

The Chandler wobble of the poles and its amplitude modulation

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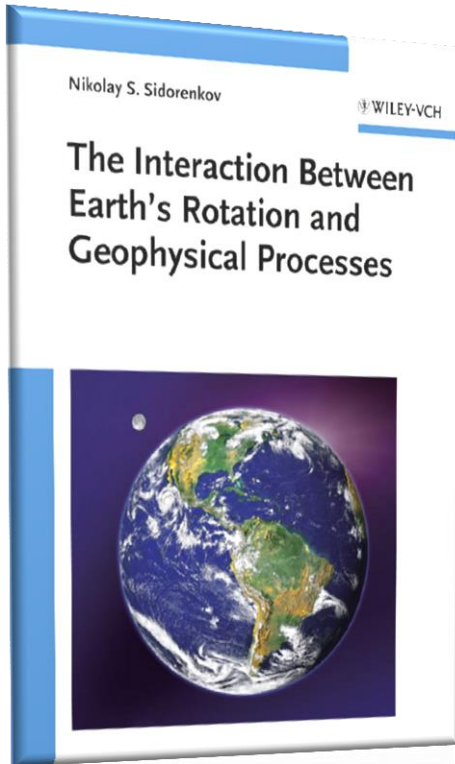
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- Starting with the Earth's motions, irregularities and the effect of atmospheric processes on the Earth's spin is then discussed.
- Tides and seasons occupy the following sections before a discussion of the Earth-ocean-atmosphere system and the mechanical action of the atmosphere on the Earth's rotation.
- The whole is rounded off by an index of abbreviations and appendices with sections on related physics.

Zonally-Averaged U Anomalies (EQ)

