Signals from the Planets Found in Weather Data
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UAC 2018
Astrometeorology

Ancient origins - Enuma Anu Enlil (~1000 BCE)

*When Jupiter grows bright, there will be floods and rains.*

Ptolemy (150 CE)  ➔  Al-Kindi (c.796-873)

Two traditions:

1. Ingress charts, lunation charts, conjunction charts (Ptolemy, Arab astrologers)

2. Aspects, planetary configurations (Digges, Kepler, Goad)
Leonarde Digges – Prognostication Everlasting of Right Good Effect (1553)

The conjunction, quadrature and opposition of Saturne with the Sunne, chiefly in cold signs, shows dark weather, hail, rayne, thunder and colde days.

The conjunction, quadrature and opposition of Jupiter with the Sunne, great and moist vehement winds.

The conjunction, quadrature and opposition of Mars with the Sunne in fiery signes, drought; in watry, thunder and rayne.
Johannes Kepler (1571-1630)

**Concerning the More Certain Fundamentals of Astrology (1602)**

Required to publish astrological annuals with weather forecasts.

Kept weather records from 1593 and compared with the planetary alignments. Saturn-Sun aspects as proof of astrology.

*Tertitus Interveniens (1597): 18th of September. Again a great myriad of aspects. Saturn, Sun and Mercury made three conjunctions, and all three running in square to Mars. Then after several days there came rainy weather on the 13th, very cold air, became cold and over-cast the 14th, 15th & 16th, 17th somewhat warmer, often drizzled, the 18th cold rainy air, Sun pale, 19th pleasant, 20th April weather the whole day, etc.*
John Goad (1616-1687) - *Astro-Meteorologica, or Aphorisms and Discourses on the Bodies Celestial, their Natures and Influences, Discovered from the Variety of the Alterations of the Air, temperate or intemperate, as to Heat or Cold, Frost, Snow, Hail, Fog, Rain, Wind, Storm, Lightnings, Thunder, Blasting, Hurricane, &c. Collected from the Observation of thirty years,' (1686)

A follower of Kepler - compared weather records with the angular separations of the planets.

His methodology was completely descriptive – instrumentation was just becoming available.

Did not accept the astrological methodology of Ptolemy and Arab astrologers – ingress and conjunction charts.
Goad’s weather diary - October 16 to November 8, 1660

16. Close m. p. coasting showr some places S.W.
18. Fair, some clouds. N.W.
20. Fr. Fog N W, at 0.E. clear p.m. N. E.
21. Frost, black thick clouds in S. Sun occ., clear and fair. E.N.
22. Frost, clear, some wind. N.E.
23. Cloudy, windy, Nly, fiar 9 m. N.
24. Fr. Fair, windy. S.W.
25. Fr. Cold, windy, cloudy; frequent clouds in S.SW. NE.
26. Fr. Clouds curdled, close day. W.
27. Dry, cold wdy, Hail and R. 1 p. a shower 3 p.
29. Fr. Curdled clouds. N.
30. Fr. Fair; Venus seen half an hour after Sun.
31. Fr. Mist belwo, about Horizon; some rain, close and most even. W.
1. Close, cloudy, windy, dry yet threatening. W.
2. Fr. Venus seen half an hour after Sun rising. N.W.
3. Mist, some clouds even incling to moisture. S.W.
4. Close and cloudy. W.
5. Fog below, fleecy clouds. S.W.
6. Fair, windy. N.
7. Open, windy, storm of rain 11 m. S.E.
8. Fr. And fair; freeze hard at n. W.
### Descriptive terms for Sun-Saturn aspects in Astrometeorology

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Were Digges, Kepler, Goad and others right?

**Hypothesis:** There is a correlation, shown in daily temperature records, between cold temperatures and the geocentric alignments of the Sun and the planet Saturn.

**First Problem:** *How to separate a signal from Saturn from the noise of all the other planetary aspects continuously forming?*
Preliminary testing of hypothesis:

Materials: Daily average temperature time-series.

A daily time-series from the Shaler Meteorological Station at Harvard Forest, Petersham, MA, containing daily data from 1964 to 2002 was initially utilized in this study.

Method:

For each Sun-Saturn aspect a 21-day segment, centered on the aspect, was cut from the time-series. These were then stacked and averaged yielding a 21-day mean that could be graphed.
Results:

Correlations with low temperatures, or sharp temperature fluctuations, at the time of the aspect were observed.

The opposition appeared to be the strongest aspect.

Next step:

Do similar tests with data from a variety of stations.

Find longer datasets.

