PREDICTION OF MENINGOCOCCAL MENINGITIS INCIDENCE TREND IN BURKINA FASO AND NIGER FOR YEAR 2013

I. Background

In the case of activities of Burkina National Working Group on Climate and Health, and ongoing conjoint activities of Burkina Meteorological office, Health Protection General Department (Burkina Health Ministry), Laboratory of Ocean and Climate Science: Experimentation and Numerical Approach (LOCEAN-France) and African Desk - National Centre for Environmental Prediction (NCEP-United States of America), a prediction of the trend of meningococcal meningitis (MCM) incidence in Burkina Faso and Niger for year 2013 and an evaluation of what have been done in 2012 are established.

This prediction is based on two approaches: the first one on analyzing epidemiological data and medical information, of meningitis surveillance by Direction of fighting against Disease (DLM) from Burkina Ministry of Health.

The second one comes from statistical Multidimentional analyze between meningococcal meningitis (MCM) epidemiological data in Niger and Burkina Faso (from 1968 to 2005) and reanalysis I from National Centre of Environmental Prediction (NCEP). These data have been performed to show the relationships between climate and MCM incidence variability. It has been shown that MCM outbreak and upsurge case are mostly related to an enhancement of Easterly wind (Harmattan) of October in Burkina Faso, then, November and December in Niger.

So, MCM incidence trend prediction model in these two countries has been elaborated. The model skill has been attested by cross validation coefficient (0,50) and explained variance (0,25) for Niger, showing that 25% of MCM annual incidence total variance could be explained by the variability of climatic factors (meridional wind component).

For Burkina Faso, the cross validation coefficient is less high than Niger (0.33) but still significant. These models could be used to be integrated into a system of MCM incidence trend monitoring for early warning. This system should be performed by adding other predictors like socio-demographic, economical, biological and other risk

factors. For more information, read the article on the website: http://www.ij-healthgeographics.com/content/7/1/34 .

II. Prediction of meningococcal meningitis incidence trend in Burkina Faso for year 2013

II.1. Prediction based on climatic factors.

In 2013, by analyzing forcing of climate factors (essentially meridional wind component) on meningococcal meningitis (MCM) yearly incidence in Burkina Faso*, the amplitude (peak) of MCM epidemic should be intermediate* (that's means intermediate to high and low meningitis epidemics amplitude frequently observed over forty passed years). Also, the epidemic amplitude (peak) could be slightly lower than what has been observed last year, in 2012 (see graph n°1).
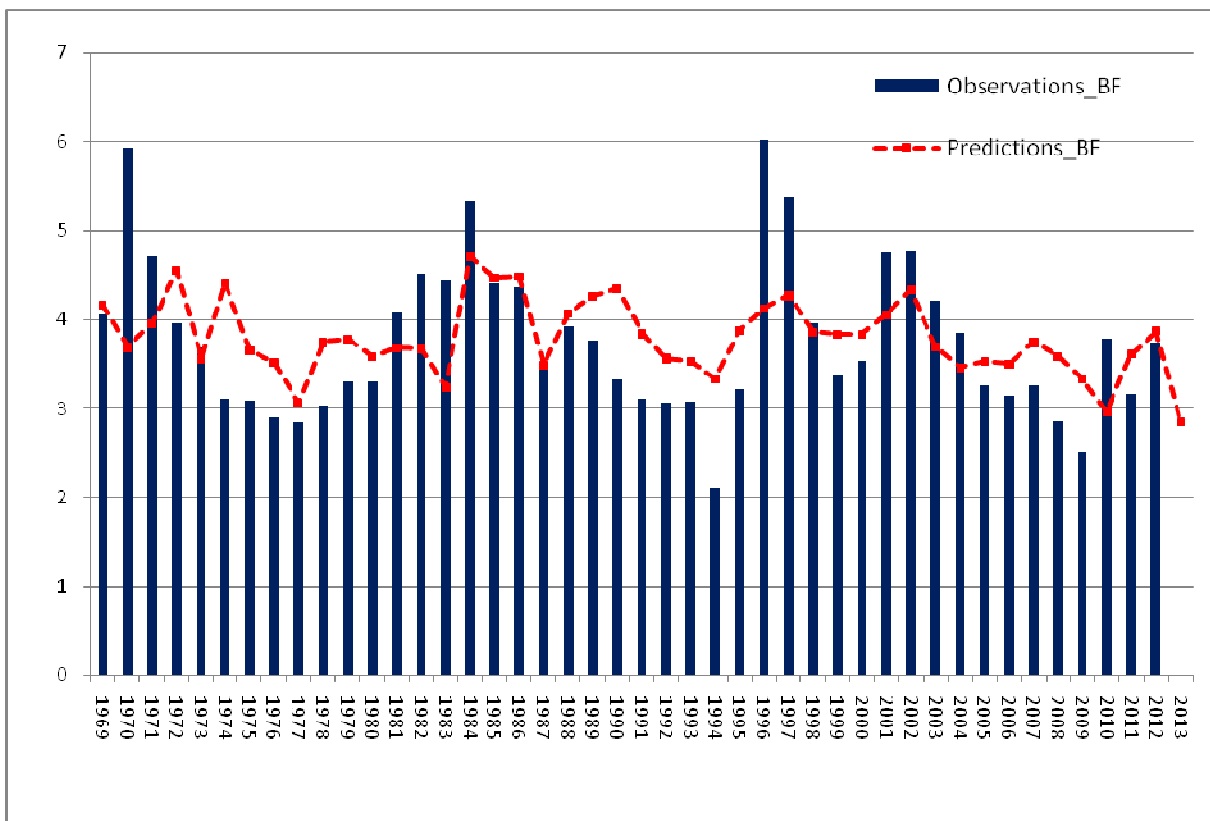
Graph n°1: Meningococcal meningitis incidence rate predicted and observed in Burkina Faso from 1969 to 2013. (years in abscissa and logarithm of MCM annual incidence rate in ordinate)

