CLIMATE CHANGE, WATER RESOURCES AND FOOD SECURITY IN MOROCCO

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SUMMARY:

The terrestrial climates affected by the climatic changes are constrained to be upset by the new mechanisms which manage global atmospheric circulation

The hot average latitudes to which Morocco belongs represent the places most vulnerable to the negative effects of this climatic upheaval considering their position of transition between the subpolar and subtropical climatic zones. The sector most affected by this situation in Morocco is WATER due to the prolonged and repetitive drought already observed at the end of this century. And this is because of the new geographical distribution of the cycle of the water which is set up in our latitudes, of the widening of the surface of the subtropical evapotranspiration which tends to accentuate the deficient hydrous balance in Morocco.

The water resources in Morocco depend mainly on the return of precipitations of the wet season (October ≅ April) where it could rain. These precipitation which know in our country an increased instability leave us in permanent concern with respect to the availability of this rare food product on which agriculture and food security in Morocco is based.

INTRODUCTION:

The impact of the climatic change on food security in Morocco is done through the water resources materialized by the availability of this rare and very valuable food product.

This drought in Morocco is a structural fact which influenced Moroccan civilization, by leaving its prints throughout the history of the country: mortality, epidemics, impoverishment, migration, displacement, degradation of the environment, …etc.

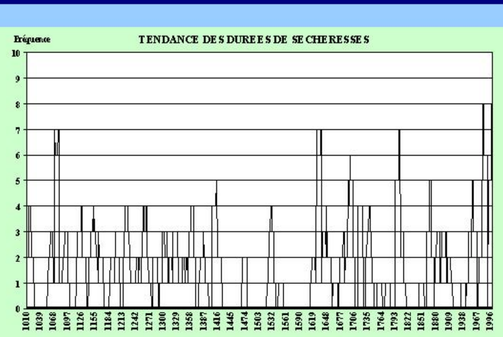

Fig. 1: Evolution of the Decennial Tendencies of the Durations of the Droughts in Morocco.

This climatic phenomenon is not recent in Morocco. The historical, dendrochronologic and weather sources inform us about devastating calamities, and social instabilities culminating in state crisis, which resulted from droughts (Fig. 1). During the past millennium, the last decade has known the longest drought ever observed before 8 years.

TELECONNECTIONS, GLOBAL ATMOSPHERIC CIRCULATION AND PREDICTING PRECIPITATIONS / DROUGHTS IN MOROCCO

For the last 100 years, precipitations in Morocco have known substantial variations and the fluctuations of the tendencies have also been relatively important (Fig. 2 and 3). These variations accompanied the great fluctuations by the extreme events observed on the planetary level, and more particularly in intertropical zone ENSO.

These events were reflected on the temperatures and especially precipitations in Morocco through the atmospheric circulation dominated by the energy transfers. These extreme fluctuations in the Pacific became more frequent these last decades and are characterized by an exceptional violence; just as the recent droughts in Morocco which were very heavy and catastrophic (1983, 1995, 2000), and their short interruption appeared by floods (1986, 1996, 1997). This increased instability of the ocean-atmospheric events puts the water resources in Morocco, agriculture and food security in danger.

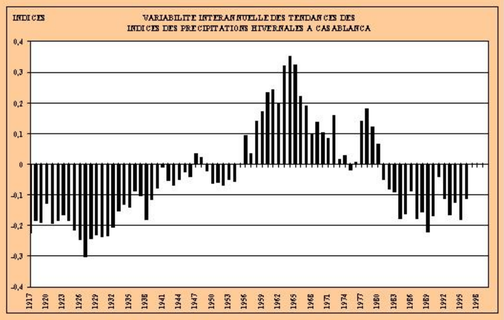

Fig. 2: Interannual variability of the Tendencies of Winter Precipitations in Casablanca

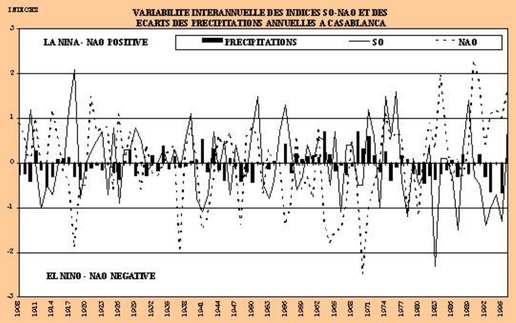

Fig. 3: Interannual variability of the SO, the NAO and Annual Precipitations in Casablanca

The precipitations in morocco are related directly to the North Atlantic Oscillation NAO, and which brings back the atmospheric undulations of the West to sweep the Moroccan North-Atlantic coasts, because of the swing of the pressures between Iceland and the Azores, both influenced by the anomaly of temperature of sea surface. At the same time, they are related to Southern Oscillation SO considering the strong relation between precipitations and event ENSO in the equatorial Pacific (Fig. 3).

It was noticed, according to the observations provided by TOPEX/POSEIDON satellite, the drought in Morocco coincide with the situations El Niño. The circumpolar current of West is tense and is located at the North of the Moroccan latitudes which prevents the passage of the disturbances of the polar face above Morocco. On the other hand, in the episode of La Niña, precipitations can reappear in Morocco, the disturbances of the polar face of West to reach the Moroccan latitudes.

