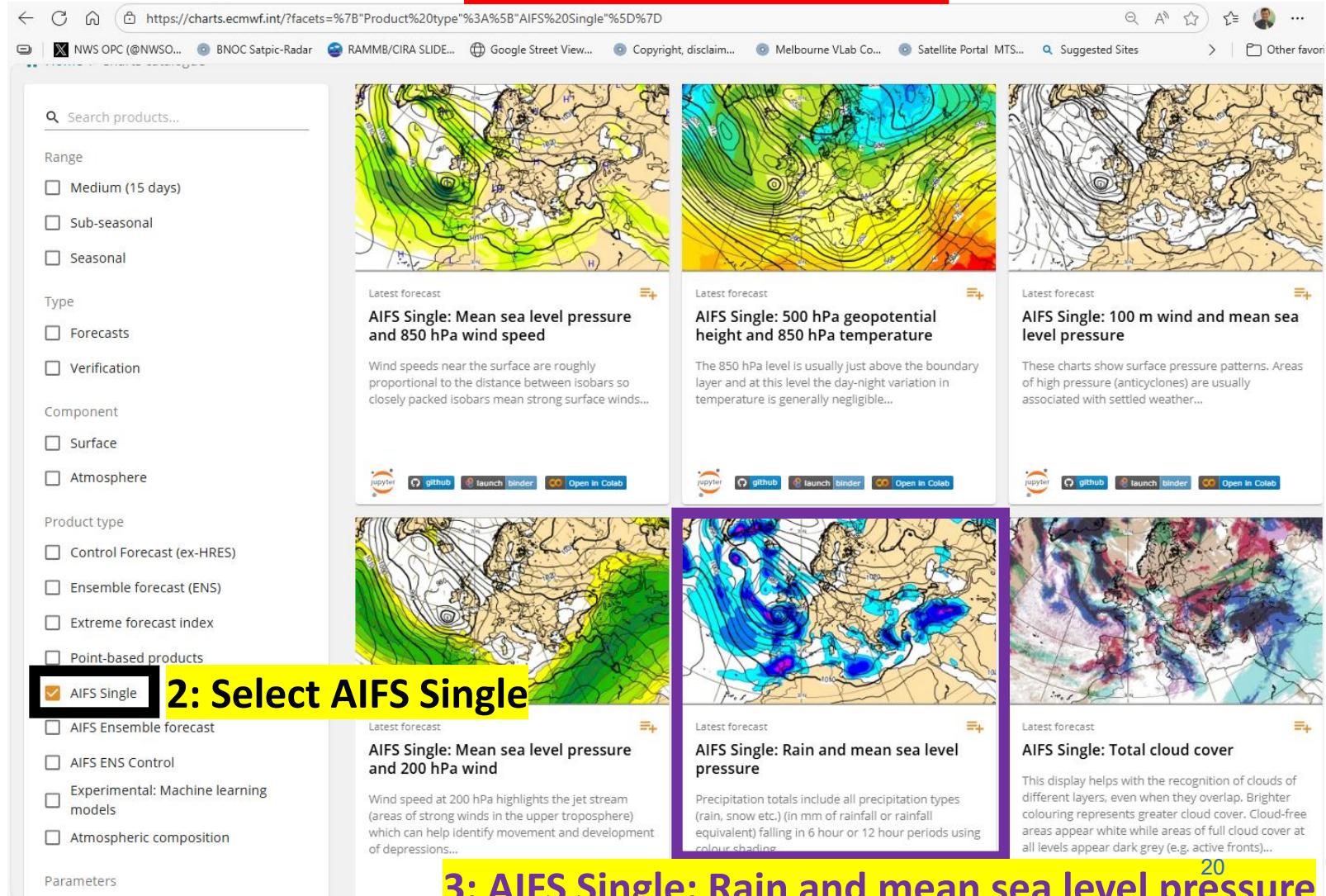
Latest forecast

AIFS Single: Total cloud cover

This display helps with the recognition of clouds of different layers, even when they overlap. Brighter colouring represents greater cloud cover. Cloud-free areas appear white while areas of full cloud cover at all levels appear dark grey (e.g. active fronts)...