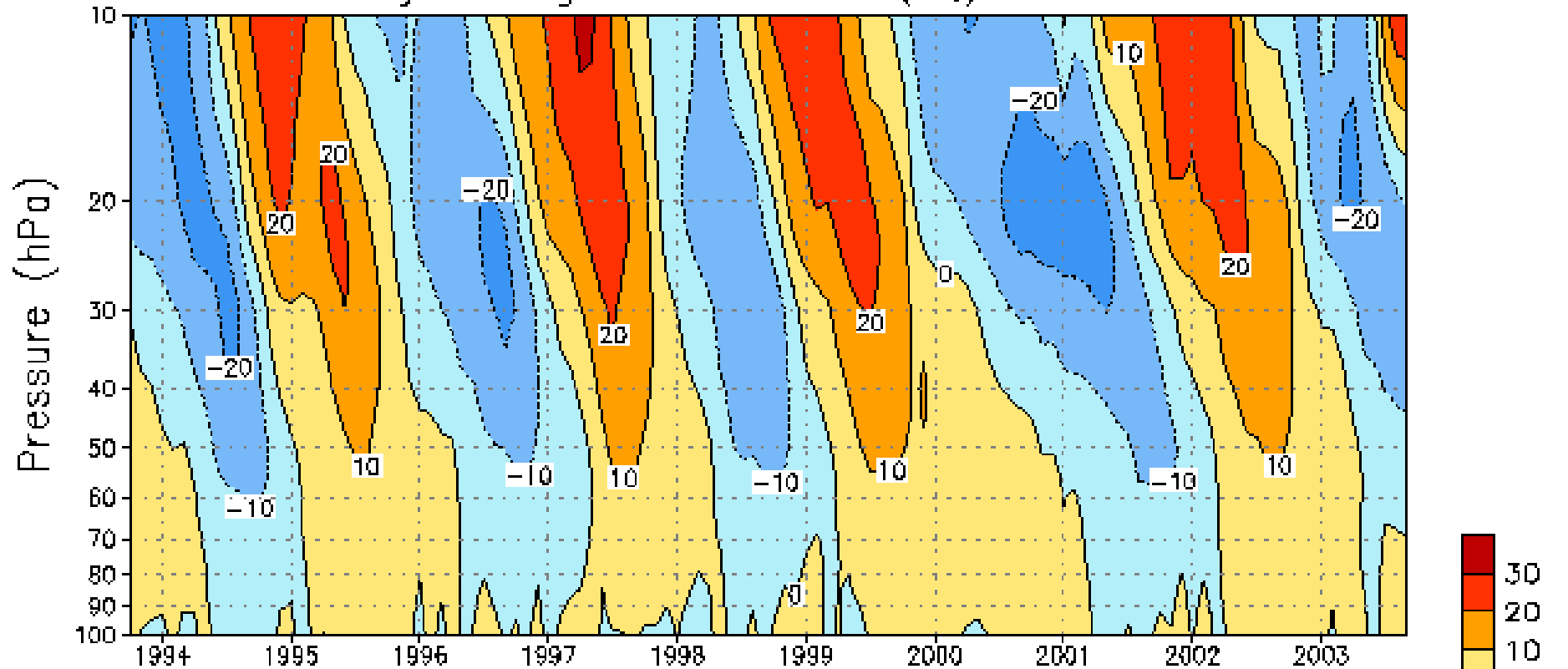


Figure 2. Time-height section of the anomalous zonal wind at the equator. Blue (red) shading indicates values less (greater) than -10 (10) m s^{-1} . Anomalies are departures from the 1979-1995 base period monthly means.

