Needs and Requirements for Forecasting African Atmospheric Dust

Wassila M. Thiaw

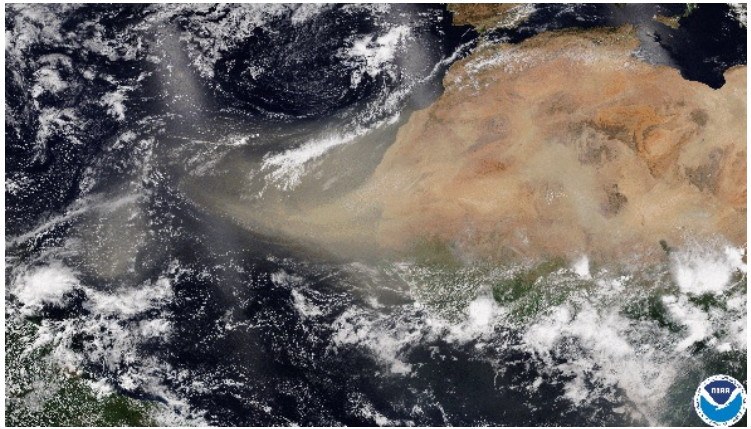
Climate Prediction Center

National Centers for Environmental Prediction

National Weather Service

Workshop on a Pilot Design for Air Quality in Africa, Virtual, 8 – 11 June 2021

Africa's Dust Problem



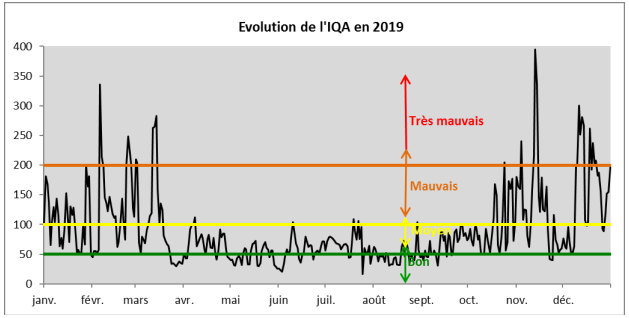
Satellite image of dust plume across Africa

- Dust particles consisting of a wide variety of pollutants and chemical compositions play a major role in air pollution

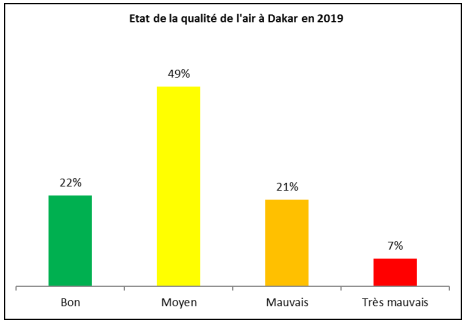
- Increases in dust over the past several years have been observed in Africa
- Africa has the highest exposure and vulnerability to dust.
- Little awareness that the presence of elevated PM concentrations have adverse impacts on air quality and weather or climate phenomenon.
  - AQ action plans in many of the western countries
  - No such initiative in Africa: Lack of reporting resulting in gap in knowing thresholds that trigger dust-related morbidity

