# LONG-RANGE FORECASTING AND THE SCIENTIFIC BACKGROUND TO JOSEPH'S INTERPRETATION OF PHARAOH'S DREAMS

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**ABSTRACT**

Long-range forecasting is today a major area of climate research. Such forecasts affect socio-economic planning in many fields of activity. There are essentially two approaches to long-range forecasting: one is based on solving the equations that govern atmospheric and ocean dynamics, the other on the statistical properties of past climate records. The present talk is based on the latter, statistical approach.

Joseph's interpretation of Pharaoh's dreams provides a striking example of long-range planning based on a climate forecast. Joseph interpreted the two dreams as a forecast for seven years of plenty, followed by seven of famine. Based on this forecast, he proposed to Pharaoh a plan for running the agriculture and economy of Egypt. It is not clear from the Biblical story why Pharaoh trusted Joseph's forecast and appointed him to implement the plan.

Our answer to this question is based on ancient and medieval Egypt's being entirely dependent on the Nile River's seasonal flooding: when the highest water levels did not cover the arable areas of the river valley, crops were insufficient to feed the population. When successive years of hunger weakened the economy and the state, change of rulers could, and sometimes did ensue. Extreme examples were the fall of the Old Kingdom in 2185 B.C. and the Fatimid conquest of Egypt in 969 A.D.

Hence the Egyptians measured the high-water mark of the Nile River for over 5000 years, using different tools. The most advanced of these tools was the nilometer; typical nilometers appear in several mosaics from the Roman and Byzantine period around the Mediterranean, such as the "Nile Festival" mosaic in Zippori (Upper Galilee), Fig. 1. The measurements had a twofold purpose: first to set the annual taxes, which were a function of the high-water mark, for obvious reasons; and second, to provide information for water management, with a view to reduce drought damage.

Our analysis of high- and low-water levels for 622–1922 A.D. shows that oscillations with a period of several years occur, with a 7-year oscillation being dominant. We suspect that the origin of this 7-year swing lies in the same periodicity being present in the North Atlantic's sea-surface temperatures and sea-level pressures. This North Atlantic Oscillation affects the climate of Europe, North America and the Middle East, and might be the ultimate reason for Joseph's successful climate forecast.


Figure 1: "**Nile River Festival"** -- The picture shows a Byzantine-period (5th century) mosaic from Sepphoris (today Zippori), in the Galilee (Northern Israel). It shows a man clambering to carve on a column ("nilometer") the level of “plenitude” (i.e., the mean high-water mark), namely 17 cubits ("IZ" in the Greek digits used at that time); at this level the irrigation ditches were opened and the Nile festival began. The Zippori mosaic seems to be the best-preserved one among several depictions of this Festival. Photographs taken and processed by Yigal Feliks.

## REFERENCES


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