matters arising

Solar activity and climatic change

SIR,—Following John Gribbin's article (*Nature*, **246**, 453; 1973), we wish to draw your attention to an unpublished thesis by Dr J. Laszewski (University of Warsaw) which supports Gribbin's suggestions (see also ref. 1). A translation of this thesis is available in the library of The Institution of Civil Engineers.

Laszewski (now professor at the University del Zulia in Maracaibo, Venezuela) has collected long term records of the mean annual discharges of many rivers in Europe, North and South America, Africa and Australia. He demonstrated that the mean annual discharge varies in a cyclic manner which is connected in a complex way with the cycles of sunspots. This is a result of the changes in the atmospheric circulation influenced by the sunspot cycle. The long cycles are divided into shorter cycles, so the story is very complex.

Although none of the records of river discharges examined cover more than about 150 yr and most cover less than 100 yr, one may suspect that the cycle of 200 yr suggested in Gribbin's article is detectable.

Yours faithfully,

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1 Stachy, J., *Long term variation of the runoff of Polish rivers* (Institute of Meteorology and Hydrology, Warsaw, 1970) (in Polish).

Refining geoid heights

SIR,—In their recent paper refining the longitude-averaged geoid height with improved values for the zonal harmonics in the geopotential, King-Hele and Cook[1] show their latest version of the height of the meridional geoid section relative to a spheroid of flattening 1/298.25. In this definition an axially symmetric Earth is assumed.

If the distribution of Precambrian exposed and overlaid rocks[2] is expressed as the ratio of their occurrence along a particular line of latitude to the total length of that line (that is longitude 0° to 360°) and plotted against latitude, there seems to be reasonable correlation with geoid height. The actual proportions are plotted in Fig. 1 together with a smoothed curve on twice the scale.

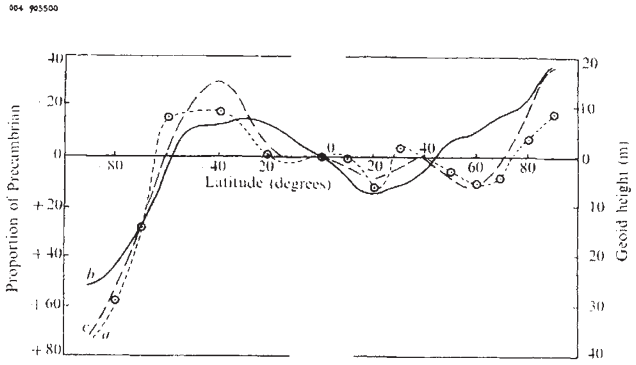

FIG. 1 Comparison of geoid heights given by King-Hele and Cook[1] with proportion of Precambrian stable areas. *a*, Proportion of Precamprian rock; *b*, geoid height, after King-Hele and Cook[1]; *c*, precamprian proportion smoothed on double scale.

A similar correlation exists with longitude for the gravimetric geoid published by Marsh[3] which agrees well with the Smithsonian Standard Earth 1969 (ref. 4). The geoid height at latitude 35°N is plotted against longitude in Fig. 2 and the distribution of Precambrian rocks is shown together with the extent of regions of Tertiary and Hercynian folding, which appear to have some significance, particularly in regions of orogeny such as 35°N, 65°E.

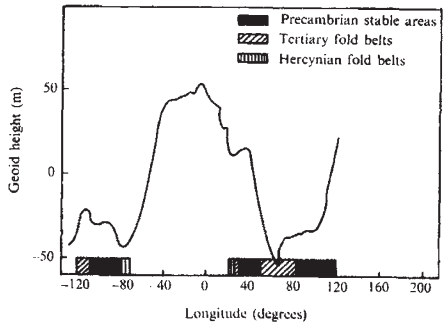

FIG. 2 Detailed gravimetric geoid at latitude 35° N showing correlation with geological formation.

The surprising feature of these effects is that the geoid height seems to be lower than the 1/298.25 spheroid in the stable land areas and higher than it in the oceanic areas. This is the reverse of what would have been expected intuitively.

Yours faithfully,

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1 King-Hele, D. G., and Cook, G. E., *Nature*, **246**, 86–8 (1973).
2 *The Times Atlas of the World* (Times Newpapers Ltd., London 1968).
3 Marsh, J. G., *Significant Accomplishments in Sciences NASA Goddard SFC*, SP-331, 212 (1972).
4 Gaposchkin, E. M., and Lambeck, K., *Smithson. astrophys. Obs. Spec. Rep.*, **315**, (1969).

Left and right in Goya's portraits

MCMANUS and Humphrey[1,2] have described biases in the frequency with which more of the right or left sides of faces are shown in paintings. Examination of 1776 portraits by different artists revealed that, overall, 57% showed more of the left side of the sitter's face. Whilst self-portraits tended to show more of the right side of the face (61% of those examined), male portraits tended to show more of the left side of the face (56%) and female portraits showed an even stronger bias towards the left (68%).

In an analysis of 335 portraits by Rembrandt, the same authors found that the frequency with which more of the left face is shown increases progressively across the following categories of sitter: self, male kin, male non-kin, female kin, female non-kin. To explain this it was suggested that the categories represent positions on a dimension 'socially like myself—socially unlike myself' along which Rembrandt placed his sitters. The choice of mainly left or right face was an indication by Rembrandt as to how he perceived his social relationship with the subjects of his portraits.

Table 1 summarises an analysis of 295 portraits by Goya taken from a comprehensive illustrated account of his works[3]. Each portrait was classified simply as