Senegal CGQA – ANACIM Collaboration – Air Quality Forecasting

Seasonality of atmospheric pollution

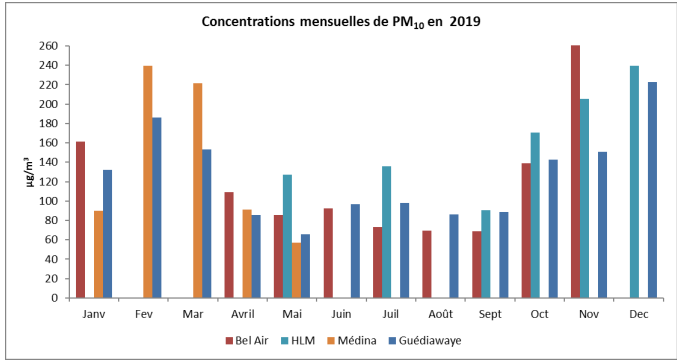


State of Air Quality

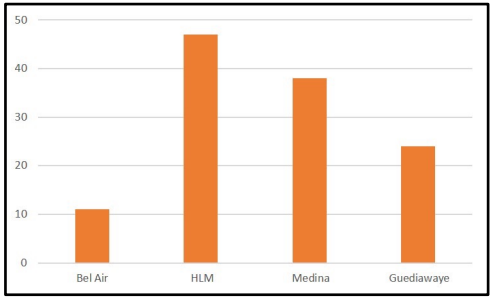


- Centre de Gestion de la Qualite de l'Air: Senegal government body responsible for monitoring AQ and for issuing warnings and advisories related to AQ.
- Agence Nationale de la Meteorologie: Senegal government body responsible for weather forecasting and for issuing warnings and advisories

Evolution of PM10 concentrations



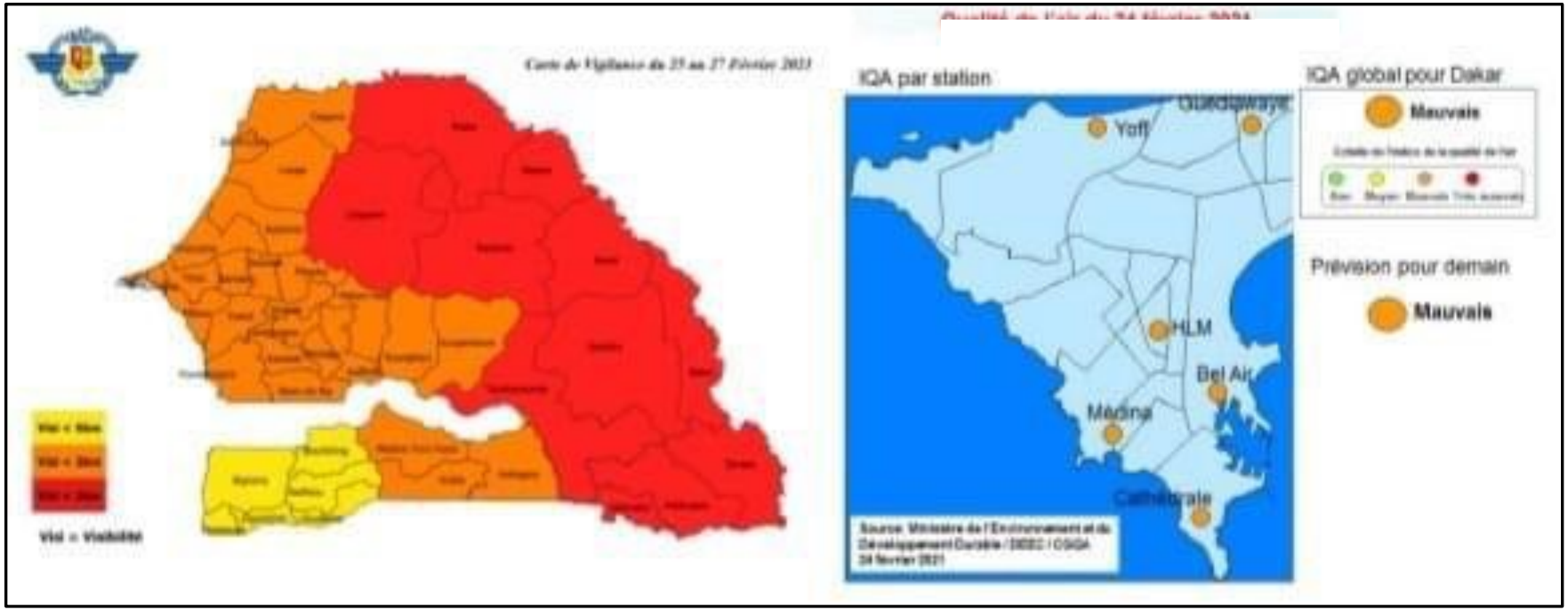
PM Exceedance Thresholds (%)



Annual PM10 concentrations high and largely exceeded WHO threshold values of 20 µg/m3.