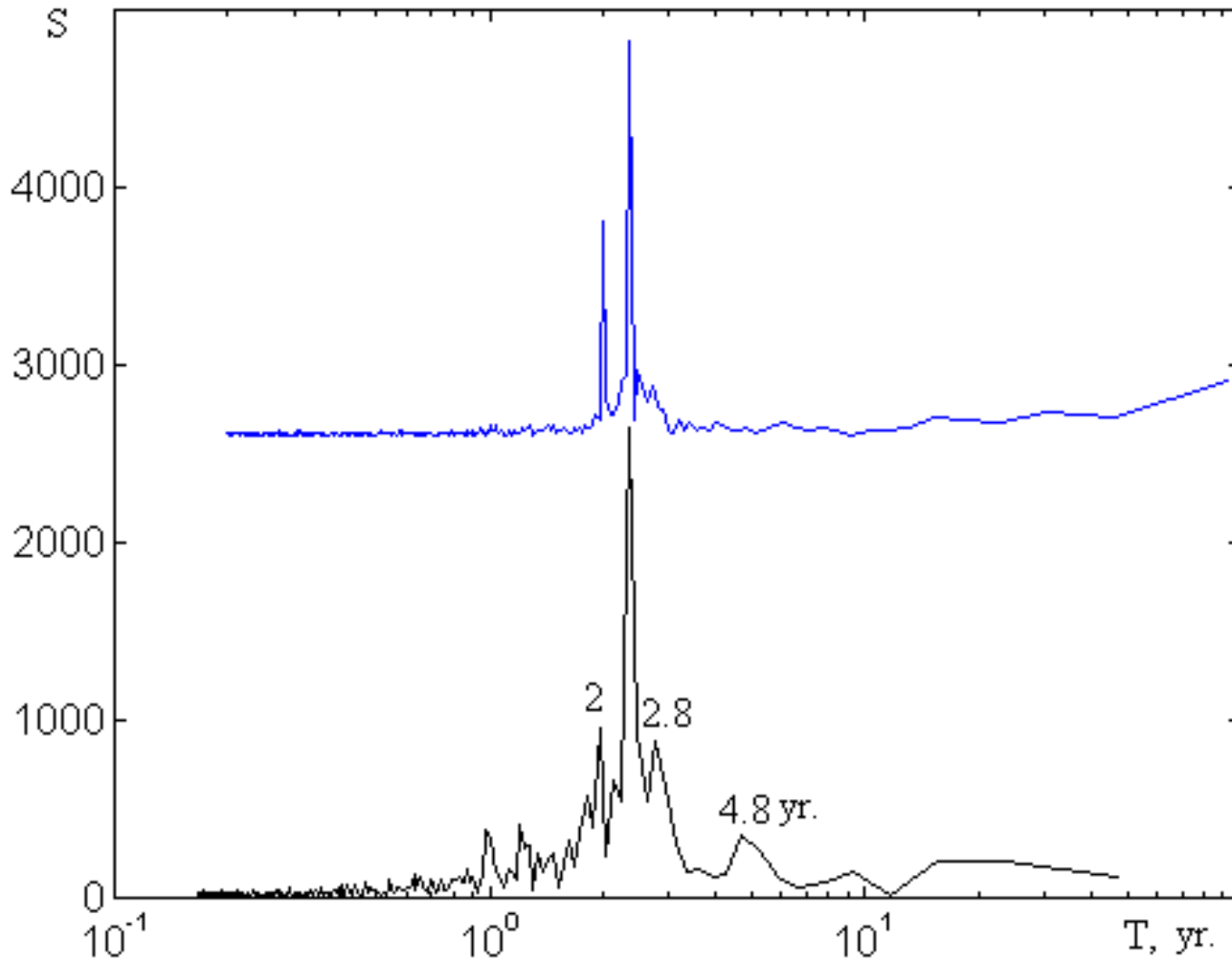


Figure 3. Power spectra of the pole coordinate x (top) and the QBO indices \bar{u} (bottom). To demonstrate the curves' similarity, the pole's curve was transformed as follows: $T = 2T_0$ and $S = 30S_0 + 2600$, where T_0 and S_0 are the actual values of the periods T and spectral densities s , respectively.

The QBO period is equal to a linear combination of the frequencies corresponding to the doubled periods: of the tidal year (0.97 year), of the regression of nodes (18.6 years), and of the motion of perigee (8.85 years) of the Earth's monthly orbit:

$$\frac{1}{2} \left(\frac{1}{0.97} - \frac{1}{18.61} - \frac{1}{8.85} \right) = \frac{1}{2.3 \text{ yr}} \quad (1)$$

In other words, the quasi-biennial oscillation of the wind direction in the equatorial stratosphere is a combined oscillation caused by three periodic processes experienced by the atmosphere: (a) lunisolar tides, (b) the precession of the orbit of the Earth's monthly revolution around the barycenter of the Earth–Moon system, and (c) the motion of the perigee of this orbit.

The wobble forcing with a solar year period is modulated by the precession of the Earth's monthly orbit with a period of 18.6 years and by the motion of its perigee with a period of 8.85 years. Finally, the resulting solar annual forcing generates polar wobbles with a Chandler period of 1.2 year:

$$\frac{1}{1.0} - \left(\frac{1}{18.61} + \frac{1}{8.85} \right) = \frac{1}{1.20} \quad (2)$$

The wobble forcing with a lunar sidereal or tidal year period of 355 days is modulated by the precession of the Earth's monthly orbit with a period of 18.6 years and by the motion of its perigee with a period of 8.85 years. Finally, the resulting "lunar sidereal" forcing generates polar wobble with a period of 1.16 year:

$$\frac{1}{355.18days / 365.24days / yr} - \left(\frac{1}{18.61} + \frac{1}{8.85} \right) = \frac{1}{1.1606yr} \quad (3)$$

Interference of the 1.20-year Chandler oscillation and the 1.16-year oscillation leads to beats, i.e., to periodic variations in the polar wobble amplitude with a period of 35.3 years:

$$\frac{1}{1.16} - \frac{1}{1.2} = \frac{1}{35.3} \quad (4)$$

Similarly, the lunar anomalistic year (13 anomalistic months) must excite polar wobble with a period of 1.172 year:

$$\frac{1}{358.21days / 365.24days / yr} - \left(\frac{1}{18.61} + \frac{1}{8.85} \right) = \frac{1}{1.172yr} \quad (5)$$

Interference of this “lunar” wobble with “solar” CWP generates beats with a period of 50.9 years:

$$\frac{1}{1.172} - \frac{1}{1.2} = \frac{1}{50.9} . \quad (6)$$

Thus, interference of CWP (1.20-year period) with these moon-caused oscillations gives rise to beats, i.e., to slow periodic variations in the CWP amplitude with periods of 32 to 51 years. They are observed in reality.

