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Dust in the Wind and Public Health: Example from Mauritania

by

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KEYWORDS. — Air Quality; PM_{10}; Dust Storms; Horizontal Visibility; Sahara; Mauritania.

SUMMARY. — The Sahara largely contributes to the global injection of mineral dust into the northern hemisphere. Since the onset of the drought in the Sahel and the environmental degradation in the arid and semi-arid belts surrounding the Sahara, the frequency and intensity of dust storms have dramatically increased. It is now irrefutable that air pollution caused by large amounts of respiratory particulates or Particulate Matter less than 10 μm in aerodynamic diameter (PM_{10}) has numerous undesired consequences on human health. Air quality degradation far away from the African continent, in the US and in Europe, caused by high concentration of African dust is seen as a major health threat, although most of these countries are very distant from the Sahara. Surprisingly, no estimates of PM_{10} levels near the Saharan dust source are available. Based on horizontal visibility observations, which are reduced by the presence of dust in the atmosphere, PM_{10} levels are estimated at the station of Nouakchott, Mauritania, by using relations found in the literature. It appears that excessive concentrations of particles are very important, both in magnitude and frequency, as the 24-hour PM_{10} thresholds established by the US EPA National Ambient Air Quality Standards and the EU Limits Values for Air Quality were systematically exceeded. The average yearly concentration is far above air quality standards. These very high particulate levels are likely to represent an important public health threat and should be considered as a major environmental risk. In this paper we present a first comparison between monthly respiratory diseases data and PM_{10} concentrations due to dust storms.

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1. Introduction

Growing populations and unsustainable land-use practices are causing the world's deserts to expand, swallowing previously productive lands and placing millions of lives in jeopardy. According to the United Nations' Millennium Ecosystem Assessment, desertification threatens dry land areas that make up 34 % of the Earth's total land area and are home to about two billion individuals. It is occurring all around the globe, but has dramatic impacts in vulnerable developing countries, including many countries in western Africa. In these areas, pressure from population growth, climate change, and poor agricultural practices can cause these fragile ecosystems to become degraded. This degradation can cause massive dust storms, famine, mass migration, and political instability, all of which may contribute to significant health problems in affected regions. To draw attention to this growing problem, the United Nations has declared 2006 the International Year of Deserts and Desertification. In recognition of this year, the United Nations will work to raise awareness of the problems caused by this phenomenon and encourage local governments to take steps to protect or restore dry lands by implementing sustainable land management strategies. In the framework of the International Conference on "Desertification: Migration, Health, Remediation and Local Governance", the purpose of this paper is to make an overview of health impacts of dust storms globally, and to focus on this thematic in West Africa, a region where this topic is unstudied.

The Sahara largely contributes to the global injection of mineral dust into the northern hemisphere (PROSPERO *et al.* 2002, WASHINGTON *et al.* 2003). Yet it is estimated that the Sahara and its margins yearly inject amounts of dust into the atmosphere varying between 600 and 900 10^6 tons (D'ALMEIDA 1986, MARTICORENA *et al.* 1997, CALLOT *et al.* 2000), about half of the yearly global mineral dust production (GINOUX *et al.* 2004).

For the last decade, mineral dust has become a major topic in environment studies. The increase of aeolian processes observed in most arid and semi-arid areas of the world over the last decades is thought to be a response to environmental stresses and global climate change (TEGEN & FUNG 1995, LANCASTER 1996, ROSENFELD *et al.* 2001, OZER 2002). Since the onset of the drought in the Sahel and the environmental degradation in the arid and semi-arid belts surrounding the Sahara, dust storms' frequency and intensity has dramatically increased (OZER 2000, PROSPERO & LAMB 2003). This increasing formation of dust storms, in turn, could affect cloud formation and induce aridification of drylands (ROSENFELD *et al.* 2001). Since climate models used to simulate the future climate of the Sahel suggest that the dramatic droughts of the 1970s and 1980s may become permanent by 2050 as a result of increasing greenhouse gases (HELD *et al.* 2005), and as most indicators tend towards further degradation of the Sahelian environment (OZER & OZER 2005, HOUNTONDJI *et al.* 2006), dust storm processes are not foreseen to decline in coming decades.

In addition, there is a growing evidence that air pollution caused by increasing concentration of Total Suspended Particulates (TSP) and respirable particulates, *i.e.* those smaller than 10 μm (PM_{10}), have many local to global environmental and human-related consequences, most of which are adverse (GOUDIE & MIDDLETON 2001). Wind-borne dust may also carry bacteria, allergens and fungi (KELLOGG *et al.* 2004, PROSPERO *et al.* 2005) and can be contaminated with pesticides (O'HARA *et al.* 2000) or even radioactivity (PAPASTEFANOU *et al.* 2001).

