

LUNAR, SOLAR (DAILY), & SOLAR (ANNUAL) KINETIC ENERGY TRANSFER DRIVES TIDAL BULGE, PACIFIC PLATE & CONTINENTAL LAND MASS MOVEMENT, AND THE EL NINO SOUTHERN OSCILLATION

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AUTHOR INTRODUCTION: Retired and Independent researcher. Entire career in the private sector. No employment in academia nor government service. BChE Chemical Engineering Univ. of Detroit-Mercy 1973, MBA Univ. of Delaware 1980, Prof. Engr (non-practicing). Member American Geophysical Union and Geochemical Society. Forty (40) years experience in industrial commodity chemical processes. Thirty two (32) years with E.I. DuPont de Nemours in Process Engineering, Design, and Project Engineering leadership. This paper is entirely my own based upon my engineering education, experience, literature search, and logical deduction. I have received no funding for this work.

DEDICATIONS - To the most special people in my life, Judy Cronin, love of my life, now departed, and our sons Steven and Robert.

ABSTRACT – Tidal Pumping is the very well-known Astrophysical phenomenon wherein the gravity of a major celestial body exerts a “pumping” or drag force on a smaller orbiting celestial body as it swings through an eccentric orbit. This force drives tectonics and volcanism. Jupiter’s volcanic moons are paved in basaltic rock, like the ocean floor of the Earth. Jovian moon Io is the most volcanic celestial body in the solar system. Saturn’s tidally pumped moons have cryovolcanoes. Planetary rings were formed by moons ripped apart by tidal pumping forces.

As the Earth passes from the Aphelion (July 4, the most distant point in Earth’s orbit) to the Perihelion (Earth’s closest approach to the Sun, approx. Jan. 4), both its rotation and orbital motion speed up. As Earth passes through its Winter Solstice (Dec. 21) and its Perihelion, there is a deceleration, with kinetic energy transfer onto the solid Earth and causing a tidal bulge calculated at 10 to 12 cm. There are limited means for direct observation during this once-per-year transient event. By comparison, the Moon causes a tidal bulge on the Earth with a vertical lift of 40 to 55 cm. The gravity of the Sun also exerts a tidal deformation on the solid Earth from day-to-night. The side of the Earth rotating to face the Sun is uplifted 15 to 21 cm.

This paper extends prior papers that the tidal effects of the Moon, Sun, and Earth’s passage through the Perihelion are contributors, if not the principal causes, of tectonic activity and the El Nino Southern Oscillation (ENSO) - by exerting tidal bulge (vertical uplift) on highly stressed seismic regions in the near-equatorial South Pacific and releasing seismic heat into the waters of the South Pacific. Furthermore, these combined tidal forces have dragged and pushed continental land masses into the Northern Hemisphere.

Pertinent references on tidal deformation related to seismic activity are listed. Particular emphasis on reference (74), Ruyu Yan, et al.

DISCUSSION

(1) TIDAL PUMPING - Tidal Pumping is the very well-known Astrophysical phenomenon wherein the gravity of a major celestial body exerts a “pumping” or drag force on a smaller orbiting celestial body as it swings through an eccentric orbit to drive tectonics, volcanism, and uplift on land masses. Prime examples include the volcanic moons of the gas giants as they swing through their eccentric orbits. The Jovian moon Io is the most volcanic celestial body in the Solar System. Enceladus undergoes cryo-volcanism as it is tidally pumped by Saturn. The rings of the gas giants were formed as moons were ripped apart by Tidal Pumping forces.

The Sun tidally pumps Venus, producing circular corona volcanoes, a CO₂-rich atmosphere and all-enshrouding clouds of sulfuric acid. Sulfuric acid’s heat capacity is approx. 1/3 that of water, thus sulfuric acid a far less powerful coolant than water. The Water Cycle is the dominant cooling system for the Earth.

The Earth’s rotation deforms Earth into a globe, an oblate spheroid, bulging at the Equator by 21 kilometers vs. a spherical shape. The Equator is a line of crustal stress concentration.

Earth gains rotational speed and orbital speed as it moves from Aphelion (most distant point in the orbit, approx. July 4) to the Perihelion (Earth’s closest approach to the Sun, approx. Jan. 4). As the Earth passes through the Perihelion, there is a brief deceleration, like tapping the brakes, with kinetic energy transfer on the order of 10^{20} Joules once per year, causing a tidal bulge (vertical uplift) on Earth calculated as 10 to 12 centimeters. There are limited means for direct observation during this once-per-year transient event. By comparison, the Moon’s tides exert a kinetic energy transfer of 10^{20} Joules/year. The solid Earth’s tidal bulge is 40 cm in the mid-latitudes and 55 cm at the Equator. The Sun’s night-to-day tidal effect also deforms the solid Earth, exerting a daily energy transfer of 10^{17} Joules/day. The side of the Earth facing the Sun is uplifted 15 to 21 cm. These are elastic deformations. (Calculations by AI).

