



Weekly meningitis bulletin at ACMAD

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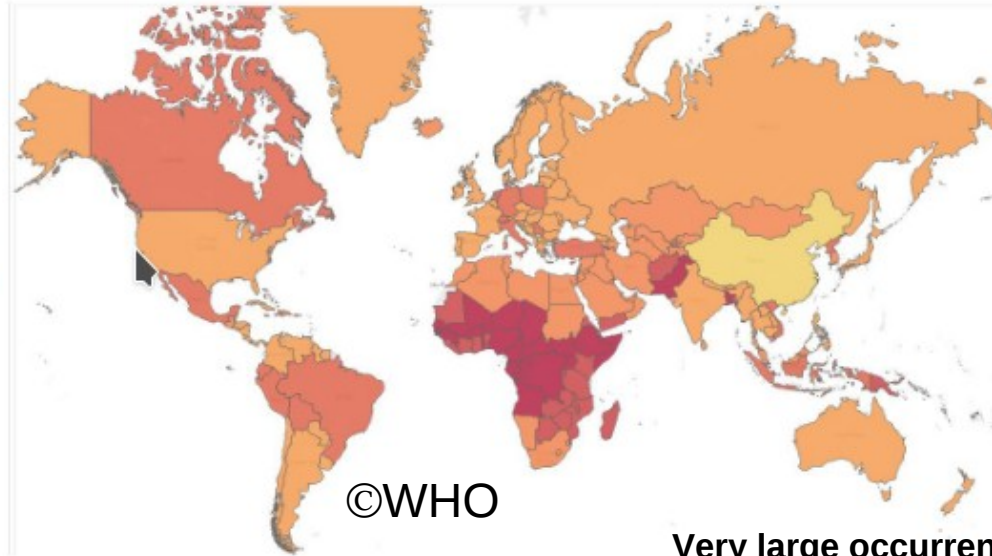
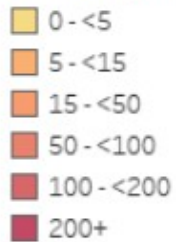
Outline

1. Description of the product
2. Who is using the product
3. What is the product used for decision making
4. How the product is developed
5. Details of the evaluation conducted in this product
6. Documentation of code and script used to generate the product

1. Description of the product

Meningitis incidence

Incidence (cases per 100,000)



Meningitis a deadly and debilitating disease, significant public health concern

Climate sensitive disease associate with several serogroups

Very large occurrence of outbreaks in Africa

Meningitis epidemics develop during the dry season and end at the monsoon onset ([Sultan et al., 2005](#), [Yaka et al., 2008](#), and [Martiny and Chiapello \(2013\)](#))