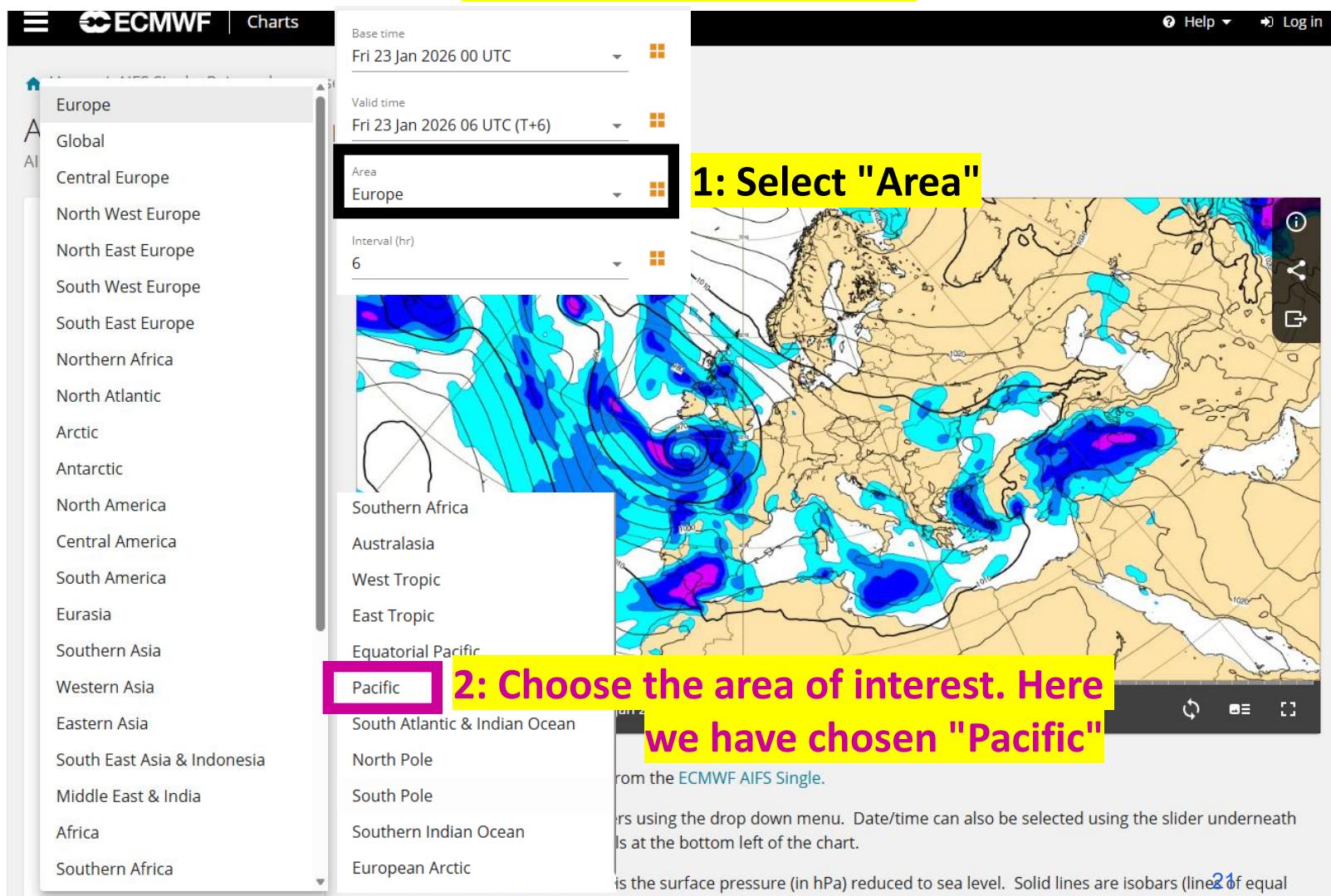
2: Select AIFS Single

3: AIFS Single: Rain and mean sea level pressure




Choosing 12-hour precipitation and MSLP forecast from the AIFS ECMWF Single model

<https://charts.ecmwf.int/>



Choosing 12-hour precipitation and MSLP forecast from the AIFS ECMWF Single model

<https://charts.ecmwf.int/>

ECMWF | Charts

Home / AIFS Single: Rain and mean sea level pressure

AIFS Single: Rain and mean sea level pressure

AIFS

1: Select "Valid Time"

Valid time: Fri 23 Jan 2026 06 UTC (T...)

