

A statement of the coordinate transformation that Noonan would advocate to relate the coordinates of a rotating system to those of an inertial frame would also be welcome. Any such proposal must be evaluated in the light of previous literature on this subject⁴. Reference 1 points out the anomalous situation that exists in that the Lorentz transformation between inertial frames has been exhaustively verified by experiment, although no such verification exists for transformation to a non-inertial frame—in particular to the important case of rotating coordinates.

The world-line element proposed by Marsh in his equation (1) is that obtained from the coordinate transformation: $r=r'$, $\Phi=\Phi'+\omega t'$, $z=z'$, $t=t'$. This is the cylindrical coordinate equivalent of the rotating coordinate transformation used by Schiff. As I pointed out in my original communication¹, the latter coordinate transformation predicts the same equations of the electromagnetic field as does the classical Galilean transformation for rectilinear motion. This does not suggest that it is a correct description of the nature of the rotating system, more than would any other *ad hoc* assumption for the transformation law. What is needed here is independent confirmation, either from experiment or observation.

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Universal Time Control of the Antarctic Ionosphere

It has been suggested¹ that over Antarctica maximum upward ionospheric drifts will be produced at about 0600 UT when horizontal neutral air winds at thermospheric heights blow directly over the magnetic pole (67° S, 141° E) towards the various Antarctic observatories. These winds lift the *F* region ionization to heights at which the electron loss rate is reduced. It would thus be expected that, at 0600 UT, maximum values of the *F* layer peak height ($h_m F_2$) and critical frequency ($f_o F_2$) will occur and it was proposed¹ that the well known dependence of $f_o F_2$ on Universal Time could be accounted for in this way.

The purpose of this communication is to correct a recent publication² by one of us (R. A. C.) in which it was concluded that the effects of neutral air winds on the Antarctic ionosphere may not be as important as originally suggested by King *et al.*¹.

Fig. 1 in ref. 2 (not to be confused with Fig. 1 of this article) was based on results reported by Piggott and Shapley³ and was intended to show the Universal Times at which maximum and minimum values of $h_m F_2$ were observed at the Antarctic stations. Piggott and Shapley published the Universal Times at which the minimum $h_m F_2$ values were observed, but the Local Times at which the maximum values occurred. Fig. 1 of ref. 2 was constructed in the belief that all the times quoted by Piggott and Shapley were Universal Times and, therefore, the comparisons made of these times with those expected theoretically led to erroneous conclusions.

Another difficulty about the procedure followed by R. A. C. is that, as King *et al.*⁴ showed, the chief component of the

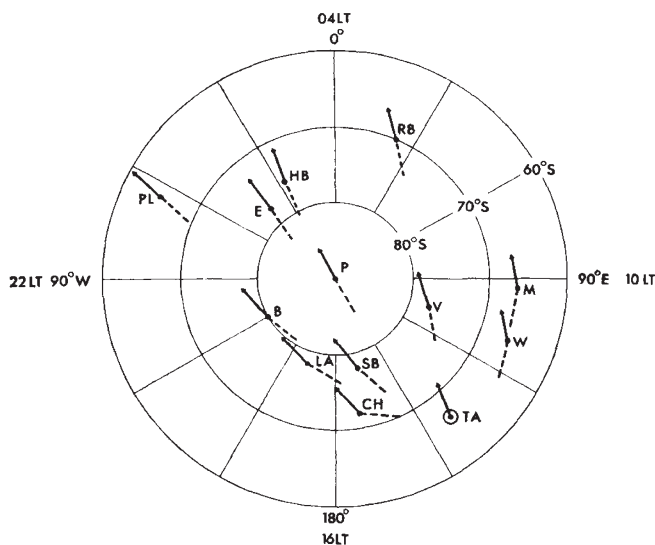


Fig. 1 A polar plot in geographic coordinates showing the directions of the neutral air wind at 0400 UT (arrows) and the magnetic meridian (dashed lines) at each of the Antarctic observatories; the wind directions were calculated for December 1958 and for a height of 300 km. The observatories are: Roi Baudouin (RB), Mirny (M), Vostok (V), Wilkes (W), Terre Adelie (TA), Scott Base (SB), Cape Hallett (CH), Little America (LA), Byrd (B), Port Lockroy (PL), Ellsworth (E), Halley Bay (HB) and Pole (P).

observed diurnal variations of $h_m F_2$ in Antarctica is approximately sinusoidal; it is this component which is associated with the neutral air winds. In individual cases the times of maximum and minimum $h_m F_2$, as quoted by Piggott and Shapley, refer to maxima and minima which are superimposed on the chief sinusoidal variation and it is therefore undesirable to use these times to evaluate the overall agreement between the calculated and observed behaviours.

King, Eccles and Kohl have recently completed a detailed investigation (to be published) in which simultaneous solutions of the ionospheric continuity equation and the equation of motion of the neutral atmosphere were obtained in order to investigate fully the effects of neutral air winds on the Antarctic ionosphere. The results of these calculations have been compared with observed data and have confirmed that, although the observed diurnal variations of $h_m F_2$ and $f_o F_2$ are sometimes complicated by the existence of secondary maxima, the 0600 UT phenomenon can be attributed to the effects of winds. Fig. 1 contains results of these calculations and shows that at 0400 UT the winds (arrows) blow directly away from the magnetic pole at Terre Adelie (TA) along the magnetic meridians (dashed lines) at most of the Antarctic observatories. Because of these winds, maximum values of $f_o F_2$ will occur at approximately 0600 UT. The 2 h delay arises because of the diffusion time constant⁴.

We wish to point out that, although the 0600 UT effect is a consequence of neutral air winds, there are other features of the Antarctic ionosphere which may be associated with energetic particles. The possible effects of such particles have not yet, however, been fully established.

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