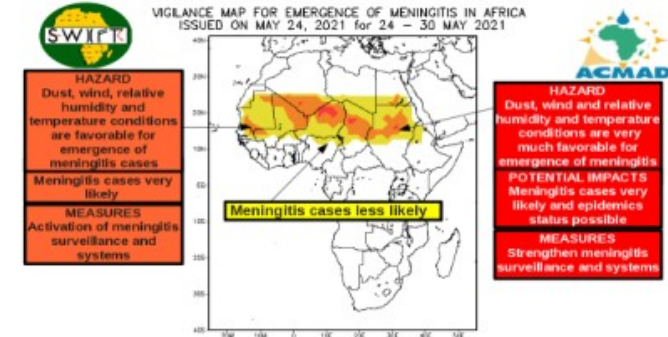
MERIT Project



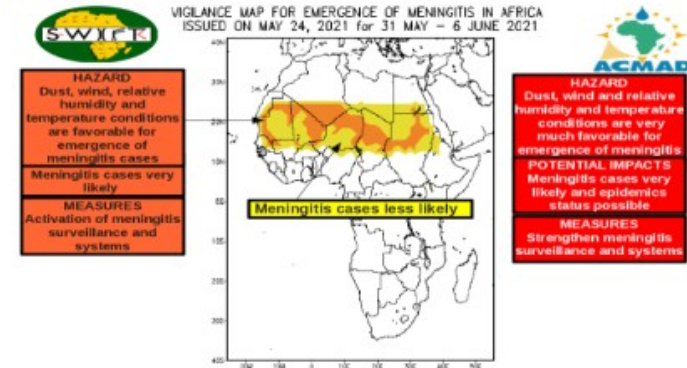
1. Description of the product

- Weekly meningitis bulletin is produced every Monday from week 1 to 26 (January to June).
- A summary presenting the meningitis forecasts, a description of the atmospheric conditions expected during the next 2 weeks, and the impact on health of the surface dust concentrations forecasts in the week.
- Two vigilance maps of the meningitis forecasts.

Week 1



Week 2





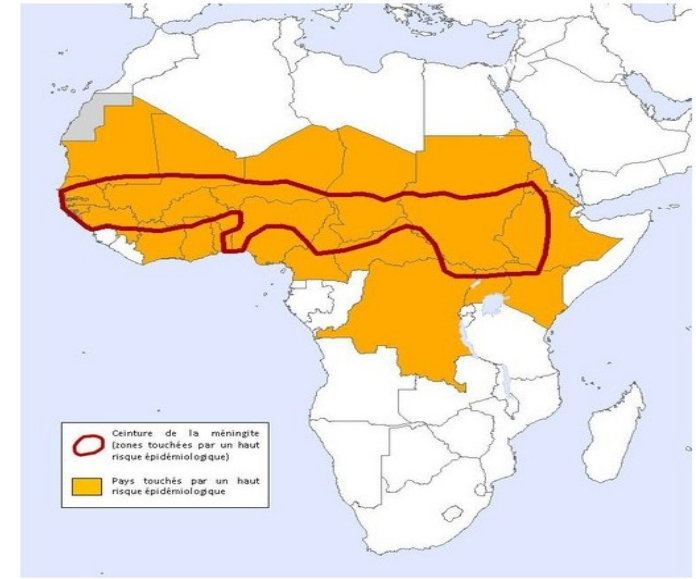
2. Who is using the product

World Health Organisation (WHO)

Dr Ado Bwaka – Vaccine Preventable Diseases/Polio Eradication Programme Team Leader, Inter-Country Support Team (IST) **West Africa**, World Health Organization (WHO)

Missions

- Coordinating immunization by providing technical support to West African countries in planning, implementing and monitoring/evaluating
- Supporting countries on Supplemental Immunization Activities, Vaccine and Preventable Disease Surveillance.
- Alerting countries especially the 26 countries of the meningitis belt to prepare for meningitis epidemics and respond to them adequately
- Providing technical assistance to countries affected by meningitis outbreaks during the dry season.

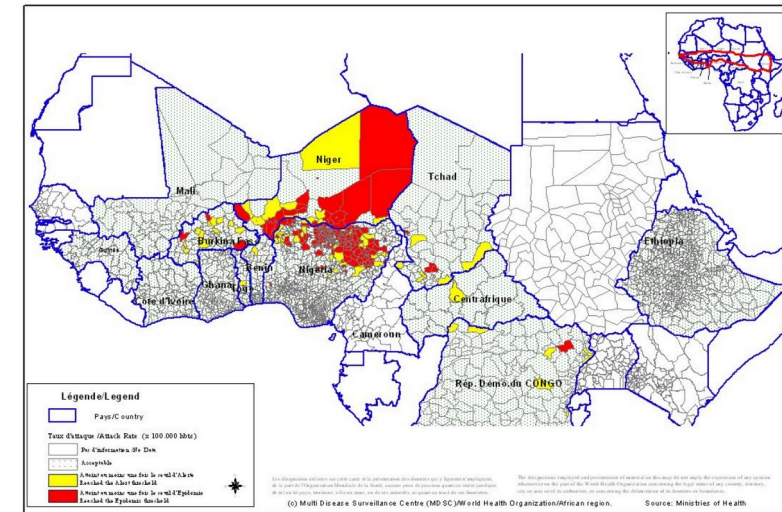


African meningitis belt (AMB)

3. What is the product used for decision making

- Situation awareness of the meningitis outbreaks over Africa
- Guidelines for local health services to carry out vaccination and take measures to avoid an epidemic
- Districts under high vigilance of meningitis cases to take efficient measures for the management of an epidemic.

