Comments on "Interpretation of Flux-Profile Observations at ITCE (1976)"

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The adequacy of the uniform upwind fetch is of special interest in the case of the ITCE (1976) micrometeorological study, because of the accidental fire that destroyed the natural grass cover in the vicinity of the main site. The search for fetch effects by Francey and Garratt (1981) failed to identify any strong evidence either that the limited fetch was indeed sufficient or that data obtained beneath 16 m height were adversely affected in any consistent manner. Francey and Garratt acknowledge that some effects must be expected, but argue that these are likely to impose random errors upon the conclusions to be drawn, rather than a consistent bias.

Fig. 1 is derived from the ITCE data set published by Garratt *et al.* (1979). This body of data includes several independent evaluations of eddy fluxes. Fig. 1 presents a plot of flux divergences derived from sensible heat fluxes measured at 8.5 m height and independent evaluations at 5.5 m; one set of sensors was mounted directly above the other and identical analysis methods were used. A variation with wind direction is evident in the diagram and appears to be related to the fetch. Fetch estimates shown are slightly different from those given by Francey and Garratt; they are independently derived from a map of the burnt area, after assuming that the effective fetch is determined by the average over a sector subtending an angle of 20° centered on the mean wind direction. The angle is estimated on the basis of values of σ_θ, likely to be applicable in the conditions of the experiment.

Even in the best of circumstances, some flux divergence must be expected. However, the values plotted in the diagram clearly indicate a divergence that is fetch-dependent. We should conclude, therefore, that the 8 m level was somewhat influenced by the distant upwind surface. In this, we should not be too surprised, since the application of a fetch/height ratio of 200 would provide a first-order estimate of the depth of the fully-adjusted surface boundary layer of between 4 and 8 m, in most circumstances of the ITCE study.

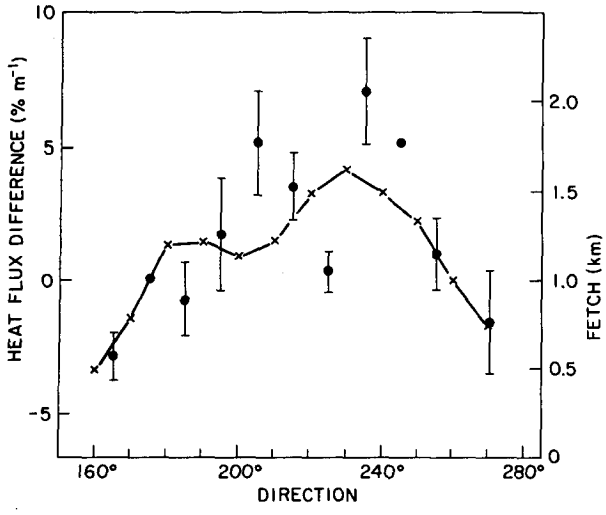

FIG. 1. The variation with wind direction of fetch (crosses) and sensible heat flux divergence (dots) for the 1976 ITCE data. Standard error bars are shown except where averages contain fewer than four evaluations of the heat flux divergence.

A conservative analysis would therefore omit data obtained above ~8 m from any consideration of flux-gradient relations. The effect on the conclusions drawn by Francey and Garratt cannot be evaluated from the data provided in their tables, but the effects are likely to be small. Inspection of their Table 2, for example, suggests that k_m might be increased, but Table 4 indicates otherwise. However, it seems possible that it was fetch inadequacies that resulted in many of the inconsistencies between adjacent height levels, rather than calibration errors as suggested by Francey and Garratt.

REFERENCES

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Garratt, J. R., R. J. Francey, I. C. McIlroy, A. J. Dyer, I. Helmond, E. F. Bradley and O. T. Denmead, 1979: The International Turbulence Comparison Experiment (Australia, 1976)—Meteorological support data. Tech. Pap. No. 37, CSIRO Div. Atmos. Phys., 23 pp. [ISBN 0 643 00352 5].