CLIMATE CHANGE, PREDICTING PRECIPITATIONS, WATER RESOURCE AND FOOD SECURITY IN MOROCCO

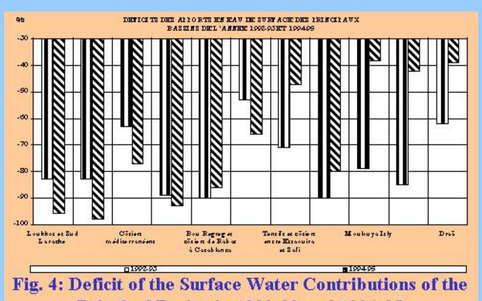

Fig. 4: Deficit of the Surface Water Contributions of the Principal Basins in 1992-93 and 1994-95

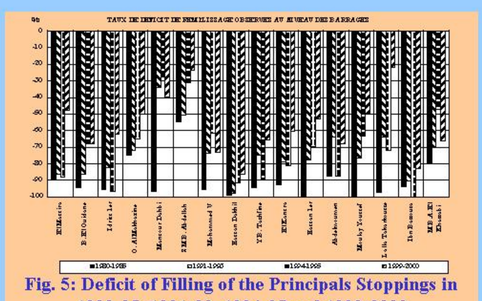

Fig. 5: Deficit of Filling of the Principals Stoppings in 1980-85, 1991-93, 1994-95 and 1999-2000

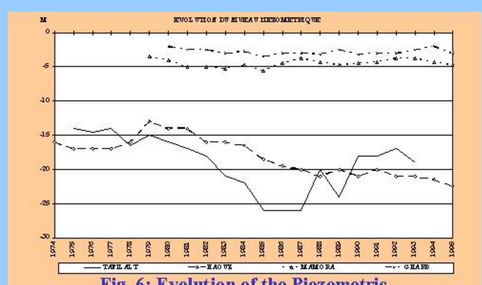

Fig. 6: Evolution of the Piezometric Level of Certain Tablecloths

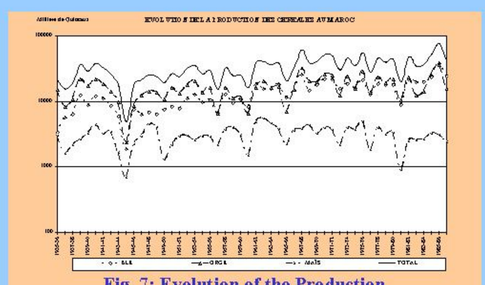

Fig. 7: Evolution of the Production of Cereals in Morocco

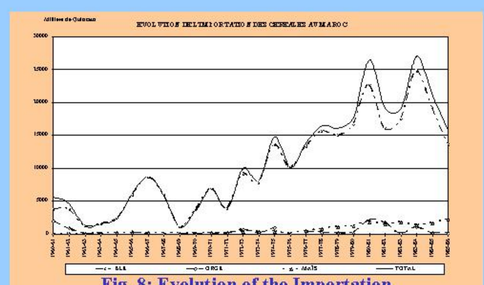

Fig. 8: Evolution of the Importation of Cereals in Morocco

The surface water resources in Morocco, estimated on average at nearly 30 billion M³, depend mainly on the invaluable precipitation of the wet season when it could rain. These precipitations which know an increased instability in our country leaves us in permanent concern with respect to the availability of this rare food product.

The average water surface flows in Morocco, are frequently affected by the drought that touches the country. More recently, the last drought lasted more than one score of years according to areas, and was marked by three great episodes of global drought in 1980-85, 1991-95 and 1998-2000, whose consequences were deeply felt. In Tangiers, an area considered as subhumid and wet, where annual average precipitations exceed the 750 mm, the hydrological situation in 1995 was most dramatic at the national level (Fig. 4), the dams of region were completely empty as from July 1995 (Fig. 5), and the drinking water supply of the town was secured only by means of the transfer of water by tankers. The hydroelectric energy production knew a very significant fall during these two droughts. These years knew the most negative rain assessments and left their traces on the economy related to the water of the country and the psychology of the population. According to testimonies of the population and the history of the observations, these two droughts were qualified as droughts of the century.

Underground water are not immune from the harmful influence of these droughts which the country has known, and undergoes a permanent fall of their piezometric level. The figure 6 summarizes the alarming situation of some tablecloths during the last drought.

The food security in Morocco materialized mainly in agriculture that represents between 13 and 20% of the GDP national according to periods, and 23% of the surface of the country of which 54% are occupied by the cereals. But this activity knows a continuous instability since it is related to pluviometry (rain agriculture).

The evolution of annual pluviometry in Morocco was accompanied systematically by the same evolution by the agricultural production, mainly cereal. The dry periods were always marked by a fall of the cereal production and livestock in Morocco, and this in spite of the great progress made on the level of the planning of the management of water and the remarkable increase in the number of dams and the techniques of breeding (Fig. 7).

These situations impose on Morocco the massive importation of these products for basic human consumption; hence, food dependence with respect to the outside, and which is not other than dependence with the climate (Fig. 8).