the two events are required to confirm this picture and to help elucidate the mechanism of generation of noise observed in regions 1, 2 and 5.

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Correlation between Zurich Sunspot Number and Prominence of Jupiter's Red Spot

Graf, Smith and McDevitt¹ have presented a graph which purports to show a correlation between the prominence of the Great Red Spot on Jupiter and the Zurich sunspot number between 1892 and 1947. They did not, however, quantitatively establish the significance of this correlation. More recently Argyle² has shown the correlation coefficient from the data of Graf *et al.* to be 0.27 for the years 1892–1947, and from this concludes that the relationship is not established unless a better correlation is obtained. We have used and extended Peck's³ numerical rating of Red Spot prominence for the period 1892–1967 and have tested it for correlation with the Zurich sunspot

number during the observed interval has not been established.

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Exchange of Atmospheric Angular Momentum between the Hemispheres

IN regions of surface easterly winds (where the surface is moving in space faster than the air) a transfer of westerly relative angular momentum takes place from the Earth's surface to the atmosphere, while in regions of surface westerlies the transfer is from the atmosphere to Earth. These transfers are necessarily accompanied by transports of angular momentum within the atmosphere from low latitudes, where easterly winds prevail, to middle latitudes where westerly winds prevail. Such transports are accomplished chiefly by large-scale quasi-horizontal eddy processes as first suggested by Jeffreys¹. Lorenz² and Starr³ have recently summarized the observational evidence which bears out Jeffreys's suggestion and have shown how the angular momentum transports act to maintain the angular momentum of the Earth's atmosphere. Concomitantly with the transfer of angular momentum between low and middle latitudes we have recently found evidence of a transfer of momentum between the hemispheres⁴. In the winter hemisphere the low latitude surface easterlies are strong and more angular momentum is communicated to the atmosphere than is transported polewards. The excess is transferred across the equator into the summer hemisphere. The purpose of this letter is to communicate our recent numerical estimates of the interhemispheric transfer and to compare them with the hemispheric contents of angular momentum.

Data from almost three hundred balloon sounding stations in the zone between 40° N and 30° S have been used for the period 1957–64. For each station, month and level mean temperature, wind components, momentum transport and heat transport were evaluated and station data were combined, using objective map analysis techniques, into latitude band means⁴ for 3 month seasonal periods centred on January, April, July and October. The resultant momentum transport across the equator is given in Table 1. The total transport is composed of three contributions: transient eddy transport derived from time correlations computed at each station (usually written $[\bar{u}'\bar{v}]$, where u and v are the zonal and meridional components of the wind, primes denote departures from the time mean, a bar represents a time mean and square brackets indicate a zonal average value); standing eddy transport derived from the mean patterns of the u and v components (usually written $[\bar{u}\bar{v}]$, where the asterisks denote the deviations at a particular longitude from the average value round a latitude circle so that, for example, a point value is given by $\bar{u} = [\bar{u}] + \bar{u}^*$) and transport by the mean motions themselves (written $[\bar{u}][\bar{v}]$). As Table 1 shows, all three terms are important and act in concert in July to produce a large flux into the northern hemisphere. There is also a net flux into the northern hemi-

Table 1. RED SPOT DARKNESS SINCE 1947

Year	Darkness
1948	0
1949	6
1950	6
1951	6
1952	6
1953	0
1955	4
1956	3
1957	6
1958	5
1959	0
1960	6
1961	8
1962	8
1963	7
1964	8
1965	8
1967	4

number^{4,5}. Our Red Spot ratings for the years following 1947 (Table 1) are those compiled over the years by Mr Elmer J. Reese, using Peck's criteria. Standard statistical correlation methods were used, yielding a correlation coefficient of +0.16 for the sixty-nine pairs. The probability is 0.15 that a correlation coefficient this large could result from chance alone. We may therefore conclude that the correlation coefficient is not significant at the five per cent confidence level, and that the correlation between Red Spot prominence and the Zurich sunspot