Although Venus does not have a direct tidal effect on Earth, the combined gravities of Venus and Jupiter can elongate the eccentricity of Earth’s orbit on a 405,000 year cycle, thereby providing a closer approach at Earth’s Perihelion (27).

As a final note, the last full solar eclipse observed across North America occurred on April 8, 2024. As the Sun and Moon were moving into full alignment, combining their tidal effects, a rare Richter 4.8 earthquake struck Tewksbury, NJ on April 5, 2024.

(2) TECTONIC PLATE MOVEMENTS –

The hypothesis proposed here describes the movement of the Pacific plate from Southeast to Northwest due to the combined tidal pumping effects described above. The Pacific plate is the largest tectonic plate in the world. The Winter Solstice (approx. Dec. 21) positions the Southern Hemisphere facing the Sun most directly. The Earth’s closest approach to the Sun, the Perihelion (approx. Jan. 4) incurs a brief transient of an annual tidal force, in addition to lunar tides and daily solar tides. The SE to NW movement of the Pacific plate opens the East Pacific Ridge (divergence). The Nazca plate is pushed eastward to subduct beneath the South American plate at the Peru/Chile Trench. The Peru/Chile Trench moves East-Southeast to East-Northeast at 6.5 to 7.5 cm per year.

In the western Pacific, the Pacific plate subducts beneath the Australian plate at the Tonga Trench (convergence). The Tonga Trench is the fastest moving trench system in the world and only slightly less than the Mariana Trench in depth. The northern end of the Tonga moves West-Northwest at 24 cm per year. The Australian plate is pushed North-Northeast at 6.5 to 7 cm per year. Likewise, the Indian plate moves northly at 5 cm/year and subducts beneath the Eurasian plate to thrust up the Himalayas. The Mid-Atlantic Ridge spreads west and east driving the Eurasian plate eastward.

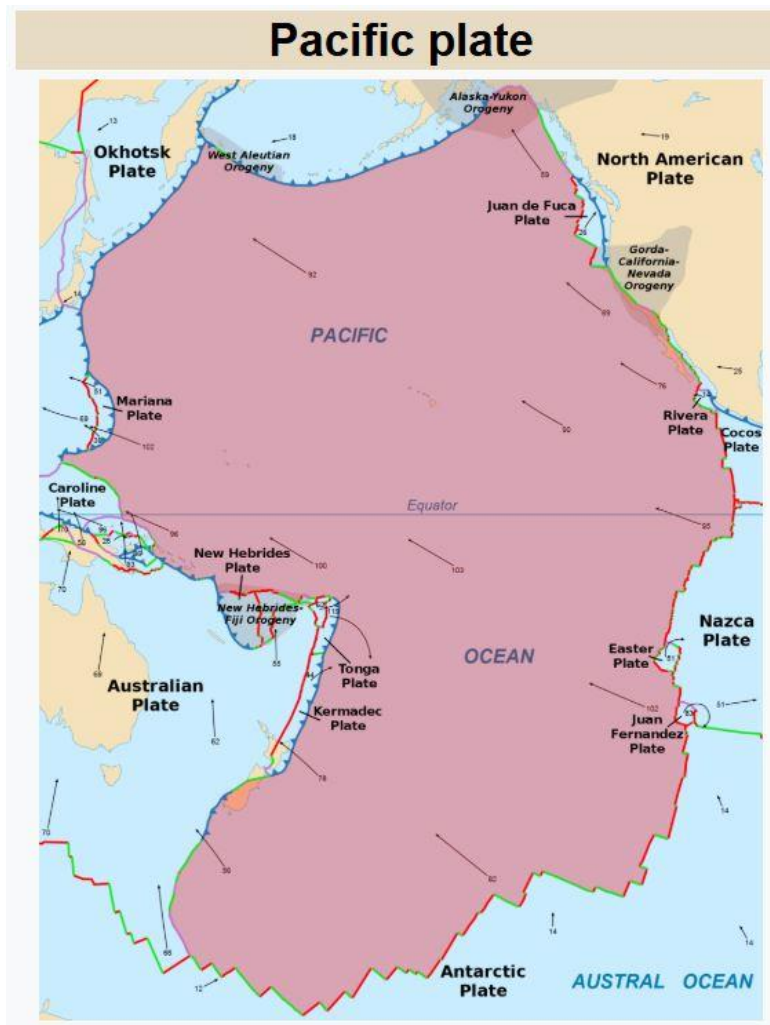
The combined action of the spreading Mid-Atlantic Ridge and the north-going Indian plate cause the Eurasian plate to rotate in a very slight clockwise rotation.