Saharan dust is often transported far away from the sources (MIDDLETON & GOUDIE 2001). As a result, air quality deterioration caused by high concentrations of respirable African mineral dust has been reported in various regions of the world, such as the Canary Islands (VIANA *et al.* 2002), Spain (BALDASANO *et al.* 2003; RODRIGUEZ *et al.* 2001, 2003; SALVADOR *et al.* 2004; MORENO *et al.* 2005; VAUTARD *et al.* 2005), the United Kingdom (RYALL *et al.* 2002), the Middle East (ALPERT & GANOR 2001), the West Indies (RAJKUMAR & CHANG 2000) and the south-eastern United States (PROSPERO 1999).

2. Dust and Health: a Short Review

Such mineral particulate matter air pollution is a serious health threat in various regions of the world because it may promote respiratory infection, cardiovascular disease and other ailments (GRIFFIN & KELLOGG 2004, KUEHN 2006, OZER *et al.* 2006).

High concentrations in mineral PM_{10} are cause of morbidity and mortality. Yet, in Seoul, Korea, a close association between the Asian dust events and deaths from cardiovascular and respiratory causes (+ 4.1 %) suggests that persons with advanced cardiovascular and respiratory disease may be susceptible to dust storms (KWON *et al.* 2002). Similar results were obtained in Taipei, Taiwan, where an increase of 7.66 % of respiratory diseases (+ 1.12 % per 10 μg m^{-3} increase in PM_{10}) and 4.92 % of the total mortality (+ 0.72 % per 10 μg m^{-3} increase in PM_{10}) was recorded during Mongolian dust outbreaks (CHEN *et al.* 2004).

Other studies in Taipei and in Korea showed that Asian dust events are impacting on the respiratory symptoms of subjects with bronchial asthma (PARK *et al.* 2005, YANG *et al.* 2005a) and indicated a statistically significant association between Asian dust storm events and daily primary intracerebral haemorrhagic stroke admissions three days after the event (YANG *et al.* 2005b). Other works in Taipei demonstrated an association between Mongolian dust storms and clinic visits for conjunctivitis (YANG 2006), daily hospital admissions for cardiovascular disease (CHEN & YANG 2005), daily clinical visits for allergic rhinitis (CHANG *et al.* 2006). However, none of these associations were statistically significant.

In Australia, a number of dust events were significantly associated with changes in asthma severity, but general relationships could not be determined (RUTHERFORD *et al.* 1999). And as far as the Caribbean island of Trinidad, African dust clouds have been associated with increased paediatric asthma accident and emergency admissions (GYAN *et al.* 2005).

Regarding health impacts of dust storms in West Africa, little information is available in the literature. But this does not mean no problems are perceived by local populations. In forty-one villages across Niger, a survey was undertaken by BIELDERS *et al.* (2001) to assess farmers' views about the relative importance of perceived constraints to agricultural production. Against all odds, wind-erosion related health problems were of more concern than crop damage or loss of topsoil by wind erosion. Other studies on meningitis in Africa correlated the incidence of meningococcal disease with dry and dusty conditions (BESANCENOT *et al.* 1997, MOLESWORTH *et al.* 2003). The human health threat of mineral dust is therefore likely to be real, despite statistical evidence from West-African studies because particulate air pollution data are currently inexistent (WHO 2000, BALDASANO *et al.* 2003).

3. Data

Based on horizontal visibility measurements reduced by mineral dust in the air, PM_{10} concentration levels are estimated at Nouakchott, Mauritania, by using a strong relation found in the literature. Comparisons with air quality standards from various sources are realized and discussed. In addition, a first comparison between respiratory diseases and concentrations of particles due to dust storms will be presented.

The meteorological horizontal visibility is one of the elements worldwidely identifying air mass characteristics. In synoptic stations, horizontal visibility is observed on a hourly basis and defined as the greatest horizontal distance at which a black object of suitable dimensions, located near the ground, can be seen and recognized when observed against a background scattering of hydrometeors (rain, snow, fog, mist) or lithometeors (dust processes) (WMO 1992). Synoptic stations usually use enough targets (buildings, towers, mosques, etc.) with well-measured distance to the point of observation to estimate horizontal visibility. In the scope of this paper, we used data collected in Nouakchott-Airport, Mauritania, for the period 2000 to 2005.