Senegal CGQA – ANACIM Collaboration – Air Quality Forecasting

Dust and Air Quality Alert



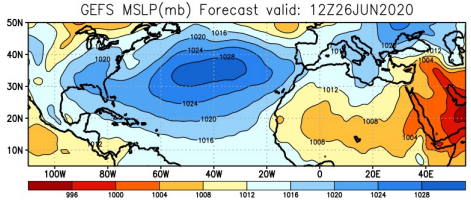
Features: dust forecasts; current state of dust concentration; impact on AQ

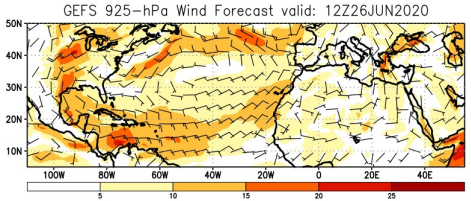
NOAA's CPC International Desks Forecast Tools

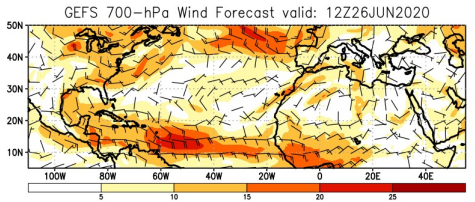
- Provide access to real time weather and climate forecasts:
  - 925-hPa wind: Dry source mostly northeasterly to easterly across the Sahel
  - Wind speed: The stronger the wind, >10ms^{-1}, the higher the dust concentration
  - 700-hPa wind: Steering flow mostly northeasterly to easterly
  - MSLP: To identify the heat low and look for conditions that fuel dust.
  - Navy NGCAC model Optical Depth guidance combined with wind forecasts to monitor the evolution of dust across Africa and the Atlantic Ocean: https://www.nrlmry.navy.mil/aerosol_web/loop_html/globaer_sahara_loop.html#
- Uses Navy PM concentration model guidance
- Issue dust forecasts as part of training in the African Desk

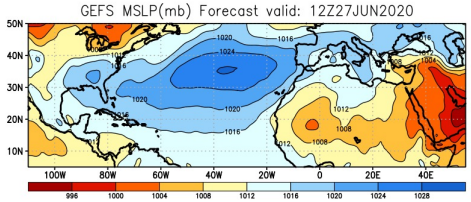
NOAA's CPC International Desks Forecast Tools

