SOME COMMENTS ON 'VARIATIONS OF THE EARTH'S ALBEDO DEDUCED FROM THE ASHEN LIGHT OF THE MOON', BY HEINZ HILBRECHT AND GERD KÜVELER

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(*Letter to the Editor*)

GARRY E. HUNT

Centre for Remote Sensing

and

Atmospheric Physics Group, Imperial College of Science and Technology, London, England

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Hilbrecht and Küveler (1985) have presented the results of 'possible' variations of the Earth's albedo which have been deduced from the ashen light of the Moon. The observations presented in the paper were made during the period of June 1972 to December 1973. While it is acknowledged that studies of the possible variations of the Earth's albedo are an important part of investigations of climate variations, the approach adopted by Hilbrecht and Küveler (*loc cit*) and the results presented are not sufficiently accurate for this purpose.

During the early part of this century a number of astronomers made estimates of the global mean albedo of the Earth using this approach (Hunt *et al.*, 1985). In Table I we have summarised the values that were estimated during these previous studies. The wide variation in values of the Earth's albedo would, at first, suggest a major climatic change! However, the differences between the individual results is a direct result of the difficulties in accurately interpreting the photometric observations as a consequence of the phase ventions of the total and local regions of the Moon.

The variations of the brightness of the ashen light are shown in Figure 3 of Hilbrecht and Küveler (*lop cit*). There are differences of a factor of 6 in the observations during January, March 1973 and July 1973 (see Figure 1 of Hilbrecht and Küveler) which will drastically affect the statistical significance of the results. Furthermore, the error bars of

TABLE I
Some astronomical estimates of the planetary albedo

		Albedo
Russell	1916	0.41–0.49
Danjon	1928	0.29
Danjon	1936	0.39
Satellite Estimate		~ 0.3

the brightness values are so large that one may also suggest that there is essentially no variation throughout the observational period. However, the figure clearly illustrates that the use of such data to estimate albedo values would introduce significant errors that could then make any physical significance to the values obtained.

The importance of the Earth's albedo may be seen in the net radiation budget of the planet which is given by

$$N = S(1-A)-E,$$

where S is the solar constant, A the albedo and E the emitted radiation to space. Stephens *et al.* (1981) estimate the net radiation to be $9 \pm 10\,\mathrm{W\,m^{-2}}$, $A = 0.3 \pm 0.01$ and $E = 234 \pm 7\,\mathrm{W\,m^{-2}}$. There are, of course, some uncertainties in the estimation of the albedo from the satellite measurements. However, the error bars are significantly smaller than those of the brightness curves from which Hilbrecht and Küveler hope to derive their values. It is unlikely then that the ashen light studies can produce values of A suitable for the climate investigations.

The authors state that "... the variations of the Earth's albedo deduced from the observation of the Moon's ashen light and the correlation with solar activity seems to be of some importance ...". However, the links between solar activity and the Earth's albedo must be, at most, tenuous. Any solar activity will affact the composition of the middle atmosphere which will have a very small affect on the albedo. The large contribution to the value of A is due to the cloud distributions which can be affected by changes in the hydrological cycle. However, for this effect to take place will require a larger change in the solar constant than has been observed at this time.

The results presented in the paper by Hilbrecht and Küveler, while of some astonomical interest, have limited value for climate studies of the Earth.

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