In the middle of the Pacific plate is the Hawaiian island chain, stretching from Oahu in the Southeast, only 3 million years old, to Kauai in the northwest, at 3.8 million years old. Midway atoll is 28 million years old. The Hawaiian islands move Northwesterly at 7 to 10 cm/year, passing over the fixed Hawaiian mantle plume volcano.

The north-going Pacific plate forms strike-slip transform faults like the San Andreas fault to also shoulder the North American plate northward. The North American plate extends above the Eurasian plate and then rotates in a slight Southeasterly or counterclockwise rotation. The Eurasian plate and North American plate mesh as a pair of gears.

Through all of these movements the major continental land masses are dragged and pushed into the Northern Hemisphere.

PACIFIC PLATE



GALAPAGOS TRIPLE JUNCTION (3-WAY DIVERGENT)



The Galápagos microplate is forming at the triple junction of the Nazca (shown in pink), Cocos, and Pacific plates

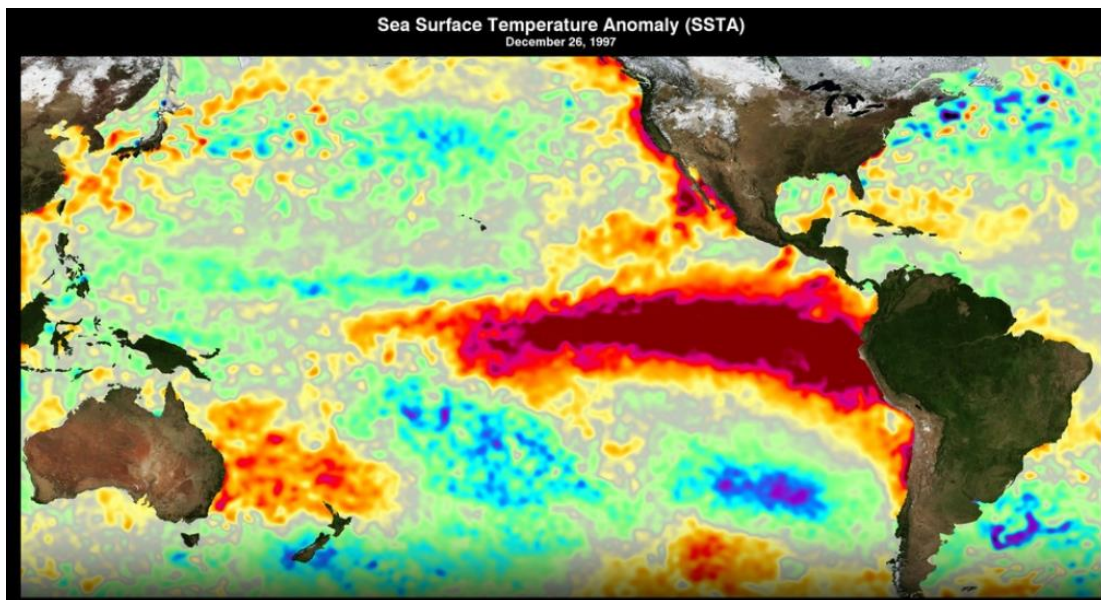
TONGA TRENCH (CONVERGENT), PACIFIC PLATE SUBDUCTS BENEATH AUSTRALIAN PLATE



(3) EL NINO SOUTHERN OSCILLATION –

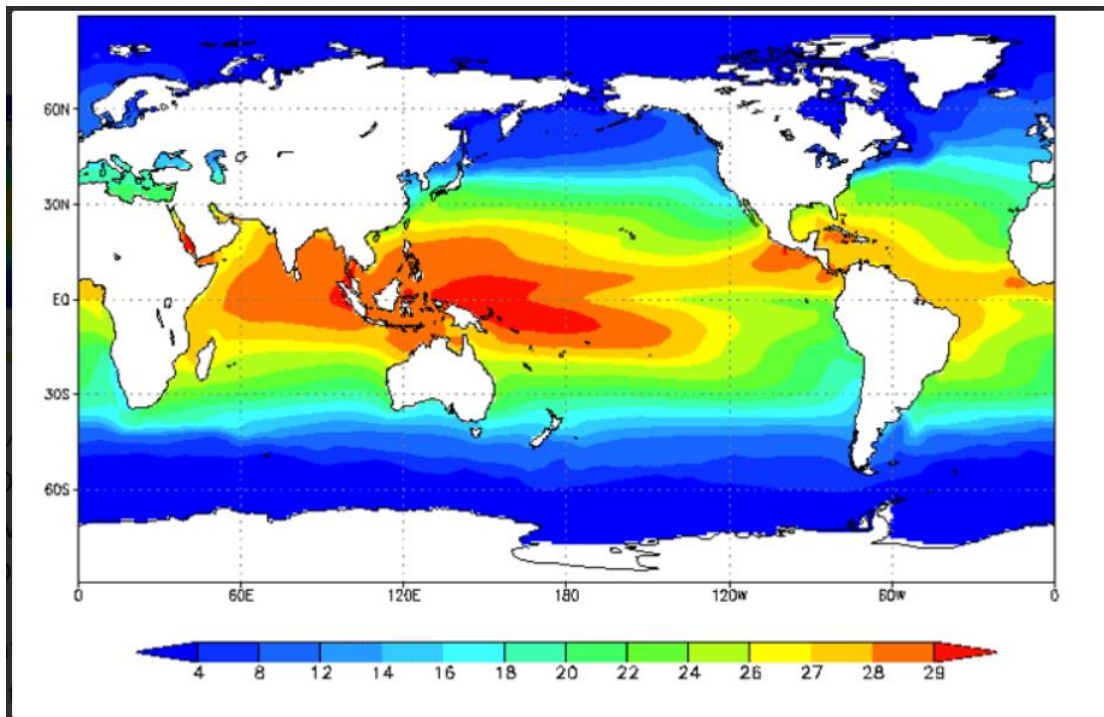
(3.1) El Nino - The Galapagos Triple Junction is a 3-way divergent point where the East Pacific Rise, Coco plate and Nazca plate are pulling apart. The Galapagos lie at 1° S. Latitude and 90 ° W. Longitude. This area is noted as the warmest waters of the El Nino phenomena, initiated right at Christmastime. Spreading of the Peru/Chile Trench injects seismic heat and warms the waters along the Peruvian coast, also noted at the El Nino. As the crustal uplift initiates divergence of the Coco/Nazca ridge, the warming spreads to the west, along the Equator. The South Pacific gyre carries the warm waters westward. An upward convection cell forms a low pressure center in the eastern Pacific, drawing moist air from the Amazon, over the Andes. The peak rainy season in the Amazon and the Galapagos spans Jan. to March.

SEA SURFACE TEMPERATURES – EL NINO