The international synoptic surface observation code (SYNOP code, WMO 1996) allowed the identification of four classes of dust-related conditions:

- Dust being raised from the ground at the time of the observation (SYNOP codes 07 and 08) and reducing horizontal visibility to less than five kilometres (blowing dust).
- Dust storms resulting from turbulent wind systems entraining particles of dust into the air, at various degrees of intensity (SYNOP codes 09 and 30 to 36) reducing horizontal visibility to below one kilometre.
- Dust suspended in the air but not being raised from the ground at the time of observation (SYNOP code 06), remnants of earlier deflation events reducing horizontal visibility to less than five kilometres. Dust deposition is noticed at the time of the observation.
- Haze (SYNOP code 05, presumably caused by dust) reducing horizontal visibility to less than ten kilometres. In this case, no dust deposition is observed, which suggests that dust particles have been raised from the soil at a considerable distance away.

Further detailed information on dust-related conditions used in the literature can be found in OZER (2000).

Only dust processes reducing horizontal visibility to five kilometres and below were taken into account. Horizontal visibility data were selected on a three-hourly basis, *i.e.* at 03:00, 06:00, 09:00, 12:00, 15:00, 18:00, 21:00 and 24:00 UTC. Other horizontal visibility data were not used because only one target is available above this distance and may induce large imprecision.

Monthly health data related to Acute Respiratory Infections (ARIs) were made available from the *Direction de la planification, de la coopération et des statistiques du Ministère de la Santé et des Affaires Sociales* (MSAS) for Mauritania in 2003.

4. Methods

4.1. RELATION BETWEEN HORIZONTAL VISIBILITY AND TSP OR PM10

Very few studies on the relation between horizontal visibility and PM_{10} levels of mineral dust mass concentration were carried out in West Africa.

Here, we will refer to previous works of D'ALMEIDA (1986) to estimate PM_{10} mineral dust mass concentration. D'ALMEIDA (1986) made a correlation analysis linking observed aerosols turbidity, horizontal visibility and mineral dust mass concentration. This was developed on a turbidity network based on eleven stations set up in the Sahara, in the Sahelian belt and in the surrounding southern area during two years (1981 and 1982). Used visibilities range from 200 metres to 40 kilometres and the obtained relation is:

$$C_{PM10} = 914.06\ VV^{-0.73} + 19.03 \qquad (r^2 = 0.95) \qquad [Eq.\ 1]$$

where C is the PM_{10} concentration in $\mu g.m^{-3}$ and VV is the horizontal visibility in kilometre.

Comparative suspended mineral dust concentration data for atmospheric dust processes linked with visibility measurements are very scarce in the literature. Reduced visibility to 1.9 km during a yellow sand storm in Kwangju, Korea, was associated with PM_{10} concentrations of 602 $\mu g\ m^{-3}$ (KIM *et al.* 2001). For this visibility reduction, D'ALMEIDA's relation estimates a concentration in PM_{10} of 591 $\mu g\ m^{-3}$.

This relationship (Eq. 1) is applied to the visibility data of Nouakchott-Airport in order to retrieve PM_{10} estimates. Obtained results are presented at the daily, monthly and derived yearly scale.

4.2. AIR QUALITY REGULATIONS

Several guidelines and regulations have been adopted to define air quality levels. The World Health Organization (WHO) considers Guideline Values (GV), the US Environmental Protection Agency (EPA) defines the National Ambient Air Quality Standards (NAAQS), and the EU labels the Limit Values for Air Quality (LVAQ). A recent compilation of the air quality regulation status around the world has shown that no such criteria exist in Africa (BALDASANO *et al.* 2003).

For annual average PM_{10} concentrations, the current strictest value is 40 $\mu g\ m^{-3}$ in the EU and in New Zealand. Elsewhere, when regulations exist, the limit is usually established at 50 $\mu g\ m^{-3}$. In the EU, the limit value of annual PM_{10} will be lowered to 20 $\mu g\ m^{-3}$ in 2010.

For daily particulate matter, Total Suspended Particulates (TSP) concentration has been one criterion to monitor air quality in developed countries during the 1980s and the 1990s and is still used in many developing countries where PM_{10} concentration measurements are not undertaken.

For PM_{10}, the EU-LVAQ is the strictest limit, with 50 $\mu g\ m^{-3}$ not to be exceeded thirty-five days per year and seven days per year from 2010. Other 24-hour standard concentrations range from 100 to 150 $\mu g\ m^{-3}$ (BALDASANO *et al.* 2003). In the USA, the EPA-NAAQS established that the 150 $\mu g\ m^{-3}$ threshold cannot be exceeded more that once per year, averaged over three years. In addition to these daily limits, the US EPA developed the Air Quality Index (AQI) as a tool to provide people with timely and easy-to-understand information on local air quality and on whether it poses a health concern (US EPA 1999). As shown in table 1, the AQI scale has been divided into six categories, each corresponding to a different level of health concern. The first two AQI categories (good and moderate, < 155 PM_{10} $\mu g\ m^{-3}$) have no impact on health, while the last AQI category (hazardous, > 424 PM_{10} $\mu g\ m^{-3}$) is associated with a serious risk of respiratory symptoms and aggravation of lung disease, such as asthma, for sensitive groups, and with respiratory effects likely in general population.

