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Solar Wind and Hydrologic Cycle

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Abstract. The solar hydrologic cycle is the process of comets delivering water and gasses to the planets by collision, and solar wind stripping water and gasses from the planets and delivering them back to the Kuiper Belt. This new theory of solar hydrologic cycle provides that the solar hydrologic cycle is the continuation of planetary formation, and the cause of outer planets becoming gas giants, inner planets staying small rocks.

Keywords. solar wind, Kuiper Belt, comet, planets formation, Jupiter.

There is constant mass movement in the solar system. Mass is moving from Kuiper Belt to the inner solar system through comet collision with the planets, mass is also moving the opposite direction by solar wind stripping water vapor and gasses from the inner planets. The mass movement forms a cycle, like Earth water cycle, so it is called solar hydrologic cycle. The balance of the cycle determines the mass of the planets today, such that the solar hydrologic cycle is the continuation of planetary formation.

Hydrogen and other light elements are the most abundant elements in the solar system, rocky materials are a tiny fraction. Comparing total comet mass today of 2% solar mass (Mendis *et al.* 1986), total asteroid mass of 12^{-10} solar mass (Pitjeva *et al.* 2015) is negligible. The existence of a separate comet hydrogen envelope (Mancuso 2015) indicates that the comet is hydrogen rich. Movement of mass in the solar system is the movement of lighter elements, primarily hydrogen.

In the young solar system, there were a vast number of comets. Solar hydrologic cycle started strong. Comets rained large quantities of water and gasses on the planets.

Solar wind works in the opposite direction, brings hydrogen, water vapor and other gasses, back to the direction of Kuiper Belt, and at farthest, to the heliopause. In that region, the particles and molecules are bumping into each other forming small chunks, losing electric charge in the process. Ebb and wane of the solar wind, and gravity ripples of planets swinging by congregate the material like waves in the pond congregate leaves. The larger chunks are pulled inward by solar gravity to the Kuiper Belt, where they reform into comets by the positive feedback loop of gravity. There can be many cycles of water and gasses traveling between the Kuiper Belt and inner solar system over billions of years. The gasses react with each other on the warm planets with lightning, producing methane, ammonia, and other compounds to be carried by solar wind back to the Kuiper Belt, changing the composition of next generation comets. Today's comets have a small amount of methane (Mumma *et al.* 1996) and ammonia is the result of the solar hydrologic cycle.

Solar wind exerts great influence in the inner solar system, blows away water and gasses from inner planets, including Mars (Barabash *et al.* 2007). This prevents inner planets mass growth from comet collisions. The solar wind, however, has diminished effect on the

Table 1. Relationship of outer planets mass.

Outer Planet	Distance from the Sun [AU]	Mass [Earth mass]	Orbital Mass Gain Constant	Adjusted Orbital Mass Gain Constant
Jupiter	5.2	318	1654	8599
Saturn	9.6	95	912	8755
Uranus	19.2	14.5	278	5345
Neptune	30.0	17.1	513	15390

outer planets due to the distance. When comets collide with outer planets, their mass stays with the planets. Outer planets are deadends for solar hydrologic cycles.

Outer planets grow larger and larger as the solar hydrologic cycle repeats, locking up more and more comet mass, reducing the number of comets and intensity of solar hydrologic cycle, depriving inner planets of an ample supply of water and gasses. With solar wind relatively constant, the inner planets began to dry up. Earth, with a magnetic field and large mass, is able to retain most of the water and heavier gasses. The present day mass and composition of water and air on Earth are the result of billions of years of seesaw action between comets and solar wind with many sharp spikes.

The comet mass does not distribute to outer planets evenly or randomly, but in accordance with the probability of collisions. There are many factors that contribute to the probability. The comet orbit plane relates to the planet orbit plane is an important factor, yet does not favor any particular planet. Whether perihelion of comet orbit is inside the planet's orbit is another factor, yet minor for outer planets. The deciding factor is the planet orbit size, which can be substituted with mean distance from the Sun. The planet mass gain is in inverse proportion with distance from the Sun. Assuming outer planets started with negligible mass, then, mass gain from the comet equals to planet mass. The equation can be expressed as:

$$m_1 r_1 = m_2 r_2 = c \tag{0.1}$$

Where m is the mass of a planet, r is the distance the planet is from the Sun. c is the Orbital Mass Gain Constant related to the total comet mass at Kuiper Belt.

The next weighty factor is the positive feedback loop where larger mass attracts more comet collisions, which in turn produces even larger mass. The positive feedback loop has many random factors, and can not be predicted by simple formulas. Since distance to the Sun drives mass, and mass drives positive feedback loop, the final mass could be driven by the square of the distance to the Sun, Eq. (0.1) becomes:

$$m_1 r_1^2 = m_2 r_2^2 = c_{adj} \tag{0.2}$$

Calculating the constants for outer planets as in Table 1.

Jupiter and Saturn fully align with Eq. (0.2). Uranus fits less well, perhaps because positive feedback loop effect is not as pronounced when the mass is small. Neptune is an exception, because of its proximity to the Kuiper Belt.

References

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