(3.1) La Nina - In the West, the Pacific plate subducts beneath the Australian plate at the Tonga Trench at 15 °S. Lat. and 174 °W Long.. A hot water plume effect stretches westward from the Tonga Trench so the warmest surface temperatures of the La Nina are observed in the Marianas Islands, waters east of Papua New Guinea, and the Solomon Islands, spanning 0 °– 5 ° N. Lat. and 150 °– 170 ° E. Long. Combined with the counter-clockwise rotation of the planet, the Pacific plate is dragged from SE to NW and major continental land masses are pushed or dragged into the North Hemisphere. The Indian plate subducts beneath the Eurasian plate to form the Himalayas. Tidal Pumping explains how new crust is formed as the Earth is pulled apart in the SE Pacific. There are deep flaws in the concepts of Mantle Convection, crustal recycling, “slab pulling”, subduction extending several kilometers deep, and Continental Drift.

SEA SURFACE TEMPERATURES – LA NINA



(4) STRENGTH OF MATERIALS –

The ocean floor is comprised of basaltic rock [(Mg, Fe) SiO₂]. In a dense, unfractured condition, basalts have a tensile strength ranging from 1500 to 3600 psi. In a fractured condition, as is the case of seismically active regions, the tensile strength drops to less than 725 psi. The surface and volcanic regions of Jupiter’s tidally pumped moons are also comprised of basalts. Enceladus and the tidally-pumped moons of Saturn have cryovolcanoes. The tensile strength of ice ranges from 150 to 1000 psi, in the same range as basaltic rock.

(5) FAINT YOUNG SUN PARADOX

Well known in Evolution is the paradox that the earliest photosynthetic life, Cyanobacteria, emerged 3.5 billion years ago when the Sun was only 70% as luminous as today. Only allowing for solar radiation, the Earth should have been a frozen ball of ice, with no liquid water on the surface. The current radiogenic heat of the Earth is estimated at 21 to 23 TW. Extrapolating back in time, Earth’s radiogenic heat stood at 50 to 55 TW. The Earth has 40 to 50 “hot spots” such as the Galapagos, Yellowstone, Campi Flegrei, and Hawaii. Even with a mostly ice-covered planet, scattered “hot spots” certainly provided regions of liquid water, suitable to support the earliest photosynthetic life.

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