Table 1

US EPA Air Quality Index (AQI), associated 24-hour PM_{10} ($\mu g\ m^{-3}$) concentration, and related health effects (US EPA 1999)

AQI Category	AQI Values	PM_{10} ($\mu g\ m^{-3}$)	Health Effects
Good	0-50	0-54	None.
Moderate	51-100	55-154	None.
Unhealthy for sensitive groups	101-150	155-254	Increasing likelihood of respiratory symptoms and aggravation of lung disease, such as asthma.
Unhealthy	151-200	255-354	Increasing likelihood of respiratory symptoms and aggravation of lung disease, such as asthma; possible respiratory effects in general population.
Very unhealthy	201-300	355-424	Significant increase in respiratory symptoms and aggravation of lung disease, such as asthma; increasing likelihood of respiratory effects in general population.
Hazardous	> 300	> 424	Serious risk of respiratory symptoms and aggravation of lung disease, such as asthma; respiratory effects likely in general population.

Estimated PM_{10} concentrations will be systematically compared with threshold values established by US EPA-NAAQS or EU-LVAQ.

5. Results

5.1. DAILY PARTICULATE MATTER CONCENTRATIONS DUE TO SAHARAN DUST

Estimated profiles of mean daily PM_{10} concentrations due to mineral dust processes are presented in figure 1 for Nouakchott-Airport for the years 2000 to 2005. Horizontal lines indicate the thresholds established for daily concentration.

The major number of affected days by low air quality mainly occurred from January to April, with 50.3 %, 55.2 % and 68.0 % of the yearly number of days above the 24-hour EU-LVAQ and US EPA-NAAQS PM_{10} regulations, and the hazardous air quality, respectively.

Frequency distribution of estimated daily PM_{10} concentration at Nouakchott-Airport is presented in figure 2. Results suggest that, on average, 67.7 % of days were free of mineral dust, with minimum and maximum frequencies of 62.2 % and 72.6 % observed in 2000 and 2001, respectively. Air

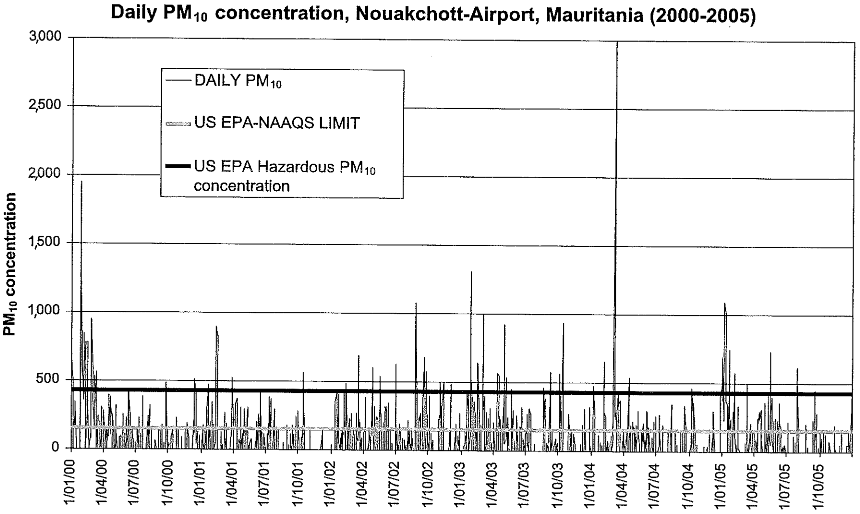

Fig. 1. — Variations of estimated daily mean concentrations of PM_{10} ($\mu g\ m^{-3}$) due to Saharan dust events at Nouakchott-Airport from 2000 to 2005.

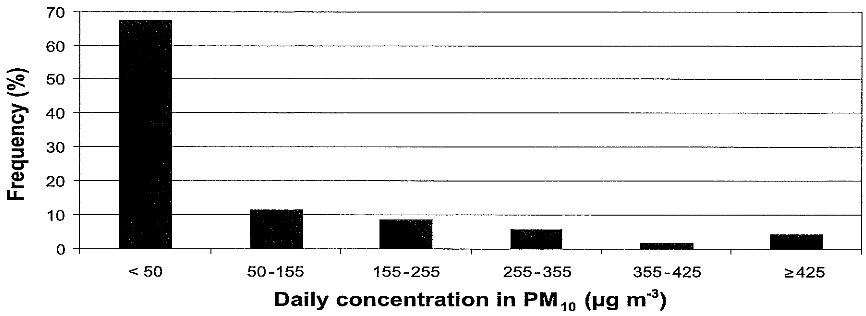

Fig. 2. — Distribution of the frequency of days with selected pollution gradients in PM_{10} ($\mu g\ m^{-3}$) that are associated with health effects (Nouakchott-Airport, 2000-2005).

