CASE STUDY 6E

USING CLIMATE INFORMATION TO PREDICT AND CONTROL MENINGITIS EPIDEMICS IN WEST AFRICA

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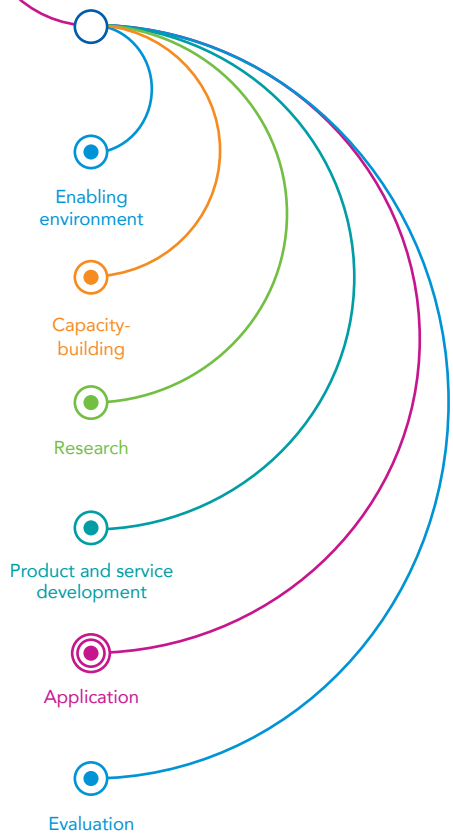


CONTEXT

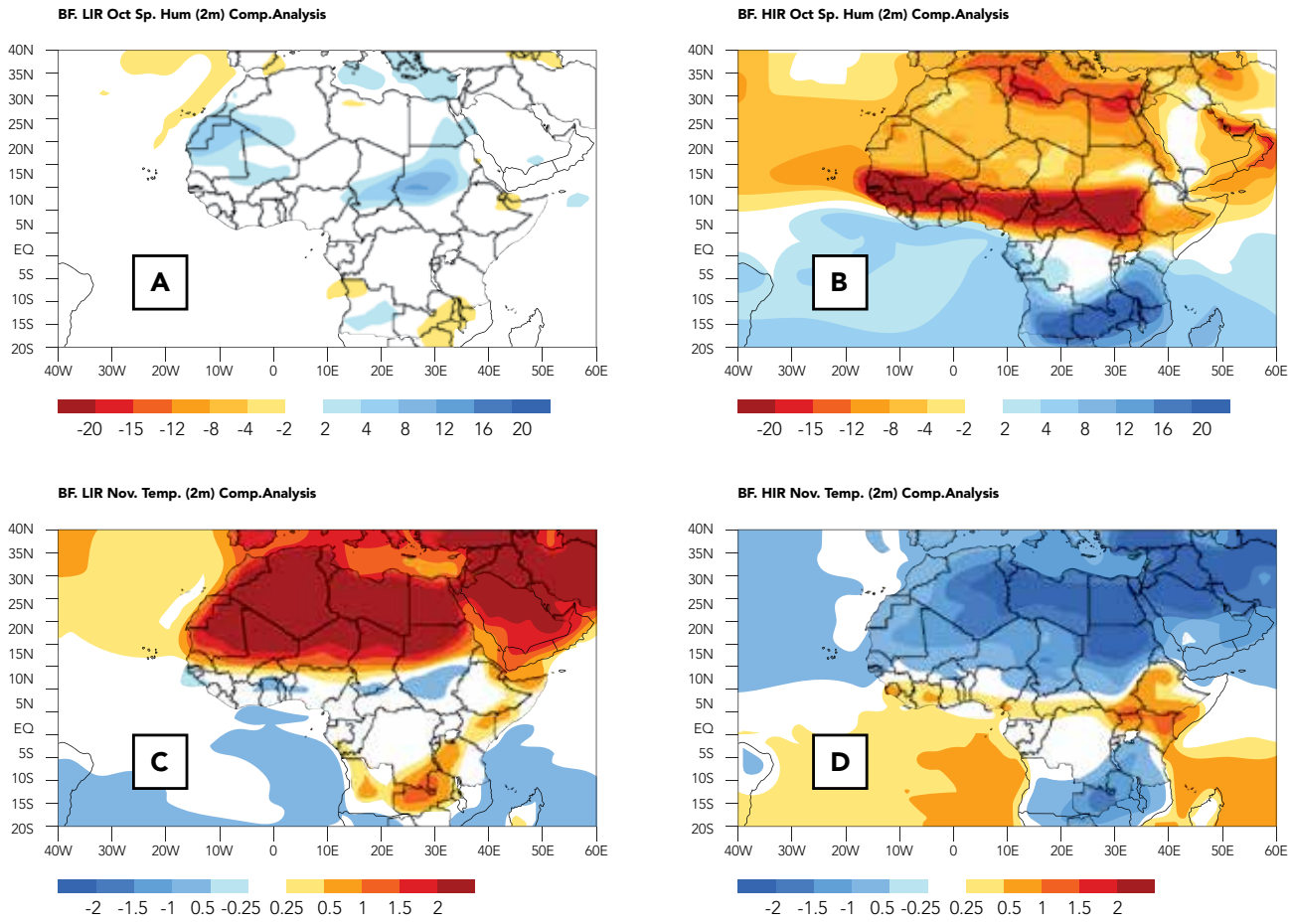
Meningococcal meningitis (MCM) is a contagious infection disease caused by the bacteria *Neisseria meningitis*. MCM epidemics occur worldwide but the highest incidence is observed in the 'meningitis belt' of sub-Saharan Africa, stretching from Senegal to Ethiopia. The severity of the MCM epidemics varies from year to year with the number of cases in the region ranging from 25 000 to 250 000. Children under 15 are particularly affected. Mortality rates average around 10%, with 10 to 20% of survivors affected by serious neurological repercussions.