Compensate for seasonal variations – anomaly from the mean.
Other time series:
1. Amherst College Weather Station: 1834 – 2017
3. Prague Temperatures: 1775-2005
4. 10 northeastern stations composite: 1971-2000 (Farmington ME, Groton CT, Amherst MA, Hanover NH, New Brunswick NJ, Cooperstown NY, West Point NY, Franklin PA, State College PA, Burlington VT)
5. Northern hemisphere high latitude stations 1964-2002: Ottawa, Canada, Mount Washington Observatory, Halifax, Canada, Igaluit, Baffin Island, Canada, Tasiilaq, Greenland. Oslo, Norway, Moscow, Russia, Novosibirsk, Russia, Jakutsk, Russia, Fairbanks, AK, Yellowknife, Canada, Saskatoon, Canada,
Methods:

Dataset preparation: Daily mean temperatures (Tavg) are used to calculate an annual daily mean (baseline) for the length of the dataset.

The prepared mean is subtracted from the dataset – the result being the “anomaly from the mean.” This derived dataset is then used for testing.

The anomaly from the mean removes seasonal variations.
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Preparation

1. Years in dataset stacked and mean calculated.

2. Mean then pasted end to end for length of dataset.

3. Daily data then subtracted from mean.
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Methods:

The exact date of the aspect being tested is taken as the midpoint of a 21-day sample. The 21-day segments are then “stacked” and a daily mean is then calculated and graphed.

Testing is done for the aspects of the synodic cycle of the Sun and Saturn. Attention is given to temperature patterns on or very close to day 0, the exact \textit{(partile)} Sun-Saturn aspect.
N = 38
Standard deviation for data set = 4.4
Mean = 0
Establishing Significance:

1. The **standard deviation** from the mean of the dataset (anomaly from the mean) is calculated. The standard deviation for the Shaler dataset is 4.38 degrees, therefore any departure from the mean of over 8.76 degrees (two standard deviations = 95% confidence level) would be considered statistically significant.

2. **Comparison with controls** using randomly generated dates, dates equidistant from the test dates, sample segments (sample halves vs control halves), and studies of alignments involving planets other than Saturn.
Establishing Significance:

3. **Correlation Coefficient**, $r$: measures the strength and the direction of a linear relationship between two variables. $+1 =$ strong positive correlation, $-1 =$ strong negative correlation. $0 =$ no correlation.

4. **t-test**: compares the mean of two sets of data. If mean of one set $> 2$ standard deviations of the other $=$ significance.
Test 1. Ptolemaic and other aspects
Test 2. 500 millibar data
Test 3. Astronomical distance
Test 4. Interference
Test 5. Declination
Test 6. Equinoxes
Test 8. Fourier analysis
Test 1. Ptolemaic aspects: conjunction, opposition, trine (2), square (2), and sextile (2). Of the eight phases of the Sun-Saturn synodic cycle, the opposition data appears to show a more marked correlation to the date of the partile aspect. This has some significance for the hypothesis in regard to astronomical distance.

Test 2. 500 millibar data: If temperatures at the surface near the time of the geocentric alignment Sun opposition Saturn are lower that before or after, what is happening higher in the atmosphere?

Figure 1a: Saturn-Sun geocentric oppositions 1971-2000 Petersham, Central Massachusetts; surface temperature (solid line) and 500 mb height (dashed line) both expressed as anomalies from the dataset mean.
Test 3. Astronomical distance: The Sun-Saturn opposition occurs when Saturn is closest to the Earth. When the Earth is furthest from the Sun at aphelion, and Saturn is closest to the Sun at perihelion. Sample size here is a problem. The most recent opposition of this type occurred 7/2/1989 when the daily temperature average dropped by 10 degrees, over two standard deviations from the mean, between day -4 and day -2.

Test 4. Interference: New or full Moons near Sun-Saturn opposition. Here temperatures during the entire period were well below the mean (n = 14).
Test 5. Declination: Temperatures when the Sun and Saturn occupy the same declination, a very small dip at partile is followed by a warming trend. Overall, the amplitude is very low. When declination is limited to 3 degrees N or S of equator, the effect is much stronger (n = 7).
Test 6. Equinoxes: When planets are located near the equinoxes they have close declination and close position in longitude. With small sample size results on day 0 are statistically significant, two standard deviations from the mean.

Figure 4c: Sun-Saturn oppositions (n=6), CET (solid line) and Prague (dotted line), limited to 3 degrees from equinoxes.

Figure 4d: CET (n=77, solid line) and Prague (n=73, dotted line) conjunctions within 30 days of equinoxes.
The correlation coefficient $r$ for the two sets of variables in Figure 1b = 0.876 (moderately strong). The roughly 3 degree drop in temperature from day -5 to day -1 is not quite one standard deviation from the mean, which for both datasets is about 4 degrees. In the Amherst 1850-2005 dataset mean temperatures declined between day -7 and the day of the syzygy 75% of the time.
Representative controls

Random generated Sun-Jupiter oppositions
Two sample (paired) t-test of data – observed vs control 1
Conclusions:

In general, annual geocentric aspects between the Sun and Saturn of 180 degrees show a correspondence with cold or falling temperatures that is not robust – at the 95% confidence level.