quality is deteriorated all other days, with 11.6 % of days in the 50-150 $\mu g\ m^{-3}$ range. Compared with threshold daily PM_{10} concentrations established by the EU-LVAQ, the number of polluted days is, on average, 3.4 times above the permitted number of days with >50 $\mu g\ m^{-3}$, and 17 times higher than the legislation on air quality to come into force by 2010. Regarding the comparison with the US EPA-NAAQS, seventy-six days exceed the 150 $\mu g\ m^{-3}$ limit value, with minimum and maximum number of polluted days observed in 2001 (sixty days) and 2000 (eighty-seven days).

Compared with the US EPA-AQI, on average, thirty-one days (8.5 %) may be considered as unhealthy for sensitive groups, twenty-one days (5.7 %) as unhealthy, seven days (1.9 %) as very unhealthy and seventeen other days (4.6 %) may be qualified as hazardous. A total of 20.7 % of days was therefore likely to impact human health in Nouakchott during the 2000-2005 period because of the high frequency of mineral dust processes.

If hazardous air quality (> 424 $\mu g\ m^{-3}$) is on average met seventeen days per year, it varies from nine (2001) to twenty-two days (2000). More striking are the very large concentrations in PM_{10} that may be measured some days during severe dust storms. Yet, two relatively short episodes with extremely high density of PM_{10} are observed (fig. 1). One occurred on January 28 and 29, 2000, with PM_{10} concentrations of 1942 and 1531 $\mu g\ m^{-3}$, respectively. The second one was recorded on March 4, 2004, with a PM_{10} concentration of 2998 $\mu g\ m^{-3}$.

This huge PM_{10} concentration recorded on March 4, 2004, was due to a very large dust storm that is well documented by satellite images. On March 3, very strong winds carrying large quantities of dust were recorded in north-eastern Mauritania and northern Mali (fig. 3). This huge dust plume