Area: Pacific

Interval (hr): 6

3: Select "Interval (hr)"

6

12

Sun 01 Feb 2026 18 UTC (T+234)
 Mon 02 Feb 2026 00 UTC (T+240)
 Mon 02 Feb 2026 06 UTC (T+246)
 Mon 02 Feb 2026 12 UTC (T+252)
 Mon 02 Feb 2026 18 UTC (T+258)
 Tue 03 Feb 2026 00 UTC (T+264)
 Tue 03 Feb 2026 06 UTC (T+270)
 Tue 03 Feb 2026 12 UTC (T+276)
 Tue 03 Feb 2026 18 UTC (T+282)
 Wed 04 Feb 2026 00 UTC (T+288)
 Wed 04 Feb 2026 06 UTC (T+294)
 Wed 04 Feb 2026 12 UTC (T+300)
 Wed 04 Feb 2026 18 UTC (T+306)
 Thu 05 Feb 2026 00 UTC (T+312)
 Thu 05 Feb 2026 06 UTC (T+318)
 Thu 05 Feb 2026 12 UTC (T+324)
 Thu 05 Feb 2026 18 UTC (T+330)
 Fri 06 Feb 2026 00 UTC (T+336)
 Fri 06 Feb 2026 06 UTC (T+342)
 Fri 06 Feb 2026 12 UTC (T+348)
 Fri 06 Feb 2026 18 UTC (T+354)
 Sat 07 Feb 2026 00 UTC (T+360)

2: Choose a forecast time out to 360 hours

is the surface pressure (in hPa) reduced to sea level. Solid lines are isobars (lines of equal MSLP)

ECMWF AIFS Single 360-hour forecast of 12-hour precipitation and MSLP over the Pacific region for 00UTC 7th February 2026