The factors behind these epidemics are not fully understood but are known to involve a complex interplay of social interactions, new bacterial strains, population vulnerability, asymptomatic carriers and environmental conditions. Climatic conditions are also considered to be important in influencing the seasonality and interannual fluctuations of MCM outbreaks, which is roughly circumscribed to the ecological Sahelo-Sudanian band.In fact, MCM epidemics usually occur during the dry, hot and dusty season (February–April), and end with the onset of rains (rainy season).

NEW APPROACHES

Climate data from national synoptic stations, re-analysis data from the National Centers for Environmental Prediction (NCEP), and annual epidemiological data from the World Health Organization (WHO) and the Burkina Faso Ministry of Health have been used to identify statistically significant links between the severity of MCM epidemics and climate variability. In particular, time-lag relationships between climate anomalies and epidemic outbreaks have been established *(35)*.

Figure 6.11 Anomaly composite of specific humidity during low MCM incidence rate period (a); high MCM incidence rate period (b); air temperature during low MCM incidence rate (c); and during high MCM incidence rate (d).



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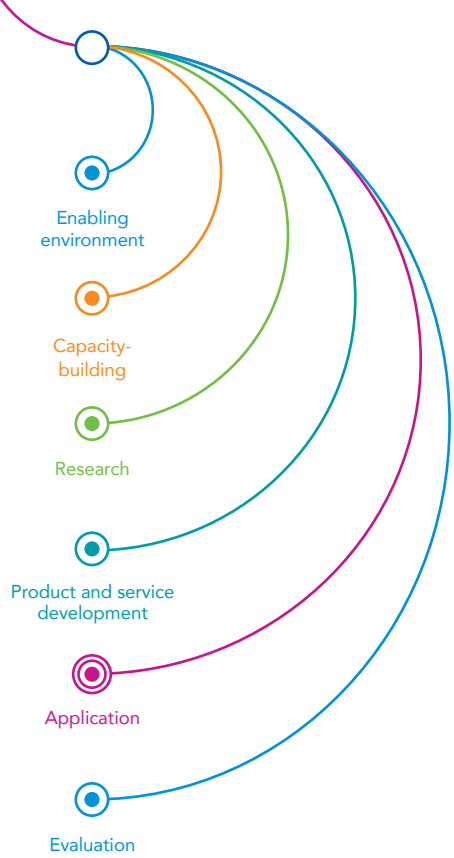


BENEFITS AND LESSONS

One of the key findings of this study is that enhanced easterly winds (Harmattan) at the beginning of the dry season, particularly the meridional component of the wind over Burkina Faso in October, and over Niger in November and December, have been associated with MCM epidemic outbreaks during the following year *(35)*. In addition, composite analysis of specific humidity and air temperature from October to December revealed specific patterns typical of MCM high incidence rate (HIR) and low incidence rate (LIR) occurring in Burkina Faso (BF) and Niger the following years *(36)*.