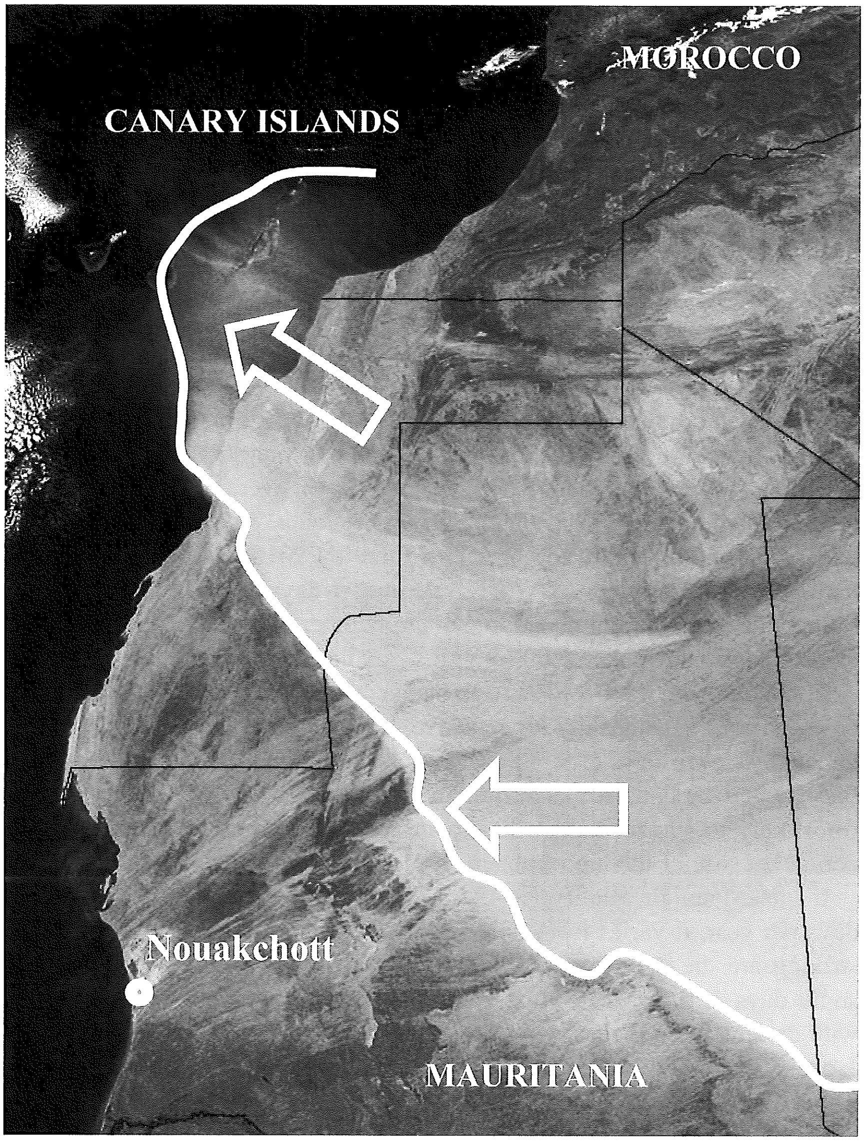

Fig. 3. — Aqua satellite image of the dust storm across western Sahara, March 3, 2004, acquired at 14:15 UTC (source: http://earthobservatory.nasa.gov/, WWW1).

reached Nouakchott on March 4, at 5:25 UTC, with horizontal visibility lower than 50 metres from approximately 8:00 to 16:00 UTC, with wind speeds reaching 12 m s^{-1}. Later that same day, Terra satellite image showed the progression of the Saharan dust off the west coast of Africa (fig. 4). This extraordinary dust storm did affect all West Africa, until Nigeria (WWW3), and was systematically associated with horizontal visibility below 200 metres.

Such very high concentrations are not uncommon during very dense dust storms. In the inland Niger delta region of central Mali, GILLIES *et al.* (1996) reported a daily atmospheric dust concentration of 13,735 μg m^{-3} measured during a dense dust haze. In Beijing, China, daily TSP concentrations greater than 4,000 μg m^{-3} were observed during explosive sandstorm (CHUNG *et al.* 2003b). Regarding daily PM_{10}, CHUNG *et al.* (2003a) recorded a 1,779 μg m^{-3} concentration in Chongwon-Chongju, Korea. In Beijing, PM_{10} concentrations above 1000 μg m^{-3} were reported during dust storms (FANG *et al.* 2003). In Kuwait, DRAXLER *et al.* (2001) measured PM_{10} air concentrations exceeding 1800 μg m^{-3} during severe dust storms.

5.2. MONTHLY AND SEASONAL PM_{10} VALUES DUE TO SAHARAN DUST

Monthly PM_{10} values estimated at Nouakchott-Airport for the 2000-2005 period are presented in figure 5. Results show that air quality degradation due to Saharan dust strongly varies during the year. A maximum value is recorded during the months of January to April, which concentrate 55 % of the annual mineral dust air pollution. Average monthly PM_{10} concentrations are above 100 μg m^{-3} with a maximum in January (146 μg m^{-3}) and a lower value in April (119 μg m^{-3}). A decline in dust activity usually starts in May to remain relatively low from June to December, with a minimum value in August (33 μg m^{-3}). A similar monthly pattern of estimated TSP and PM_{10} concentrations has been observed in Niamey, Niger, where the January-to-March period represents 61% of the annual mineral dust air pollution, with monthly values ranging from 160 to 200 μg m^{-3} in PM_{10} (OZER 2005). In Gouré, eastern Niger, monthly data showed a much higher PM_{10} concentration in January 1984 with 900 μg m^{-3}, but this was at the time of the great drought that affected all the Sahel (OZER *et al.* 2005).

Similar high monthly PM_{10} concentrations (100 to 200 μg m^{-3}) were measured in Iraq, Kuwait and Saudi Arabia during the dust season (DRAXLER *et al.* 2001). On the Aral Sea shore, monthly PM_{10} concentrations up to 400 μg m^{-3} were reported in August, the most intense sandstorm period (WIGGS *et al.* 2003).