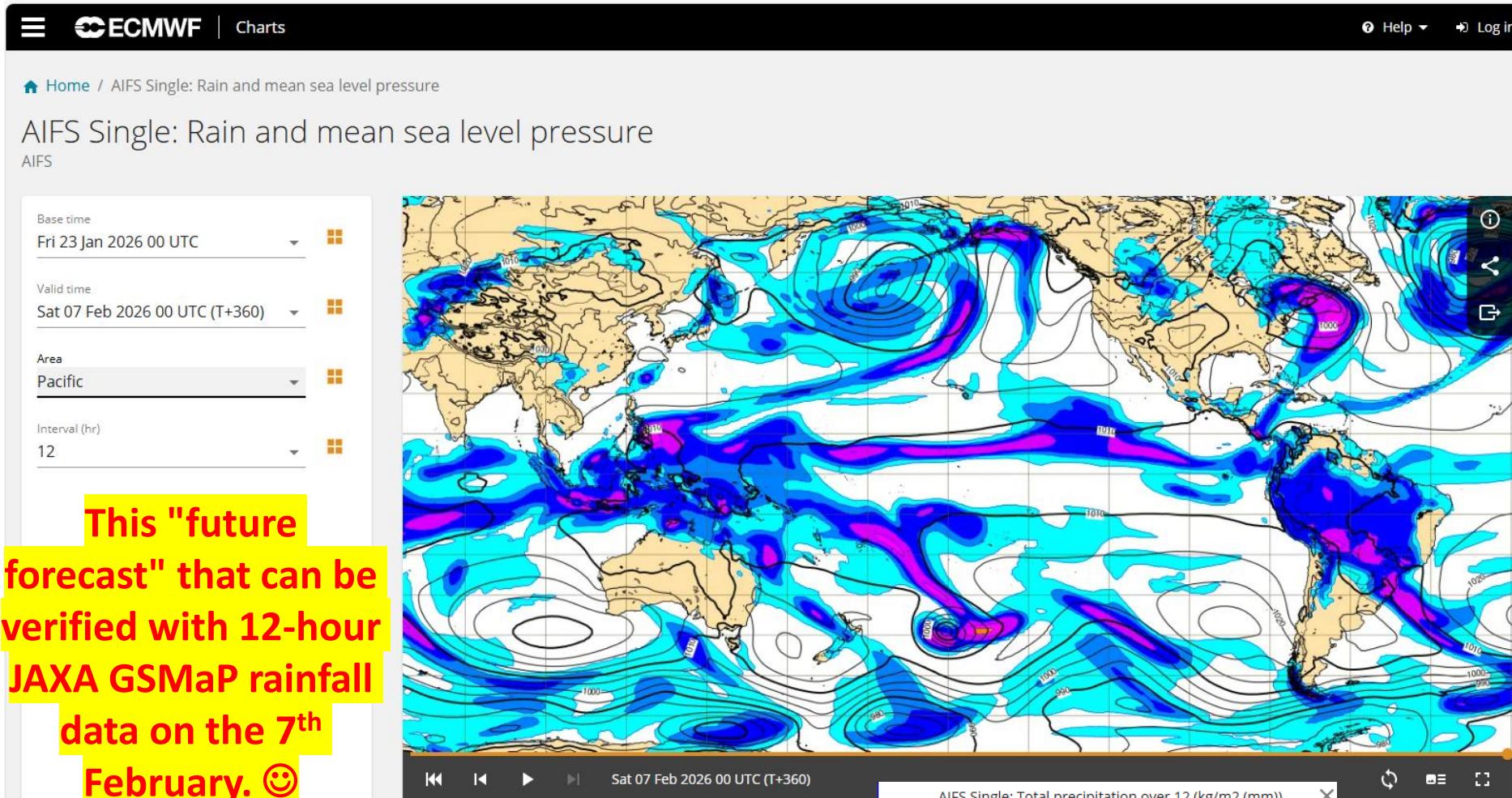


image courtesy ECMWF



Choosing 12-hour precipitation and MSLP forecast from the AIFS ECMWF ENS Control model

1: <https://charts.ecmwf.int/>

https://charts.ecmwf.int/?facets=%7B"Product%20type"%3A%5B"AIFS%20ENS%20Control"%5D%7D

NWS OPC (@NWSO... BNOC Satpic-Radar RAMMB/CIRA SLIDE... Google Street View... Copyright, disclaim... Melbourne VLab Co... Satellite Portal MTS... Suggested Sites Other favori

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- AIFS Single
- AIFS Ensemble forecast
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Experimental: Machine learning models

Atmospheric composition

Parameters

Latest forecast

AIFS ENS Control: Mean sea level pressure and 850 hPa wind speed

Wind speeds near the surface are roughly proportional to the distance between isobars so closely packed isobars mean strong surface winds...

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AIFS ENS Control: 500 hPa geopotential height and 850 hPa temperature

The 850 hPa level is usually just above the boundary layer and at this level the day-night variation in temperature is generally negligible...

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These charts show surface pressure patterns. Areas of high pressure (anticlines) are usually associated with settled weather...

Latest forecast

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Precipitation totals include all precipitation types (rain, snow etc.) (in mm of rainfall or rainfall equivalent) falling in 6 hour or 12 hour periods using colour shading...

Latest forecast

AIFS ENS Control: Total cloud cover

This display helps with the recognition of clouds of different layers, even when they overlap. Brighter colouring represents greater cloud cover. Cloud-free areas appear white while areas of full cloud cover at all levels appear dark grey (e.g. active fronts)...

2: Select AIFS ENS Control

Wind speed at 200 hPa highlights the jet stream (areas of strong winds in the upper troposphere) which can help identify movement and development of depressions...

3: AIFS ENS Control: Rain and mean sea level pressure



ECMWF AIFS Ensemble 360-hour forecast of 12-hour precipitation and MSLP over the Pacific region for 00UTC 7th February 2026

