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FOR IMMEDIATE RELEASE

THE "SHORTEST" DAY?

Everyone knows that a day on the Earth is 24 hours in duration. For millennia, this has been measured by astronomical observations. However, the invention of the first practical pendulum clock by astronomer Christiaan Huygens in 1655 gave us the first means of mechanically maintaining this time scale away from the telescope. By the late 19th Century the continued refinement of these clocks, along with new astronomical observation techniques, began to hint that the Earth's rotation was not constant.

In 1939, the variability of the Earth's rotational speed was clearly established using astronomical observations of solar system objects. In the 1930's newly developed quartz clocks were used to demonstrate an apparent annual variation in the Earth's rotational speed. Subsequently, tabulated differences between time from pendulum clocks and the rotation of the Earth for the three-year period 1934 – 1937 were also used to show an annual variation in the rate of the Earth's spin. We know now that the annual variation in length of day caused by atmospheric variations is less than ±0.5 milliseconds per day. Research in recent times, using records of ancient and medieval eclipses from 720 BC to AD 1600, and of lunar occultations of stars since 1600 has investigated long-term variations in the Earth's rate of rotation.

Fossil records show that seventy million years ago dinosaurs were lumbering about in the late Cretaceous geological period in days of 23-and-a-half-hours. Further back in time, fossilized corals from 430 million years ago indicate the days in the Silurian Period were about 21 hours long. We now know that, in addition to the secular slowing of the Earth's rotation due to the action of lunar tides, the Earth is subject to variations at many frequencies from decadal to sub-daily, and these variations have many geophysical and meteorological causes. These variations in the Earth's rotational speed result in variations in the length of the day.

In historical times, for example, the length of the day appears to have varied from being 6 milliseconds shorter (in 1660) to about 4 milliseconds longer (in 1910) than 24 hours. The most recent observations show that the length of the day is shorter by about 1.5 milliseconds, which would indicate that these are shortest days since the late 19th century.[1]

Although we would expect that lunar tides would continue to slow the Earth, it might be the case that melting glaciers at the poles cause the crust of the Earth there to lift ever so slightly but enough to change the shape of the Earth, making it rounder and thus rotate faster. Of course, all the other causes of the variable rotation rate continue to operate, and so it remains extremely difficult to predict the future length of day with much certainty.

A practical concern with the shorter length of day is the potential for adjustments to the standard time scale. By international agreement, adjustments are made to the standard Coordinated Universal Time (UTC) to keep it in sync with the Earth's rotation by the occasional insertion of one second adjustments called "leap seconds." With the longer day lengths this was accomplished by adding one second to UTC. A shorter length of day, on the other hand, could call for subtracting one second from UTC. The issue of subtracting one second from UTC (i.e., a "negative" leap second) remains only a small, yet concerning, possibility for the next few years.

The daily monitoring of the Earth's rotation is a program of the International Earth Rotation Service (IERS), whose Rapid Service/Prediction Center is an activity of the Earth Orientation Department at the U.S. Naval Observatory (USNO). The mission of the USNO includes determining the positions and motions of celestial bodies, measuring the Earth's rotation and orientation, maintaining the master clock for the U.S., and disseminating precise time (atomic and astronomical). The Earth Orientation Department contributes to this mission by collecting suitable observations and performing data analyses to determine and predict the time-varying orientation of the terrestrial reference frame within the quasi-inertial celestial reference frame.

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[1] Recent articles have stated that 29 June 2022 was the shortest day since records began, and there is concern that such a statement may not have accounted for measurements and records maintained in the past or derived from the past, before atomic clocks were developed.