Correlations with cold and Sun-Saturn oppositions vary by region – continental vs maritime climates must be considered.
Conclusions:

The opposition between the Sun and Saturn, which occurs when the Earth is closest to Saturn, appears to correlate with a small drop in temperature to day -1, which becomes amplified when occurring near a lunation (new or full moon) or at perigee – but small sample size lowers confidence.

Drops in temperature also appear to occur when Sun-Saturn oppositions are located near the equinoxes, a factor minimizing vertical distance (declination) between each other.
NE Cold Wave
12-23-2017
Daily average temperatures: Amherst MA 12/15/17 – 1/17/18

Mean temperatures: Dec = 31°, Jan = 26°
Stronger data from Sun-Saturn oppositions and positioning at the equinoxes suggests a gravitational effect is moving portions of air masses near the poles which then travel southward. When at the equinoxes, the tidal effect of a body is to pull along equator and flatten at the poles, possibly altering the jet stream, a process by which colder air could be brought to the surface in the higher latitudes.
Sun opposite Jupiter in temperature and precipitation

Digges: *The conjunction, quadrature and opposition of the Sun with Jupiter = great and moist vehement winds.*

Goad: *Jupiter with the Sun brings cool temperatures and frosts, with Mars “monstrous frosts”, and when in opposition and with assistance from other planets, “thunder and lightning.”*
Sun opposite Jupiter in temperature and precipitation
HadCET Sun-Jupiter conjunctions within 1 month of equinoxes: 1971-2000
Shaler Sun-Jupiter opposition - precipitation
1964-2002
Heathrow precipitation Su-Ju opp 1960-2017
Amherst precipitation 1893 - 2016
Sun opp Mars (Prague 1971-2000)
Sun opp Mars 01-17 precip (n=8)

These graphs, of the anomaly, or difference, from the mean, show a 41-day interval with the day Mars crossed the vernal point designated as day 0.

Mars entering Aries is nearly always found in the first six months of the year, when temperatures are naturally rising, this method is necessary to compensate for expected seasonal temperature changes.
Figure 3 depicts the mean of all Mars-Aries ingresses from 1964-2013 expressed as the anomaly from the mean of the period. Figure 4 depicts this same data smoothed exponentially. Data is from the Shaler and Fisher datasets, Harvard Forest, in Central Massachusetts.(1)
Figure 5 displays control data, randomly selected from the Shaler and Fisher datasets, for the same period as in Figure 3. (1) Figure 4 depicts this data smoothed exponentially.
Figure 7 graphs Mars-Aries ingresses from 1964-2005 using the Central England Temperature data from the Hadley Meteorological Center. (2) Figure 4 graphs the data for the 30-year period 1971-2000, but presented within a 21-day range, from Prague, Czech Republic. (3)
Discussion

It appears that the Mars ingress into Aries in the New England data **may initiate a warming trend** and suggests rapid changes in atmospheric conditions at that time. Such volatility cannot be the same for all parts of the world, however.

Several of the Mars-Aries ingresses in the Central Massachusetts dataset show distinct volatility when the **Moon** is coincidentally near either of the vernal points, or in one case, at 90 degrees from the vernal points. This can also be seen as conjunctions, oppositions and squares between the Moon and Mars, equivalents to the quarters of the Sun-Moon synodic cycle.
Six dates when the Mars-Aries ingress coincided with a 4th harmonic (conjunction, square, opposition) alignment with the Sun or Moon. Volatile conditions on the date of the ingress are shown by a 5 degree drop (over one standard deviation for the dataset) in mean temperature over two days.
Discussion:

Temperature volatility appears to increase near the day of a Mars-Aries ingress, and possibly more so if the Moon or Sun is simultaneously at or opposite the ingress (or at 90 degrees to it).

The equinoxes, vernal and autumnal, are the only points on the ecliptic that lie at 90 degrees to the poles and it is remotely possible that a planet, Sun or Moon crossing these points could disrupt atmospheric circulation by a weak tidal force, causing a bulge at the equator and depressing the poles.
Discussion:

Why this kind of effect would be registered in some regions but not in others, and not just at the spring equinox when warmer air masses are moving north, would have to be explained by land mass location and regional weather patterns.

It is apparent that much more work would need to be done (using temperature and pressure records from multiple sources) to isolate planetary effects, if they do exist, from the larger weather system.