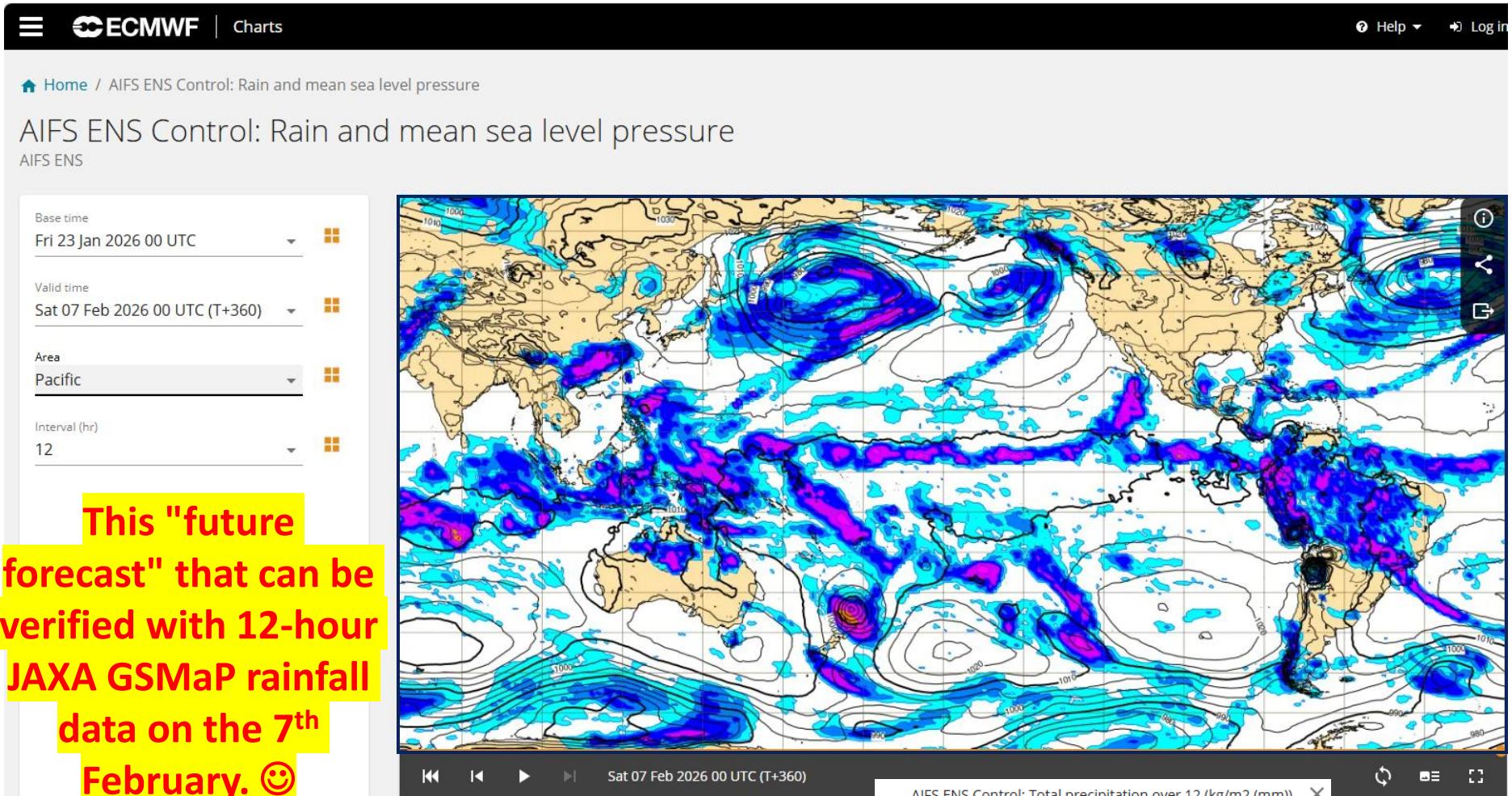


image courtesy ECMWF



Choosing Total Column Water forecast from the AIFS ECMWF Single model

1: <https://charts.ecmwf.int/>

https://charts.ecmwf.int/?facets=%7B"Product%20type"%3A%5BAIFS%20Single%5D%7D

NWS OPC (@NWSO... BNOC Satpic-Radar RAMMB/CIRA SLIDE... Google Street View... Copyright, disclaim... Melbourne VLab Co... Satellite Portal MTS... Suggested Sites Other favori

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AIFS Single

2: Select AIFS Single

Latest forecast AIFS Single: Mean sea level pressure and 200 hPa wind

Wind speed at 200 hPa highlights the jet stream (areas of strong winds in the upper troposphere) which can help identify movement and development of depressions...

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Latest forecast AIFS Single: Total cloud cover

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3: AIFS Single: Total column water

Latest forecast AIFS Single and 850 hPa

Wind speeds proportional to closely packed contours

Latest forecast AIFS Single: Total column water

The charts show the forecast value of the vertically integrated total column water (vapour + cloud water + cloud ice but with no precipitation included) in units of kg m⁻²...

Latest forecast AIFS Single: Total accumulated precipitation

Total accumulated rainfall charts identify areas at greater risk of significant rainfall (or rain equivalent e.g. snowfall) but give no information regarding whether this occurs over a short or prolonged time period...

Latest forecast AIFS Single: Total snowfall during last 6 hours

Forecast precipitation is considered to be snow if the model atmosphere above and at the ground surface is forecast to be below 0°C. Where the ground surface lies near the 0°C level...

jupyter github launch binder Open in Colab

jupyter github launch binder Open in Colab

jupyter github launch binder Open in Colab

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ECMWF AIFS Single 360-hour forecast of Total Column Water over the Pacific region for 00UTC 7th February 2026