Week 1-19 & 2009



Reported meningitis cases during week 1 to 19 in 2009



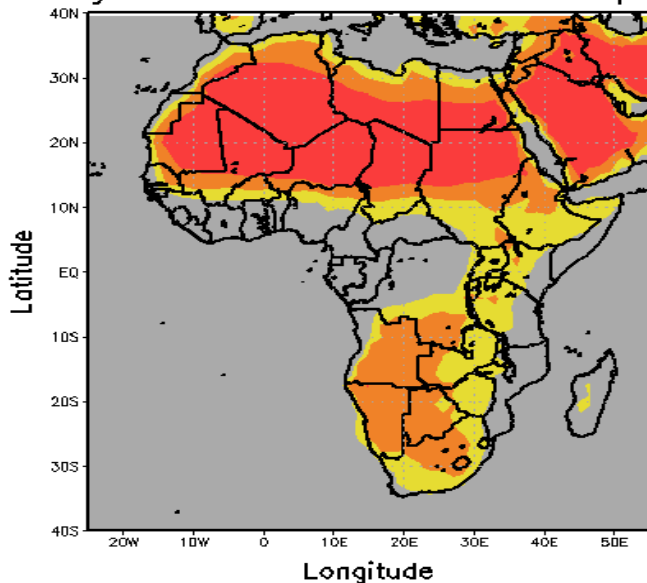
4. How the product is developed

- ◆ Vigilance maps computation is based climate metrics (temperature, relative humidity, and wind speed and direction) and dust.
- ◆ Climate metrics : S2S forecast from ECMWF (1.5° x 1.5°) at 1000 hPa
 - ◆ Data provided by the GCRF African SWIFT S2S testbed through WMO's Sub-seasonal to seasonal prediction project processed on Jasmin supercomputer (UK)
 - ◆ Bias correction using ERA5 reanalysis climatology
- ◆ Surface dust concentration data from the Barcelona Supercomputer Center (BSC) , World meteorological organization (WMO) institution
 - ◆ This center produce every day a short range forecast (3 days) of surface dust concentration using several numerical weather prediction (NWP) models.
 - ◆ Data protected need a registration online (<https://dust.aemet.es/forecast>)

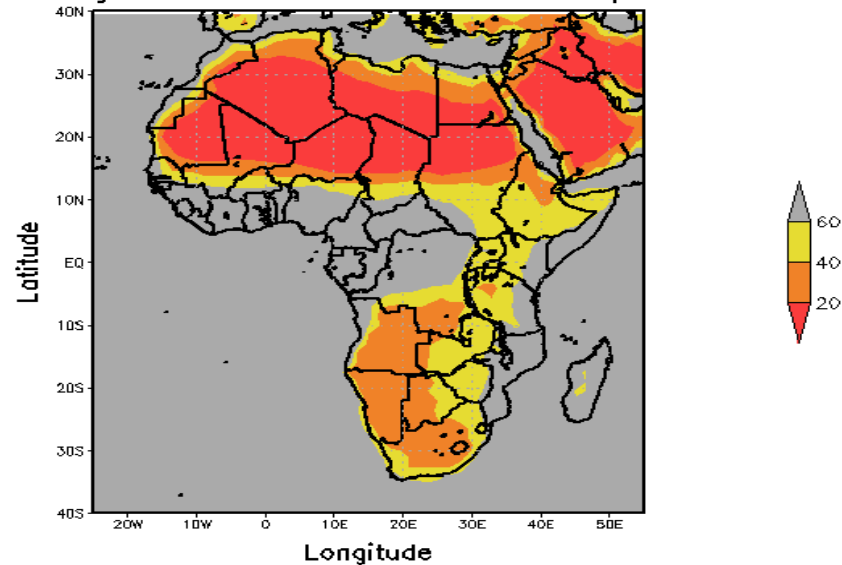
4. How the product is developed

Relative humidity forecasts

Weekly ECMWF mean relative humidity at 1000 hPa
during 31-05-2021 – 06-06-2021 period