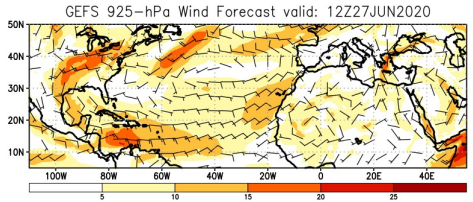
NCEP Forecast Tools, 26 – 28 June 2020

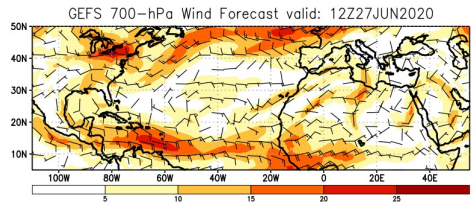


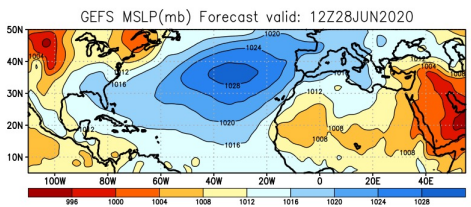


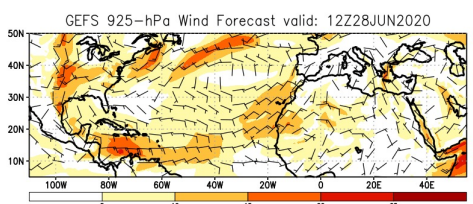


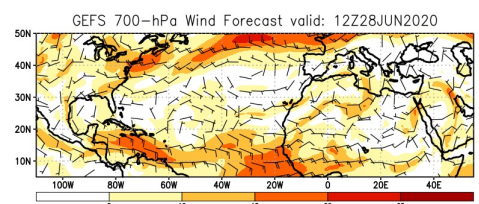




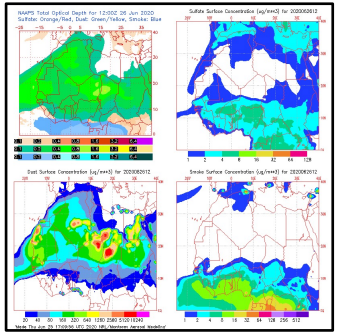


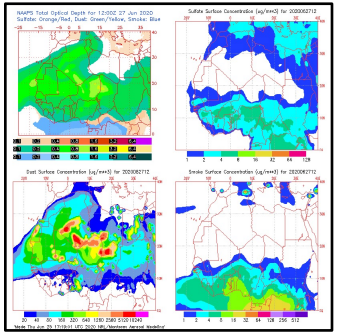


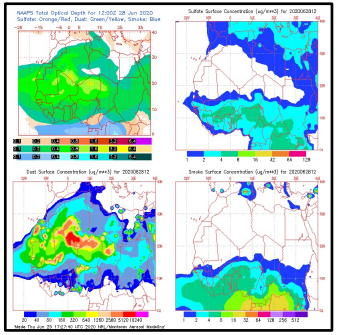


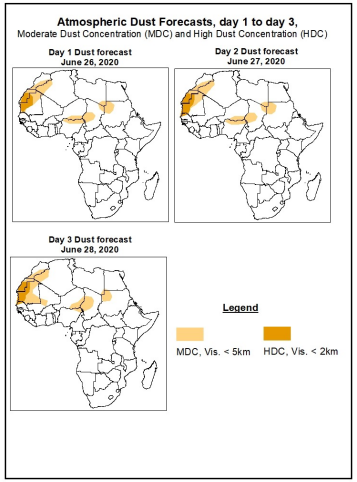


NOAA's African Desk Dust Forecasts

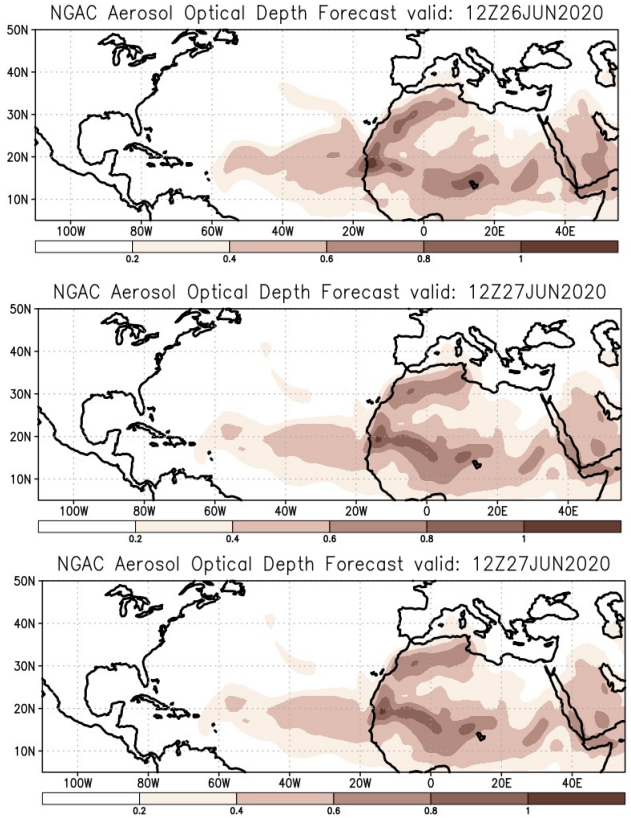






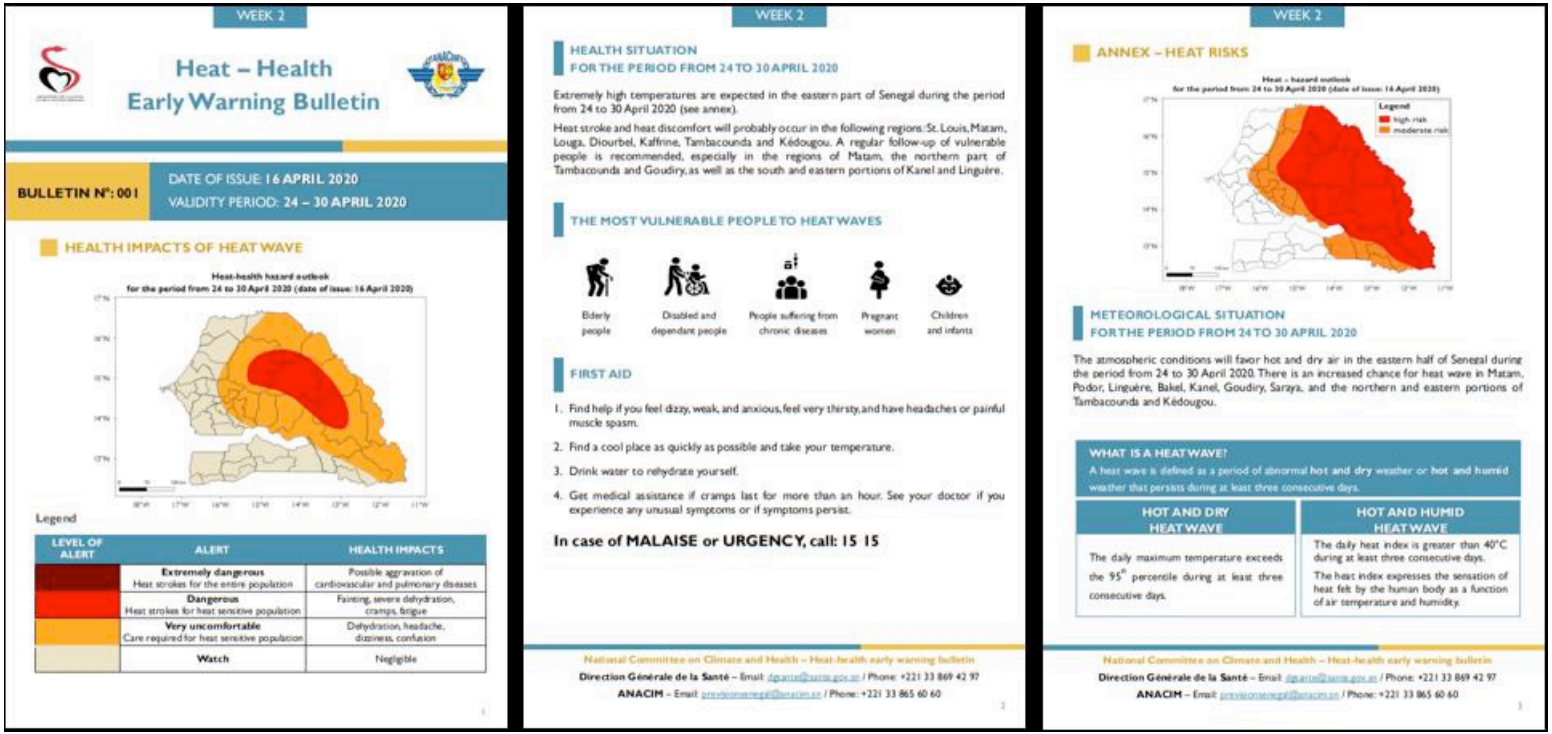


- NCEP model guidance
- Navy model outputs
- Forecasts shared with NMHS
- ANACIM uses forecasts as guidance
- Co-produces AQ bulletin with CGQA



NOAA – ANACIM – DGSP – CGQA Partnership

Prototype Heat Hazards Bulletin for Senegal



WEEK 2

Heat – Health
Early Warning Bulletin

BULLETIN N°: 001

DATE OF ISSUE: 16 APRIL 2020
VALIDITY PERIOD: 24 – 30 APRIL 2020

HEALTH IMPACTS OF HEAT WAVE

Heat-health hazard outlook
for the period from 24 to 30 April 2020 (date of issue: 16 April 2020)

Legend

LEVEL OF ALERT	ALERT	HEALTH IMPACTS
	Extremely dangerous Heat strokes for the entire population	Possible aggravation of cardiovascular and pulmonary diseases
	Dangerous Heat strokes for heat sensitive population	Fainting, severe dehydration, cramps, fatigue
	Very uncomfortable Care required for heat sensitive population	Dehydration, headache, dizziness, confusion
	Watch	Negligible

WEEK 2

HEALTH SITUATION
FOR THE PERIOD FROM 24 TO 30 APRIL 2020

Extremely high temperatures are expected in the eastern part of Senegal during the period from 24 to 30 April 2020 (see annex).

