DIRECTION GENERALE DE L'AVIATION CIVILE ET DE LA METEORO – LOGIE

Relationships between climate and year-to-year variability in meningitis outbreaks: a case study in Burkina Faso and Niger

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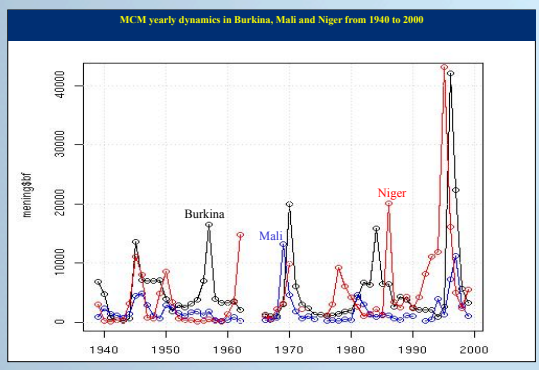
BACKGROUND

Every year, West African countries are afflicted with Meningococcal Meningitis (MCM) disease outbreaks. Although the seasonal and spatial patterns of disease cases which occur mostly during winter in the "meningitis belt" are closely linked with climate variability, the mechanisms responsible for these observed patterns are still not well identified. This is particularly true for the linkage between epidemic intensity from year to year and climate variability.

PURPOSE AND HYPOTHESIS

The objective of this study is to investigate the role of climate on the triggering of MCM epidemics by using a long-term dataset and to explore the possibility to include the climate conditions as a predictor of meningitis epidemics. To do so, we start by defining an *a priori* hypothesis on the causal link between climate and disease. Our hypothesis, based on literature, is as so : dry and windy weather conditions in early winter might cause damage to the mucous membranes of the respiratory system and/or inhibits mucosal immune and thus create propitious conditions to the triggering of MCM epidemics. According to this hypothesis, if the role of climate is strong enough, we should observe a positive correlation between the markers of these particular winter conditions (strong north-easterly wind, high pressure and dryness) and the MCM incidence.

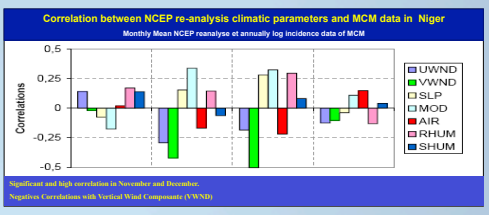


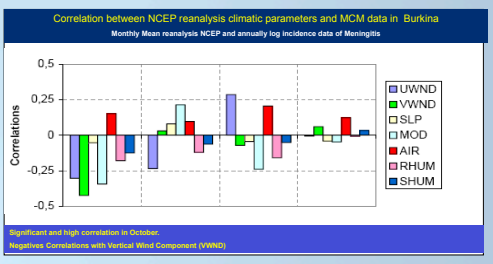
MATERIALS AND METHODS

Annual normalize cases of meningitis (1968-2005)from WHO website were used.
We select 7 variables that are likely to influence MCM disease outbreaks according to the literature: Wind velocity (zonal and meridional components, wind speed), sea-level pressure Surface temperature, specific and relative humidity near the surface.
The incidence of MCM has previously been correlated with dry and dusty conditions
For each country, we compute the correlation coefficients between each of the 7 atmospheric values for one month and the meningitis annual log-Incidence Rate of the country.

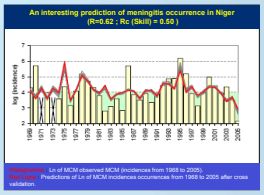
RESULTS

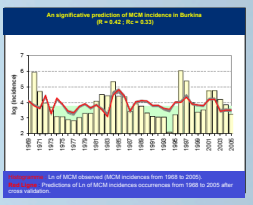
We found that disease resurgence in Niger and in Burkina Faso is likely to be partly controlled by the winter climate through enhanced Harmattan winds. Statistical models based only on climate indexes perform well in Niger, showing that 25% of the disease variance from year-to-year in Niger can be explained by the winter climate, but fail to represent accurately the disease dynamics in Burkina Faso.





CONCLUSIONS





The encouraging results of such simple models enable the development of a survey and an early warning system of MCM epidemics in African Sahelian countries. Although it points out significant statistical results it stresses the difficulty of relating climate to interannual variability in meningitis outbreaks. These outbreaks survey and forecast could help nationwide and international public health institutions to better control MCM disease.

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