Histogram : Observed MCM logarithm incidence rate from 1969 to 2012.

Curved line: Predicted MCM logarithm incidence rate from 1969 to 2013
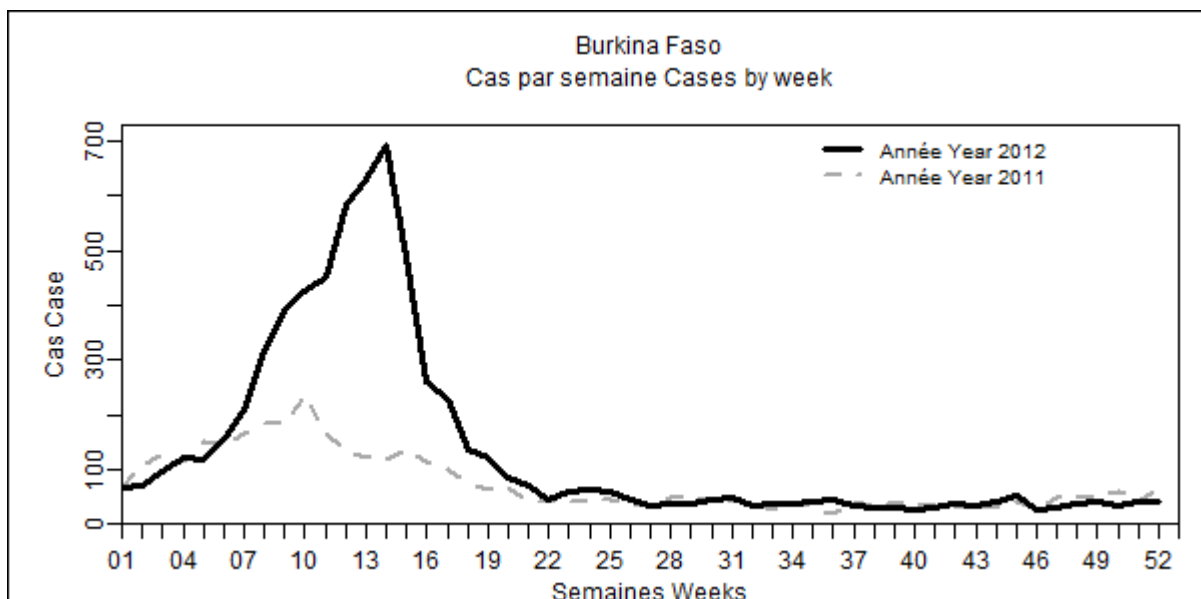
III. Evaluation of Prediction of meningococcal meningitis incidence trend in Burkina Faso for year 2012

III.1. Evaluation based on climatic factors

In this graph above (graph n°1), we remark that the MCM predicted and observed incidences values in 2012, are located in the median threshold, that's means between the threshold of separation of MCM low incidence rate (values below (log (MCM IR) = 3) and those of MCM high incidence rate (log (MCM IR) = 5).

That's significantly confirms the prediction made in the beginning of 2012, on the prediction of a MCM epidemic with intermediate amplitude (peak) in 2012. Also, in 2012, MCM incidence rate predicted and observed are quiet precise (see the values in graph n°1). Mention that the prediction of the MCM epidemic amplitude (peak) in 2012 slightly higher than what has been observed in 2011 has been confirmed.

In fact, in 2012, 6957 cases of meningitis have been registered by Health Services, comparing to 2875 cases in 2011. See the graph below (graph°2), weekly case of MCM in 2011 and 2012.

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Graph n°2 : Meningoccal Meningitis Cases by week in 2011 and 2012 in Burkina Faso. Source : Weekly feedback bulletin on cerebrospinal meningitis. World Health Organization, Regional Office for Africa.