Weekly ECMWF mean relative humidity at 1000 hPa
during 07-06-2021 – 13-06-2021 period

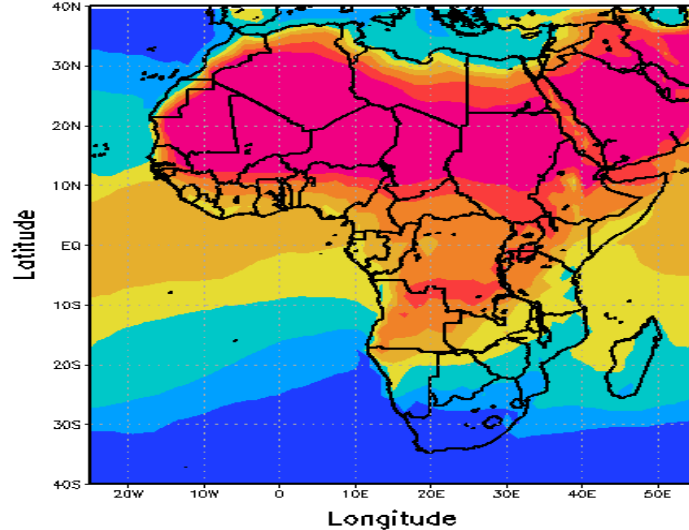


Dry conditions over Sahara and northern Sahel
Wet conditions over Gulf of Guinea

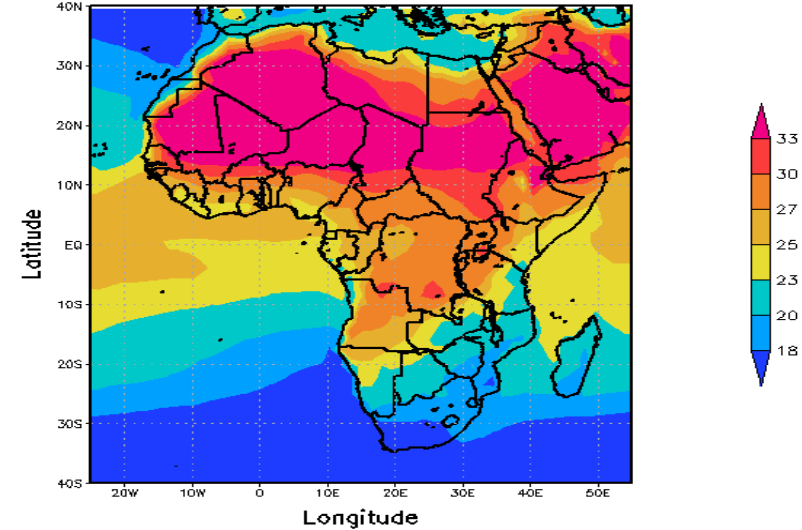
4. How the product is developed

Temperature forecasts

Weekly ECMWF mean temperature at 1000 hPa during 31-05-2021 – 06-06-2021 period



Weekly ECMWF mean temperature at 1000 hPa during 07-06-2021 – 13-06-2021 period

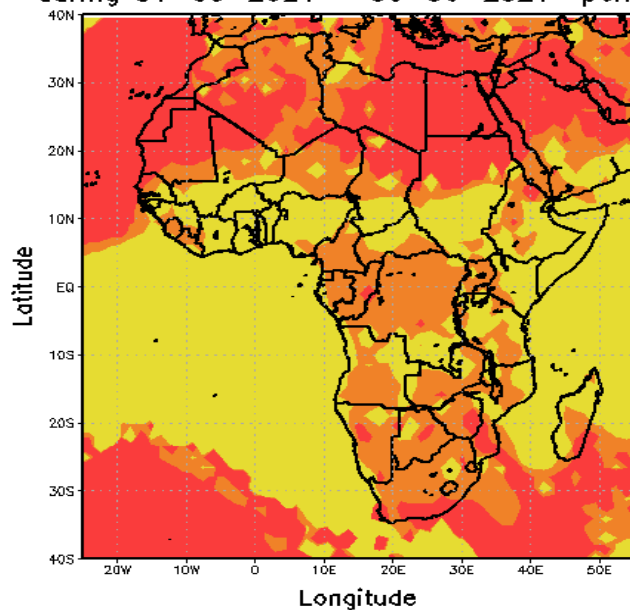


Local and episodic heat waves over Mauritania, northern Mali, northern Niger, northern Chad, southern Algeria, and Sudan