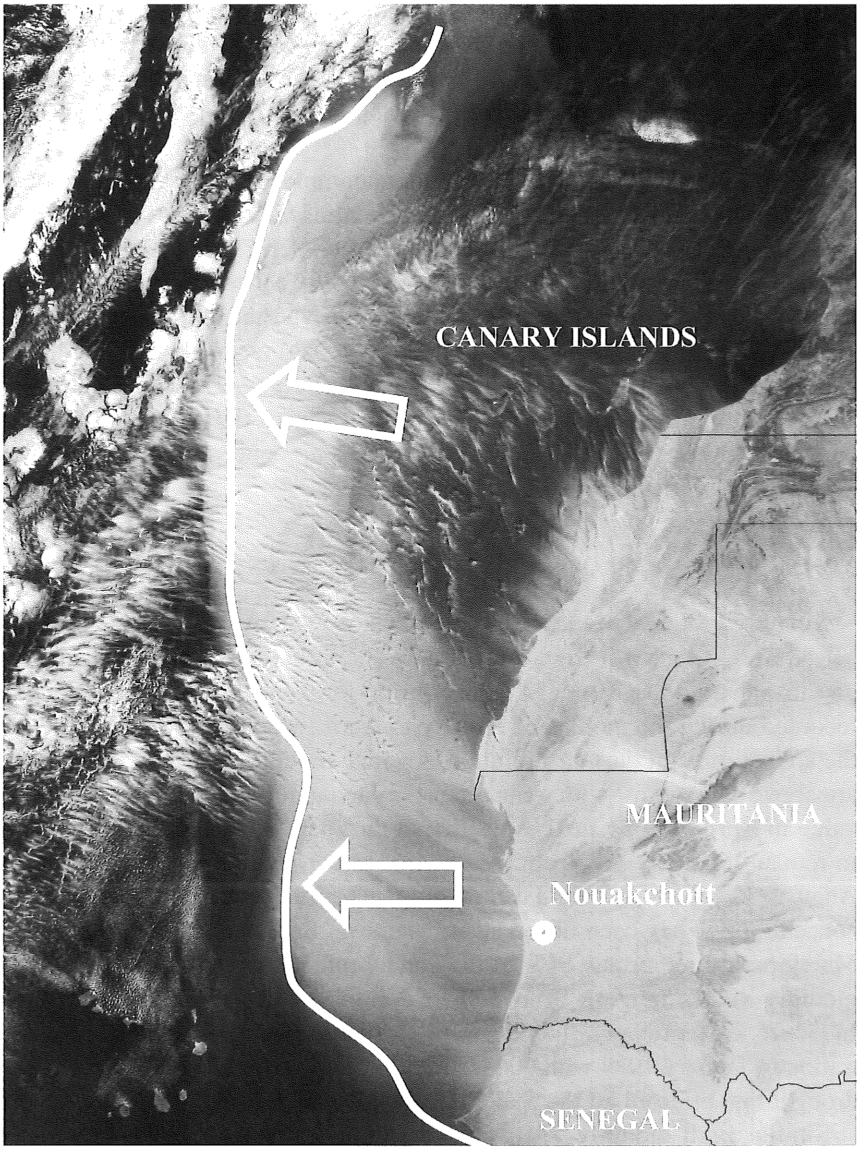

Fig. 4. — Terra satellite image of the Saharan dust off the west coast of Africa, March 4, 2004, acquired at 11:55 UTC (source: http://earthobservatory.nasa.gov/, WWW2).

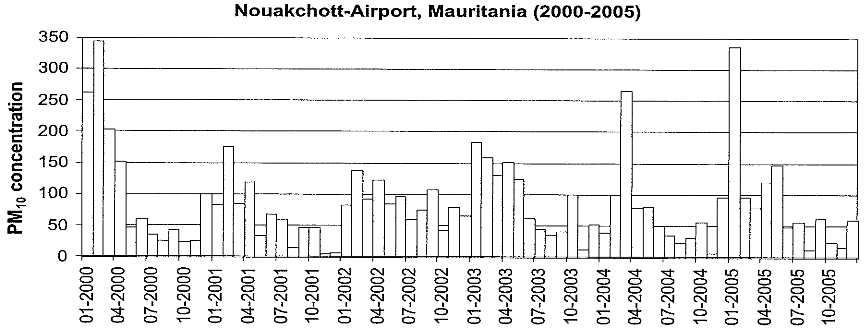

Fig. 5. — Monthly concentration in PM_{10} (μg m^{-3}) at Nouakchott-Airport from 2000 to 2005.

5.3. YEARLY PM_{10} VALUES DUE TO SAHARAN DUST

The average annual mean estimated PM_{10} concentration is 86 μg m^{-3} at Nouakchott-Airport for the 2000-2005 period only for natural dust exposure, with yearly variations from 108 μg m^{-3} in 2000 to 63 μg m^{-3} in 2001. This figure is far above the norms adopted in developed countries as it is almost twice the threshold value established by the US EPA-NAAQS and four times higher than the limit of the EU-LVAQ yearly mean PM_{10} concentration to come into force by 2010. No comparison can be made with other African data as no measurements are available in the recent compilations of air quality data (BALDASANO *et al.* 2003). However, estimated annual mean PM_{10} concentration from visibility impairments in Niamey, Niger, was 67 μg m^{-3} in 2003 (OZER 2005) and 344 μg m^{-3} in Gouré, Niger, during 1984 (OZER *et al.* 2005). From all annual mean PM_{10} concentrations reported by BALDASANO *et al.* (2003), only the city of Tegucigalpa, Honduras, exceeds the Nouakchott value with 157 μg m^{-3}. It is worth mentioning here that no records of PM_{10} concentration are available in arid regions from developing countries.