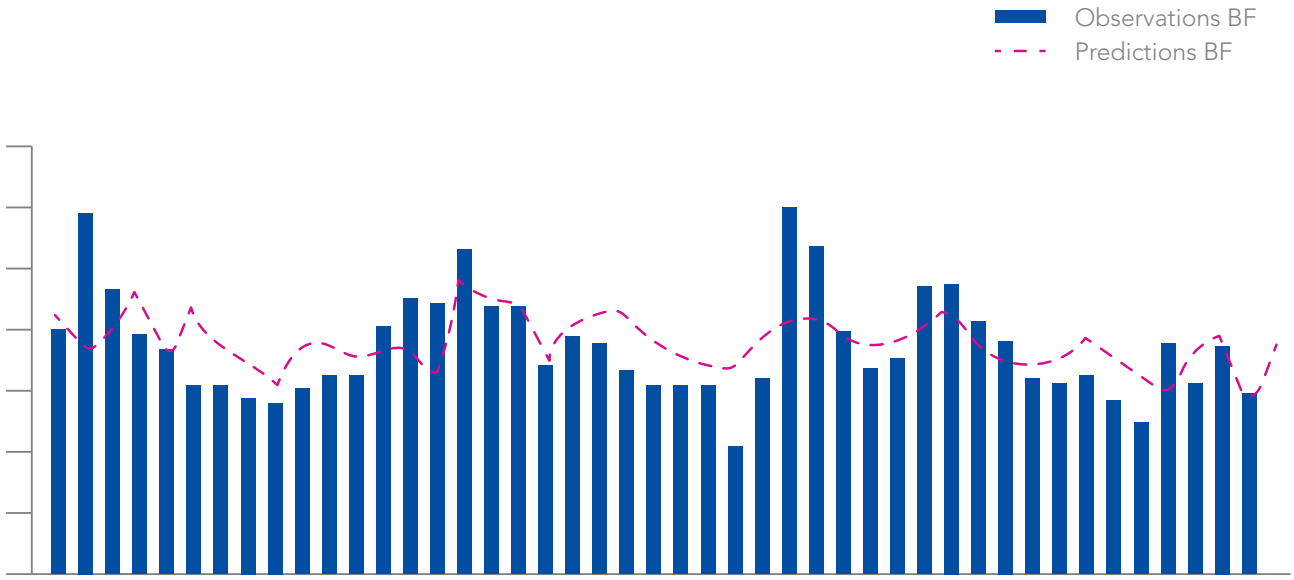
This study has resulted in experimental predictions of MCM outbreaks in Burkina Faso. A national Working Group on Climate and Health, consisting of professionals from several scientific disciplines and various sectors including civil society organizations, has been established in Burkina Faso. With support from the Laboratory of Ocean and Climate Science: Experimentation and Numerical Approach and the National Oceanic and Atmospheric Administration's Climate Prediction Centre, predictions of MCM incidence in Burkina Faso are made annually before the onset of the outbreak season, usually in December *(35)*. Health and climate professionals and students have been trained on building and updating the forecast models that link climatic factors and meningitis. An evaluation of the performance of the forecast model is also carried out each year.

Figure 6.12 A child in Burkina Faso received the recently approved meningitis vaccine. Photo credit: WHO/Barry Rodrigue.

Both forecasts and verifications are made available to the public in a bulletin form and officially distributed to the national authorities in charge of health, climate, environment, nongovernmental organizations, financial and technical partners and decision-makers involved in the control of MCM epidemics and the promotion of climate-sensitive diseases studies *(36)*.

The forecasts are integrated into the national system of surveillance and early warning of MCM epidemic outbreak and contribute to reinforcing the strategies to control MCM epidemics. This is done through education, fundraising for vaccines, and putting staff and health equipment in place in case of MCM upsurge.

Figure 6.13 Meningococcal meningitis incidence rate predicted and observed in Burkina Faso from 1969 to 2014. The x-axis indicates the years and the y-axis the logarithm of MCM annual incidence The bar graph represents observed MCM logarithm incidence rate from 1969 to 2013 and the dashed line graph represents the predicted MCM logarithm incidence rate from 1969 to 2014.



ACKNOWLEDGEMENTS