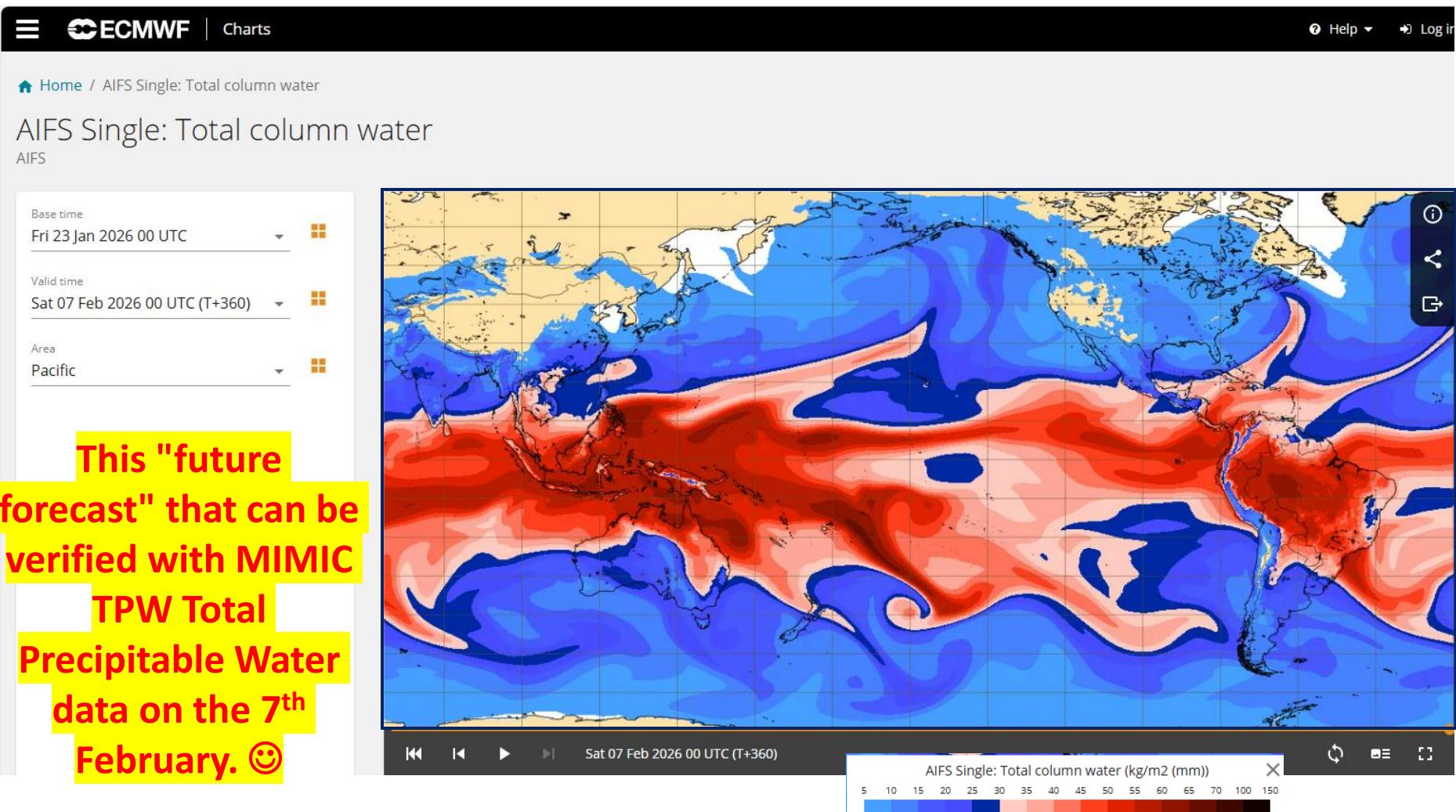


image courtesy ECMWF



Choosing Total Column Water forecast from the AIFS ECMWF ENS Control model

1: <https://charts.ecmwf.int/>

https://charts.ecmwf.int/?facets=%7B"Product%20type"%3A%5BAIFS%20ENS%20Control"%5D%7D

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Search products...

Range

- Medium (15 days)
- Sub-seasonal
- Seasonal

Type

- Forecasts
- Verification

Component

- Surface
- Atmosphere

Product type

- Control Forecast (ex-HRES)
- Ensemble forecast (ENS)
- Extreme forecast index
- Point-based products
- AIFS Single
- AIFS Ensemble forecast
- AIFS ENS Control

Experimental: Machine learning models

Atmospheric composition

Parameters

Wind speed at 200 hPa highlights the jet stream (areas of strong winds in the upper troposphere) which can help identify movement and development of depressions...

3: AIFS ENS Control: Total column water

Latest forecast AIFS ENS Control: Total column water

The charts show the forecast value of the vertically integrated total column water (vapour + cloud water + cloud ice but with no precipitation included) in units of kg m^{-2} ...