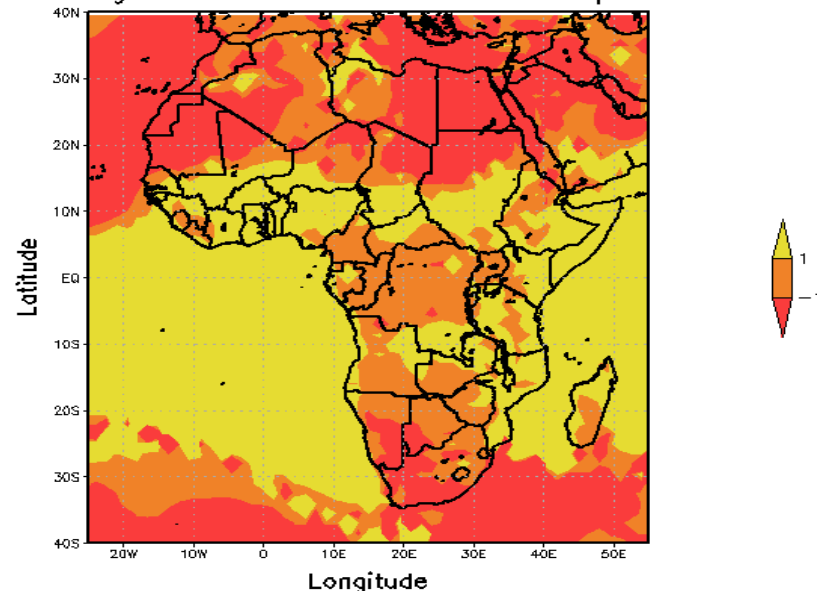
4. How the product is developed

Meridional wind speed forecasts

Weekly ECMWF mean meridional wind at 1000 hPa
during 31-05-2021 – 06-06-2021 period



Weekly ECMWF mean meridional wind at 1000 hPa
during 07-06-2021 – 13-06-2021 period

