PART 1: MAGNETIC INTENSITY AND GLOBAL TEMPERATURES: A STRONG CORRELATION

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EDITOR'S NOTE:

While GSAA does not generally report on scientific findings, the significances of the results presented in this paper concerning global security and resources are substantial. Whether global temperatures are caused by natural or anthropogenic means is irrelevant in the case of national, country, or corporate security. The ability to predict global temperatures as developed in this paper can seriously influence industrial and agricultural security decisions as well as those involving other global resources.

Increasing or decreasing global temperatures seriously influences global, continental, and (or) national resources. Small changes in global and continental ambient temperatures lead to climate and weather transformations that include — changes in the amount and pattern of precipitation that often result in drought, famine, and floods; changing frequency and severity of extreme weather events such as hurricanes, cyclones, tornados, etc.; and changes in agricultural requirements. Additionally, rising ambient-temperature trends lead to increased air- and water-borne diseases, sea level rise, and potable water-supply requirements.

Initially, recognizable environmental impacts owing to changing global, continental, and national ambient temperatures are a precursor only to the disastrous cascading or domino effects that occur in the future, such as the effects on agricultural crops yields, the availability of fresh water supplies, coastline flooding, salt-water intrusion, and animal habitat changes. Globally, many millions of people are subjected to the negative effects of ambient-temperature changes, particularly those that depend on local natural and agricultural resources for survival, such as those living in Darfur. Consequently, the ability to predict future global, continental, and national temperatures six to seven years into the future is a significant scientific finding that is of great importance to security and disaster preparedness professionals. As part of our mission, GSAA highlights some of the findings of this research and plans a two-part series submission on this topic, where PART 1 follows this discussion. PART 2 will focus specifically on global security issues and will appear in the September issue of GSAA.

— END OF NOTE —

PART 1

Global warming is a hotly debated issue in politics, science, and the media. Currently, science primarily points to anthropogenic green-house gas emissions as the cause. Are human activities solely responsible or are natural processes also involved? What of the strong relation between Earth's magnetic-field variability and global-temperature variability? During the 1970s, relations discovered between Earth's magnetic intensity and ambient temperatures (1) were refuted (2). However, analysis of better datasets using geostatistics and statistical-regression indicates global temperatures respond significantly to variations in Earth's magnetic-field strength.

Relations between magnetization and temperature show that a material's magnetic intensity decreases during heating (3). Earth's magnetic-field varies, but a decreasing trend has occurred over the past 100 years (4). Additionally, the area within a ferromagnet magnetization and hysteresis-curve, which is proportional to the driving energy delivered in one cycle, represents lost energy that is converted to heat as a magnetic field oscillates (3). As observed, Earth's magnetic-field strength oscillates year-to-year and decade-to-decade (4).

Magnet dynamics and theories that Earth's core processes are similar to the Sun's suggest that heat generated by Earth's great dynamo also oscillates. Although through geologic time, Earth has gradually cooled. Varying magnetic intensity suggests cyclic upwelling activity of mantle convection plumes; similar to sun-spot activity. Increasing core and mantle temperatures would not, however, result in instantaneous ambient-temperature increases. Mantle heat transferred through continental crusts, oceanic crusts (where the Earth's crust is thinnest and most upward heat flux occurs), and ocean waters to the surface takes time: hence, a lag period. (No attempt was made to quantify heat variability here).

In this work, global-average magnetic-intensity values were extracted from geostatistcally-generated grids of annual mean data (1958-2000) recorded at 143-191 globally-distributed stations (4). A polynomial equation (reasonably representing Earth's magnetic-field cyclicity) was fit (regressed) to calculated magnetic-anomaly data (normalized data computed from the 1961-1990 globally-averaged magnetic-intensity mean) and available temperature-anomaly data (5). The best-fit equation based on the highest coefficient of determination (R^2) occurred when temperature anomalies were advanced (lagged) seven years ahead of magnetic anomalies (Cross-Correlation, Fig1). Results show that 1958-2000 magnetic anomalies explained 79.2-percent ($R^2 = 0.792$ with $p < 0.01$) of the 1965-2006 Global Historical Climatology Network (GHCN) (5) temperature-anomaly variability (Series1, Fig 1).

As model verification, 1958-1993 magnetic anomalies were regressed against 1965-2000 temperature anomalies; while explaining only 68.5-percent ($R^2 = 0.685$ with $p < 0.01$) of temperature-anomaly variability. The resulting regression-equation coefficients were used to model 1958-2000 and predict 2001-2006 temperature anomalies (Series2, Fig 1). All computed temperature anomalies fell within the 95-percent confidence interval of Series1 values, thus further validating the model.