Latest forecast AIFS ENS Control: Total accumulated precipitation

Total accumulated rainfall charts identify areas at greater risk of significant rainfall (or rain equivalent e.g. snowfall) but give no information regarding whether this occurs over a short or prolonged time period...

Latest forecast AIFS ENS Control: Total snowfall during last 6 hours

Forecast precipitation is considered to be snow if the model atmosphere above and at the ground surface is forecast to be below 0°C. Where the ground surface lies near the 0°C level...

Latest forecast AIFS ENS Control: Rain and mean sea level pressure

Precipitation totals include all precipitation types (rain, snow etc.) (in mm of rainfall or rainfall equivalent) falling in 6 hour or 12 hour periods using colour shading...

Latest forecast AIFS ENS Control: Total cloud cover

This display helps with the recognition of clouds of different layers, even when they overlap. Brighter colouring represents greater cloud cover. Cloud-free areas appear white while areas of full cloud cover at all levels appear dark grey (e.g. active fronts)...

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ECMWF AIFS Ensemble Control 360-hour forecast of Total Column Water over the Pacific region for 00UTC 7th February 2026

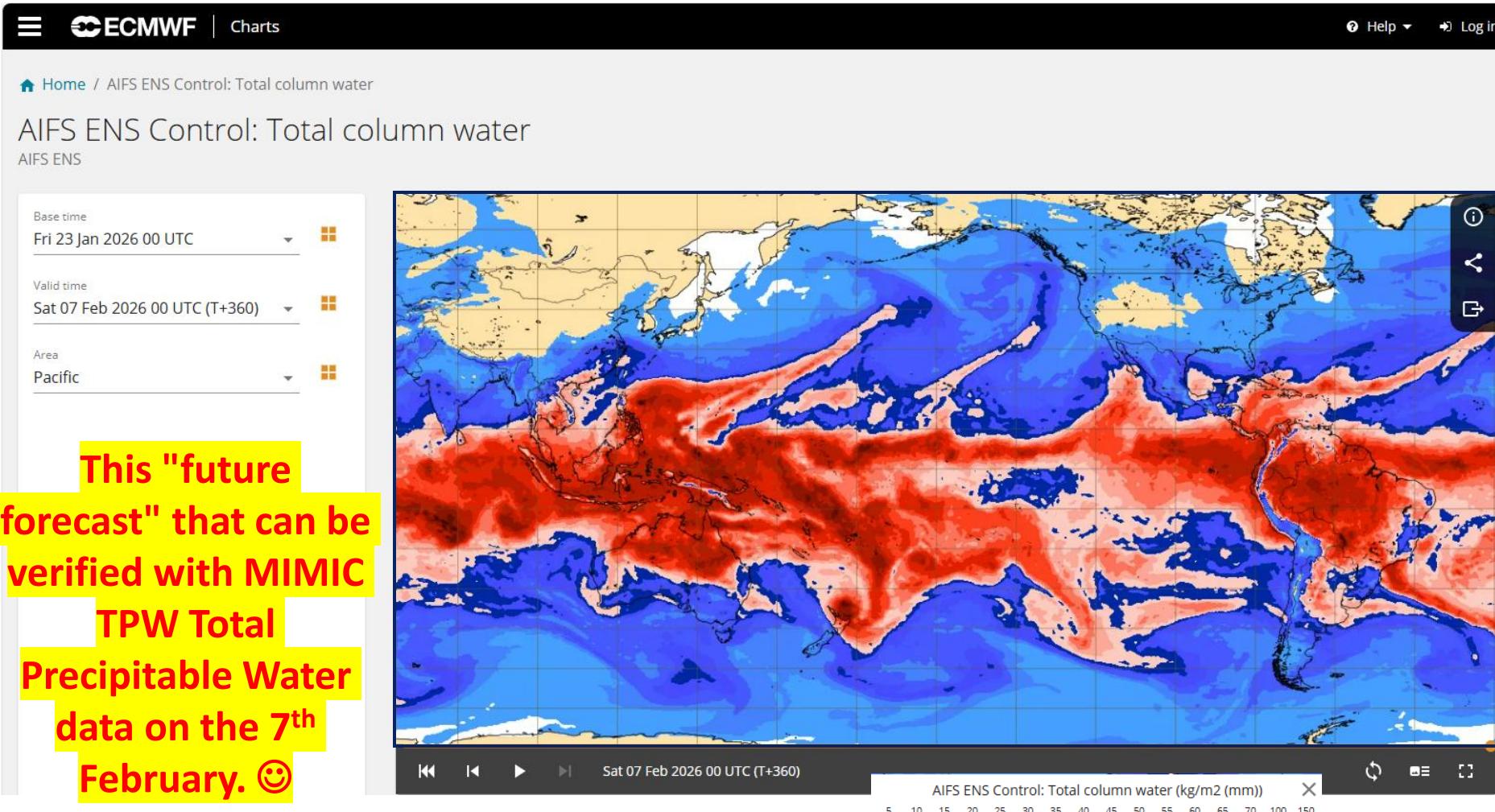


image courtesy ECMWF



Choosing the ECMWF Control Forecast (ex-HRES)

1: <https://charts.ecmwf.int/>

https://charts.ecmwf.int/?facets=%7B"Product%20type"%3A%5B"Control%20Forecast%20%28ex-HRES%29"%5D%7D

NWS OPC (@NWSO... BNOC Satpic-Radar RAMMB/CIRA SLIDE... Google Street View... Copyright, disclaimer... Melbourne VLab Co... Satellite Portal MTS... Suggested Sites Other favorite

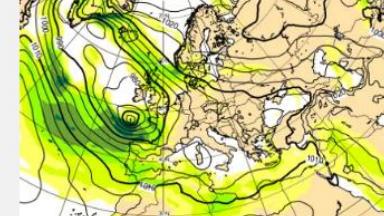
Search products...

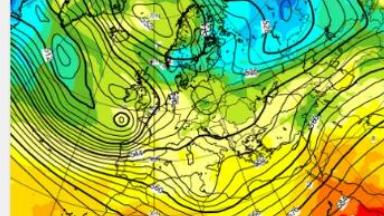
Range
 Medium (15 days)
 Sub-seasonal
 Seasonal

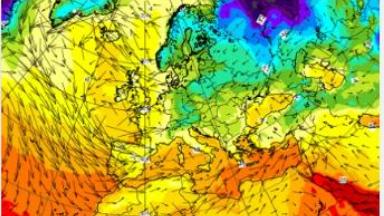