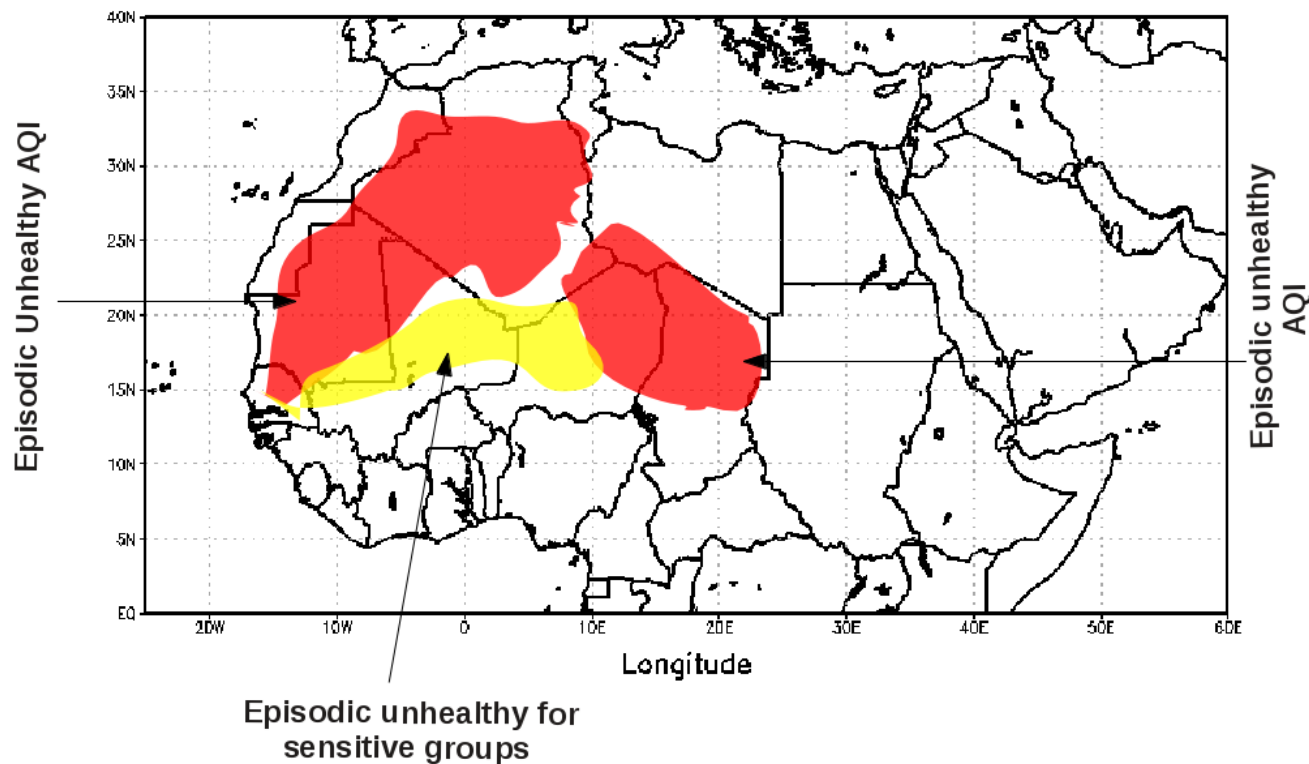


Moistening/rain over Southeastern Senegal, southern Mali, Burkina Faso, western Niger, Gulf of Guinea countries, southern Chad and southern Sudan

4. How the product is developed

Impact of dust on health

Forecast valid from 24th to 30th May 2021





4. How the product is developed

Criteria for the red vigilance

Health services strengthen
meningitis surveillance,
immunisation and systems

very favorable atmospheric conditions for meningitis
epidemics

Criterion	Relative humidity at 1000 hPa	$RH \leq 20 \%$
	Temperature at 1000 hPa	$T_{air} \geq 27 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sd_c \geq 400 \text{ } \mu\text{g m}^{-3}$



4. How the product is developed

Criteria for the orange vigilance

Favorable atmospheric conditions for meningitis cases

Health services to activate the
meningitis surveillance and systems

Criteria	Climat and dust metrics	Ranges
1	Relative humidity at 1000 hPa	$RH \leq 20 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} \leq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sdc \geq 400 \text{ } \mu\text{g m}^{-3}$
2	Relative humidity at 1000 hPa	$RH \leq 20 \%$
	Temperature at 1000 hPa	$T_{air} \geq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$150 \leq sdc < 400 \text{ } \mu\text{g m}^{-3}$
3	Relative humidity at 1000 hPa	$20 \leq RH \leq 40 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} \leq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$150 \leq sdc < 400 \text{ } \mu\text{g m}^{-3}$
4	Relative humidity at 1000 hPa	$20 \leq RH \leq 40 \%$
	Temperature at 1000 hPa	$T_{air} \geq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$150 \leq sdc < 400 \text{ } \mu\text{g m}^{-3}$
5	Relative humidity at 1000 hPa	$20 \leq RH \leq 40 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} < 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$150 \leq sdc < 400 \text{ } \mu\text{g m}^{-3}$
6	Relative humidity at 1000 hPa	$20 \leq RH \leq 40 \%$
	Temperature at 1000 hPa	$T_{air} \geq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sdc \geq 400 \text{ } \mu\text{g m}^{-3}$
7	Relative humidity at 1000 hPa	$20 \leq RH \leq 40 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} < 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sdc \geq 400 \text{ } \mu\text{g m}^{-3}$