Thank you for your attention

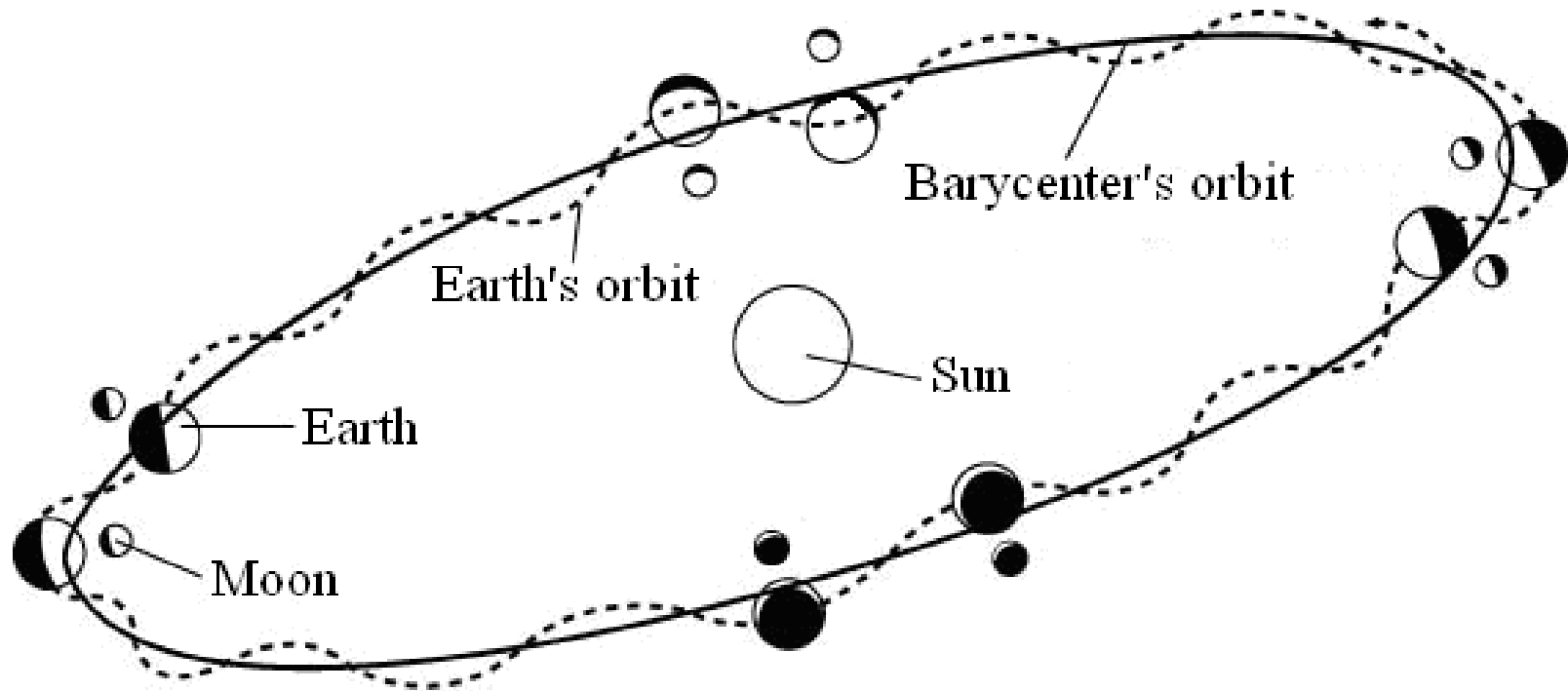


Figure 1: Revolution of the Earth–Moon system around the Sun