Such values do not estimate the urban air pollution of the city of Nouakchott, where the activities of rapid urban population growth (558,000 inhabitants in 2000 against 135,000 in 1977, WWW4) do produce large quantities of particulate matter. This urban air pollution mainly results from increasing traffic of old and badly-maintained vehicles on sandy roads, and from individual fires for cooking purposes.

6. PM_{10} Concentrations and Acute Respiratory Infections

Although adverse public health impacts of anthropogenically-derived particulate matter have been well documented, with measurable increases in both morbidity and mortality rates associated with high particulate matter pollution events, there is nothing in the literature for West Africa. In order to assess if dust storms are associated with significant risk to public health in Nouakchott, monthly health data related to Acute Respiratory Infections (ARIs) were made available for the year 2003, a normal year which recorded annual mean PM_{10} concentration of 92 μg m^{-3} and a maximum monthly PM_{10} concentration of 185 μg m^{-3} in January.

Figure 6 presents the association between PM_{10} concentrations and ARIs. Results suggest an augmentation of 2.79 % of ARIs per 10 μg m^{-3} increase in PM_{10}. Although the relation is not very strong (R = 0.60), this association could strongly improve if daily data on ARIs were available, but such data do not exist.

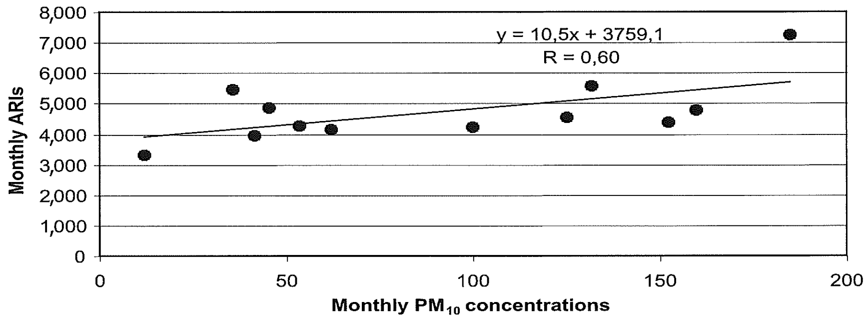

Fig. 6. — Association between PM_{10} concentrations (μg m^{-3}) and Acute Respiratory Infections (ARIs) at Nouakchott in 2003.

Comparison between PM_{10} concentrations and ARIs shows that the most dusty month of January is linked to a strong increase of ARIs as 7,253 people consulted health care officers, *i.e.* 53.4 % more than the monthly mean (4,727 people).

During Mongolian mineral dust outbreaks observed in Taipei, Taiwan, an augmentation of 1.12 % per 10 μg m^{-3} increase in PM_{10} was recorded for all respiratory diseases (Chen *et al.* 2004). Our data suggest a higher effect of PM_{10} on the ARIs.

A study of a Gobi desert dust event in the Greater Vancouver region of British Columbia, Canada, in the spring of 1998, showed that naturally-derived particulate matter is more benign than particulate matter of anthropogenic origin, and thus poses a low risk to health for the general public (BENNETT *et al.* 2006). But the maximum daily PM_{10} concentration only reached 47 $\mu g\ m^{-3}$ in the Vancouver region, while people living in Nouakchott breathe larger to much larger PM_{10} concentrations a hundred and eighteen days per year.

7. Conclusions

Developed countries are building up strategies in order to reduce air pollution. On the contrary, most African countries have neither air quality regulations, nor the tools to monitor air pollution. It is known that acute respiratory infections among children are one of the major causes of mortality in developing countries, especially in Africa (BLACK *et al.* 2003, ROMIEU *et al.* 2002, SMITH *et al.* 1999). However, no study of the impact of mineral dust on human health in West Africa has been carried out due to the lack of air quality data.

We have used estimations of PM_{10} concentrations derived from horizontal visibility observations as a first approach to assess the impact of mineral dust resulting from aeolian processes on air quality degradation in Nouakchott, Mauritania, during the 2000-2005 period.

A mean annual PM_{10} concentration of 86 $\mu g\ m^{-3}$, which dramatically exceeds all various norms established in developed countries, is alarming since only natural particulates are considered. The EU-LVAQ limit 24-hour PM_{10} concentration (>50 $\mu g\ m^{-3}$) was exceeded a hundred and eighteen days, *i.e.* seventeen times the legislation on air quality to come into force by 2010. The 150 $\mu g\ m^{-3}$ limit value established by the US EPA-NAAQS was exceeded seventy-six times, with seventeen days that may be qualified as hazardous according to the US EPA-AQI.

Regarding public health, our results suggest an augmentation of 2.79 % of acute respiratory infections per 10 $\mu g\ m^{-3}$ increase in PM_{10}.

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