ARTICLES

CAN EL NINO BE CONTROLLED BY TECTONIC VORTEX STRUCTURES AND EXPLAINED WITH SURGE TECTONICS?

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INTRODUCTION

Scientists have long sought a forcing function to account for the variability of climatic trends such as El Nino. To date models coupling only ocean/atmosphere interaction have not adequately accounted for changes in climatic trends. The World Climate Research Program's initiative on Stratospheric Processes and their Role in Climate (SPARC) currently indicates the importance of parameterizing gravity wave effects in numerical climate simulation models. Using radiosonde data, prominent eastward propagating stratospheric gravity waves around the tropical Pacific equator were first identified during atomic bomb testing in 1968. The dominant source of these stratospheric gravity waves is thought to originate in the upper troposphere from convection processes due to the high heat budgets near the equator. A potentially overlooked source for fluctuations of gravity waves could be attributed to coupling influences of the earth's interior controlled through tectonic trends (Leybourne, 1996).

THE GLOBAL OSCILLATION SYSTEM (GOS)

The three major global Sea Level Pressure (SLP) oscillation systems or teleconnections are coincidentally underlain by major tectonic vortex structures portrayed by surge tectonics (Meyerhoff et al., 1992). These 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. 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 (Leybourne, 1997).

THE PROBLEM WITH PLATE THEORY

To explain the El Nino phenomena with surge tectonics, two assumptions must be made about the scale and direction of tectonic flow dynamics which oppose the currently accepted theory of plate tectonics. First, for tectonic density oscillations within the vortices to modulate the SLP at observed frequencies of teleconnections within the Global Oscillation System (GOS), tectonic flow rates would have to be orders of magnitude greater (possibly cm/day vs. cm/year). The second assumption follows directly from surge theory in that tectonic flow is parallel to tectonic surface trend strikes instead of perpendicular, "conveyor belt", flow dynamics proposed in plate tectonics. This second assumption is extremely important, because it allows comparison of flow structures in the tectonic domain with analogous features in oceans and atmosphere such as fronts, eddies and streamflow. Thus we may coin the term, "Geostream", for high flow regimes such as the Pacific Rim. Encouraging circumstantial evidence which lend support to this hypothesis are: the increase of seismic activity along the East Pacific Rise during an El Nino (Walker, 1988; 1995); the change in sea level across the Pacific Basin during an El Nino shown by altimetry studies indicating a possible shift in the regional gravity field or a tectonic front; and the anomalous temperature increases near the Indonesian upwelling vortex as a well known precursor to El Nino.

GRAVITATIONAL TELECONNECTION: BREATH OF EL NINO

Studies by, Warburton and Goodkind, 1977, at The Univ. of Calif. Dept. of Physics with superconducting absolute gravity meters indicate strong correlations between the gravity residual (what is left after filtering out tidal affects) and barometric pressure changes at frequencies associated with weather patterns. Six microgal changes in the gravitational field are typical with barometric fluctuations in sea level pressure with maximum fluxes of up to 45 microgals. They "measure specifically the influence of barometric pressure on gravity in the frequency range between 0.1 and 10 cycles/day. The power spectrum of the gravimeter and barometric pressure signals measured suggest that the background noise continuum on the gravity signal at all frequencies is produced by pressure fluctuations" (Warburton and Goodkind, 1977).

The Southern Oscillation varies well within the pressure ranges which could cause or, as new tectonic theory would have it, be an effect of a change in the gravitational field between 6-45 microgals. The probability of density oscillations within a tectonic vortex increases when viscosity variations of up to three orders of magnitude are proposed for the lower mantle (Karato, 1981), especially when the vortex structure is the most plausible conduit between mantle-asthenosphere. Sudden phase changes at critical tectonic temperature and pressure between specific mineral suites should be considered as a possible mechanism for these viscosity changes. These density oscillations translate to atmospheric pressure changes near the vortices of the global oscillation system that modulate the global weather patterns through gravitational teleconnection. Generally atmospheric pressure changes are caused by tropospheric convection which is modulated by solar insolation, but within the domain of a tectonic vortex sea level pressure may also be tectonically modulated.

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Notes: B. A. Leybourne is an employee of the Naval Oceanographic Office. However, this paper was prepared in his personal time. As such, the opinions and assertions contained herein are those of the Author, and are not to be considered as official statements of the US Department of the Navy.