IV. Prediction of meningococcal meningitis incidence trend in Niger for year 2012

IV.1. Prediction based on climatic factors.

In Niger, for 2013, by analyzing forcing of climate factors on meningococcal meningitis (MCM) yearly incidence, ***the amplitude (peak) of MCM epidemic should be intermediate*** (that's means intermediate to high and low meningitis epidemics amplitude frequently observed over forty passed years). Also, the epidemic amplitude (peak) could be higher than what has been observed last year, in 2012. (see graph n°3).
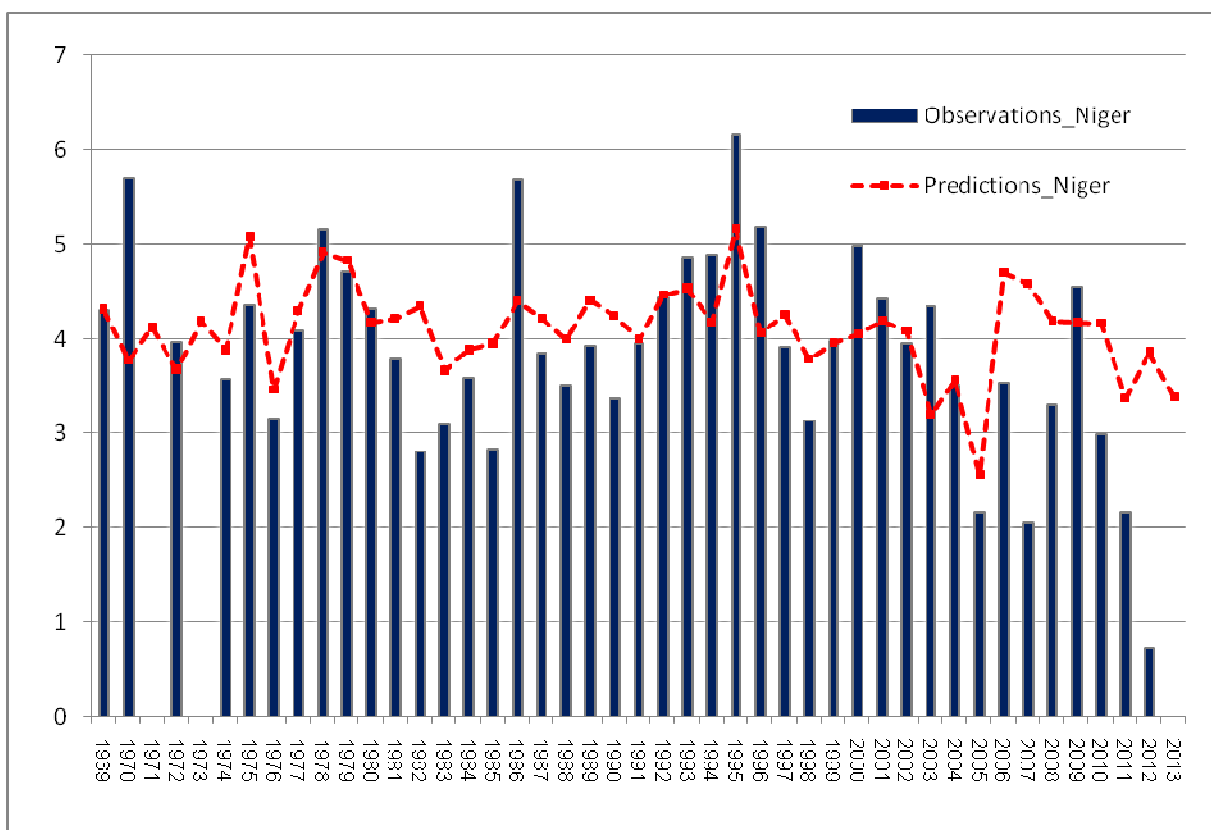
Graph n°3: Meningococcal meningitis incidence rate predicted and observed in Niger from 1969 to 2013. (years in abscissa and logarithm of MCM annual incidence rate in ordinate)

Histogram : Observed MCM logarithm incidence rate from 1969 to 2012.

Curved line: Predicted MCM logarithm incidence rate from 1969 to 2013

V. Evaluation of Prediction of meningococcal meningitis incidence trend in Niger for year 2012.

V.1. Evaluation based on climatic factors.

By analyzing the graph above (graph n°3), we remark that MCM incidence logarithm predicted value for 2012, is located inside the threshold representing MCM very low incidence rate (values below (log (MCM IR) = 3).

So, the value of the MCM incidence in 2012 did not conform to the prediction made in the beginning month of 2012.

That proves that the prediction made at the beginning of 2012, predicting an intermediate MCM IR during 2012 is not accurate. The observed incidence rate is very low by comparison to what has been predicted. The prediction has overestimated the MCM incidence rate really observed.

In fact, in 2012, 314 cases of meningitis have been registered by Health Services, comparing to 1214 cases in 2011.