Heat stroke and heat discomfort will probably occur in the following regions: St. Louis, Matam, Louga, Diourbel, Kaffrine, Tambacounda and Kédougou. A regular follow-up of vulnerable people is recommended, especially in the regions of Matam, the northern part of Tambacounda and Goudiry, as well as the south and eastern portions of Kanel and Linguère.

THE MOST VULNERABLE PEOPLE TO HEAT WAVES

Elderly people | Disabled and dependant people | People suffering from chronic diseases | Pregnant women | Children and infants

FIRST AID

1. Find help if you feel dizzy, weak, and anxious, feel very thirsty, and have headaches or painful muscle spasm.
2. Find a cool place as quickly as possible and take your temperature.
3. Drink water to rehydrate yourself.
4. Get medical assistance if cramps last for more than an hour. See your doctor if you experience any unusual symptoms or if symptoms persist.

In case of MALAISE or URGENCY, call: 15 15

National Committee on Climate and Health – Heat-health early warning bulletin
Direction Générale de la Santé – Email: dgante@sante.gov.sn / Phone: +221 33 869 42 97
ANACIM – Email: previsionsenegal@anacim.sn / Phone: +221 33 865 60 60

WEEK 2

ANNEX – HEAT RISKS

Heat – hazard outlook
for the period from 24 to 30 April 2020 (date of issue: 16 April 2020)

Legend
high risk
moderate risk

METEOROLOGICAL SITUATION
FOR THE PERIOD FROM 24 TO 30 APRIL 2020

The atmospheric conditions will favor hot and dry air in the eastern half of Senegal during the period from 24 to 30 April 2020. There is an increased chance for heat wave in Matam, Podor, Linguère, Bakel, Kanel, Goudiry, Saraya, and the northern and eastern portions of Tambacounda and Kédougou.

WHAT IS A HEAT WAVE?
A heat wave is defined as a period of abnormal hot and dry weather or hot and humid weather that persists during at least three consecutive days.

HOT AND DRY HEAT WAVE	HOT AND HUMID HEAT WAVE
The daily maximum temperature exceeds the 95th percentile during at least three consecutive days.	The daily heat index is greater than 40°C during at least three consecutive days. The heat index expresses the sensation of heat felt by the human body as a function of air temperature and humidity.

National Committee on Climate and Health – Heat-health early warning bulletin
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Co-Production of Health Alerts

Environmental health scientist (left) and meteorologist (right) during training in the African Desk, February - June 2020

BULLETIN N°: 001

DATE DE DIFFUSION : **02 JUIN 2021**

PERIODE DE VALIDITE : **DU 02 AU 08 JUIN 2021**

RISQUES D'IMPACTS SANITAIRES DE LA VAGUE DE CHALEUR

Carte d'impacts sanitaires de Vagues de chaleur sur le Sénégal
Valide pour la période du 02 au 08 juin 2021 (établie le 01 juin 2021)

Légende

NIVEAU DE VIGILANCE	ALERTE	IMPACTS SANITAIRES
	Très dangereux Coup de forte chaleur possible	Aggravation possible des maladies cardio-vasculaires et pulmonaires
	Dangereux Coup de chaleur possible	Epuisement, syncope, déshydratation sévère, crampes
	Très inconfortable Attention aux personnes vulnérables	Déshydratation, étourdissements, maux de tête, vertiges
	Surveillance	Négligeable

Next Steps

- Assess model errors in depicting circulation anomalies associated with dust
- Evaluate the performance of the Navy model in predicting PM concentrations
- Explore the influence of physical modes of variability and their interactions to help advance dust forecasting
- Improve dust forecasts, transition to operations, and transfer knowledge to meteorological services in Africa
- Work with meteorological services, health and environmental services to accelerate the establishment of dust – health early warning systems

Thank you.

Wassila.thiaw@noaa.gov