Discussions

Interactive comment on "Observing desert dust devils with a pressure logger" *by* R. D. Lorenz

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This paper provides practical information on setting up low cost, stand-alone pressure sensors for detecting ground-level/near-ground-level atmospheric vortices. I echo the review provided by Professor Colin Wilson: this paper will allow relatively low-cost monitoring of dust devil, and more generally, ground-level convective flows. In order to add to the discussion, I will merely point out (or more accurately propose) a potential, though possibly peripheral application:

1) Given simultaneous pressure data from two separate sensors, as well as simultaneous ground-level and elevated (above ground) temperature measurements, then both the approximate vertical convective velocity scale, w, as well as the approximate (radial, near-ground) size of the region influenced by/feeding dust to the dust devil, R, can be estimated, as follows:

i) In a simplified picture where the vertical devil is fed by a radially-inward, near-ground-level flow, and operating under the assumption that vertical momentum, $\rho w^2 \sim \rho l g \beta \Delta T$, where ΔT is the measured temperature difference, l is the vertical separation between measured temperatures, and β is the volumteric expansion coefficient, then $w \sim \sqrt{g\beta\Delta Tl}$.

ii) Given w, and assuming that the radial, inward, dust-laden flow begins with a velocity near zero, at a characteristic radius, R, then continuity requires that $w/l \sim u/R$, where u is the characteristic speed of the radial, inward flow.

iii) Since u can be estimated via momentum conservation as $u \sim \Delta P/\rho$, where ΔP is the measured pressure difference (at the the spatially separated sensor locations), then $R \sim ul/w \sim \Delta Pl/(\rho\sqrt{g\beta\Delta Tl})$. [Note, one would have to ensure that the flow between pressure sensor locations is strongly radial. This, in turn, might require a third, spatially separated pressure measurement.]

Given statistical information, for example, on w, u, and R (obtained over extended periods), one could then gain a semi-quantitative picture of: a) dust devil strength (with respect to dust transport, where strength, in this case, is indicated by w), and b) devil (dust) mass transport, as indicated by both u and R.

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