Earth-Ocean-Atmosphere Coupled Model Based on Gravitational Teleconnection

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Cross-correlations over great distances between time series of meteorological variables, such as sea level pressure (SLP), were realized in the early 1900's (Walker, 1924; Walker and Bliss, 1932; Wise, 1927). These linkages between weather anomalies were later called teleconnections. Extensive analysis of SLP and surface air temperature (SAT) has resulted in the discovery of three major oscillation systems or teleconnections around the globe. The most familiar are the Southern Oscillation (SO) associated with El Nino (ENSO), the North Pacific Oscillation (NPO) controlling fronts moving toward North America, and the North Atlantic Oscillation (NAO) exerting control over European weather patterns. Solar modulated ocean/atmosphere coupled models predict short-range weather phenomena adequately, but longer range climatic variability such as El Nino and global warming trends prove difficult to forecast accurately because they tend to be tectonically modulated.

By coupling geodynamic tectonic flow to ocean/atmosphere models based on principles of surge tectonics (Meyerhoff et al., 1992), we can incorporate the influences of gravitational teleconnection on atmospheric pressure into current models. In order to do this we must realize that the global teleconnected systems are influenced by major tectonic vortex structures as illustrated by surge theory. The SO is controlled by the largest upwelling tectonic vortex structure on earth, the Indonesian Island Arc. Across the Pacific Basin the SO is controlled by strong downwelling vortices along offsets on the East Pacific Rise near Easter Island. The NPO is considered a seesaw of SLP between a belt at high latitudes extending from eastern Siberia to western Canada and a broad region at lower latitudes including the subtropics. The NPO is controlled by island arcs and deep trench systems in the north and northwest Pacific, which includes the Japan, Kuril and Aleutian island arcs and trench systems. To the south the NPO pressure is controlled by the Mid-Pacific and Hawaiian volcanic systems. The NAO is controlled by an upwelling tectonic vortex beneath Iceland and a downwelling tectonic vortex along an offset of the Mid-Atlantic Ridge near the Azores.

We know how these teleconnected pressure systems affect weather patterns around the globe, but what creates the large-scale changes in pressure that cause a vacillation between zonal and meridional flow? By understanding geodynamic tectonic flow as analogous to ocean and atmosphere flow, which is inferred in surge tectonic theory, we can make the following comparisons. Atmospheric jetstream flow is analogous to the Gulf Stream or Kuroshio Current flow structure in oceans, in another word, aquastreams. These are in turn analogous to horizontal upper asthenosphere tectonic flow or geostreams, which create surface trends in the crust. The high/low pressure cells in the atmosphere are analogous to cold/warm core eddies in the oceans and downwelling/upwelling vortex structures in the earth's crust and mantle. Weather fronts are analogous to Kelvin/Rossby waves in the oceans, or oceanic fronts. These fronts are simply pressure/temperature waves moving through their corresponding medium and in the earth are called surges, gravity waves, or tectonic fronts. Earth oscillations of various periods generate these surges, and affect the vortex structures and geostreams in predictable ways.

The problem lies in modeling these undulations of the geoid over time frames corresponding to periods of climatic changes such as El Ninos and global warming/cooling trends. Time series gravitational data associated with the teleconnected earth oscillation system are needed to monitor these long-range climatic trends and create a surge index to factor into the solar modulated simulations of ocean/atmospheric coupled models.