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, \( \rho w^2 \sim \rho g \beta \Delta T \), where \( \Delta T \) is the measured temperature difference, \( l \) is the vertical separation between measured temperatures, and \( \beta \) is the volumetric expansion coefficient, then \( w \sim \sqrt{g \beta \Delta T l} \).

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 \( \Delta P \) is the measured pressure difference (at the the spatially separated sensor locations), then \( R \sim ul/w \sim \Delta Pl/(\rho \sqrt{g \beta \Delta T l}) \). [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 \( R \).