Type
 Forecasts
 Verification

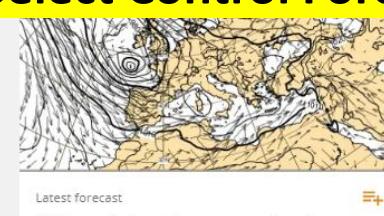
Component
 Surface
 Atmosphere

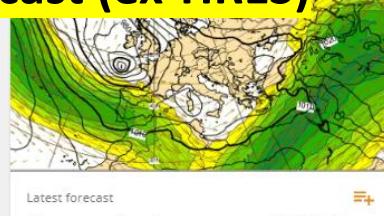
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 Extreme forecast index
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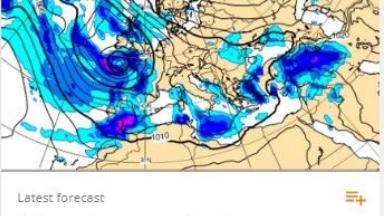
Latest forecast Mean sea level pressure and 850 hPa wind speed
 
 Wind speeds near the surface are roughly proportional to the distance between isobars so closely packed isobars mean strong surface winds...
 [ipython](#) [github](#) [launch binder](#) [Open in Colab](#)

Latest forecast 500 hPa geopotential height and 850 hPa temperature
 
 The 850 hPa level is usually just above the boundary layer and at this level the day-night variation in temperature is generally negligible...
 [ipython](#) [github](#) [launch binder](#) [Open in Colab](#)

Latest forecast 2 m temperature and 30 m wind
 
 Air temperatures at 2 m above the earth's surface approximate most closely to the conditions a person would most likely experience...
 [ipython](#) [github](#) [launch binder](#) [Open in Colab](#)

Latest forecast 100 m wind and mean sea level pressure
 
 These charts show surface pressure patterns. Areas of high pressure (anticyclones) are usually associated with settled weather...
 [ipython](#) [github](#) [launch binder](#) [Open in Colab](#)

Latest forecast Mean sea level pressure and 200 hPa wind
 
 Wind speed at 200 hPa highlights the jet stream (areas of strong winds in the upper troposphere) which can help identify movement and development of depressions...
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Latest forecast Rain and mean sea level pressure
 
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2: Select Control Forecast (ex-HRES)





Thank You 😊

Bodo Zeschke,
Bureau of Meteorology Training Centre
Australian VLab Centre of Excellence