What about the unexplained variability? Neglecting errors in the temperature dataset, much of the unexplained variability is due to magnetospheric, atmospheric, and solar storms. However, these phenomena likely would increase magnetic-intensity values measured at the Earth's surface, thus masking an actual decrease. Additionally, sparse magnetic stations reduce interpolated-grid resolution.

Would there be noticeable effects due to decreasing magnetic-field strength? Earth's decreasing magnetic intensity results in, among others — increased solar irradiance (possibly the largest contributing error, although related to observed-temperature variability), which is an observed trend in 1979-2000 global-irradiance data; areas of increased geothermal gradients as reported in Southern Australia (6) and other areas, although slight; and, as reported, increased ocean temperatures, specifically, in the South Pacific and South Atlantic where much of the intensity decrease occurs (4).

Nevertheless, this research shows a natural process that explains 79-percent ($p < 0.01$) of global average-annual temperatures and reasonably predicts temperatures seven years into the future. As more data is added to the model, more global-temperature variability is explained and predictability improves. This research provides a tool that will help better manage global resources as related to temperature variability. Moreover, what are the implications for long-term global warming and international security issues regarding global resources?"

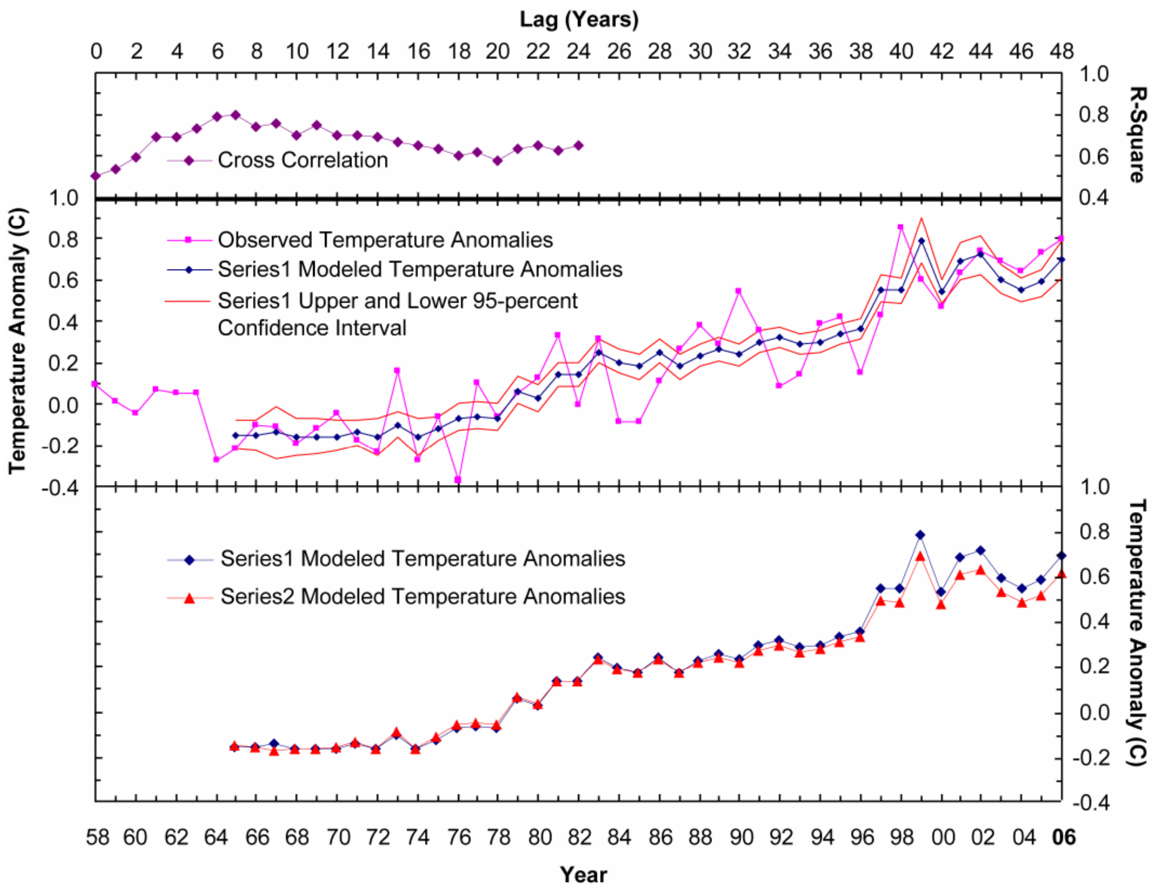

Figure 1: Coefficient of determination for cross-correlation (lag) intervals (upper pane) and observed and modeled temperatures versus year (lower two panes).

References

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