4. How the product is developed

Criteria for yellow vigilance

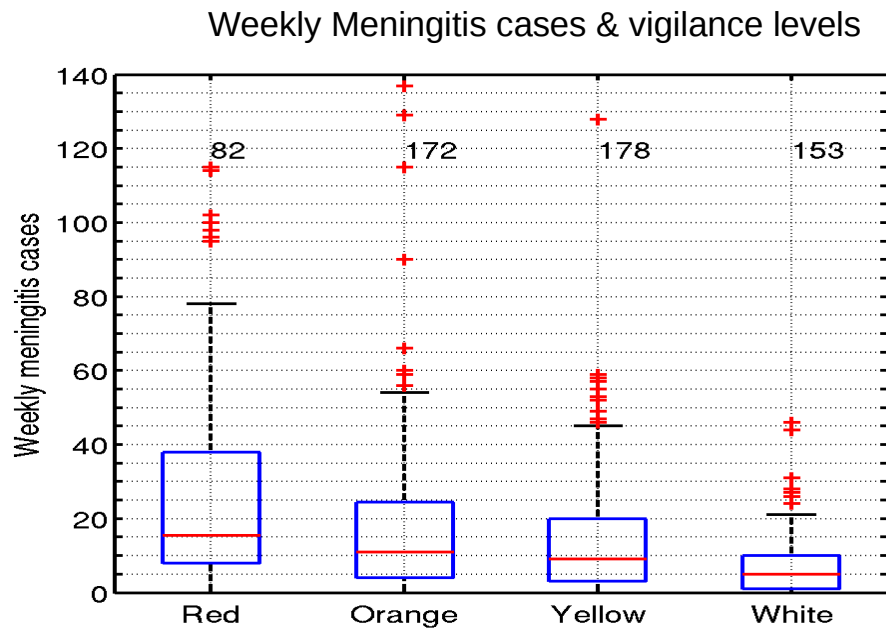
Atmospheric conditions less favorable for meningitis cases

Atmospheric conditions predicted are not favourable for the occurrence of meningitis cases.

Criteria	Climat and dust metrics	Ranges
1	Relative humidity at 1000 hPa	$RH \leq 20 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} \leq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sd_c < 150 \text{ } \mu\text{g m}^{-3}$
2	Relative humidity at 1000 hPa	$RH \leq 20 \%$
	Temperature at 1000 hPa	$T_{air} \geq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sd_c < 150 \text{ } \mu\text{g m}^{-3}$
3	Relative humidity at 1000 hPa	$20 \leq RH \leq 40 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} \leq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sd_c < 150 \text{ } \mu\text{g m}^{-3}$
4	Relative humidity at 1000 hPa	$RH > 40 \%$
	Temperature at 1000 hPa	$T_{air} \geq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$sd_c \geq 400 \text{ } \mu\text{g m}^{-3}$
5	Relative humidity at 1000 hPa	$RH > 40 \%$
	Temperature at 1000 hPa	$T_{air} \geq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$150 \leq sd_c \leq 400 \text{ } \mu\text{g m}^{-3}$
6	Relative humidity at 1000 hPa	$RH > 40 \%$
	Temperature at 1000 hPa	$27 \leq T_{air} \leq 30 \text{ }^{\circ}\text{C}$
	Surface dust concentration	$150 \leq sd_c \leq 400 \text{ } \mu\text{g m}^{-3}$

5. Details of the evaluation conducted in this product

Meningitis forecasts evaluation



Good performance of the forecasts

Vigilance levels captured the intensity of meningitis cases

Challenges

Large resolution of the forecast data ($1.5^\circ \times 1.5^\circ$)

Red vigilance over uninhabited or inaccessible area in the meningitis belt

Meningitis cases are reported at country level with discontinuity

Specificity of meningitis transmission (close contact)



6. Documentation of code and script used to generate the product

- Matlab was used to compute a two dimensional mask of meningitis alerts defined with three levels of vigilance.
- Python on jasmin to compute the means of S2S forecasts
- Grads software is used to produce the vigilance map and all figures included in this bulletin.



References

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Thank you for your attention !

This work was supported by UK Research and Innovation as part of the Global Challenges Research Fund, grant number NE/P021077/1.