8B.8 Improving the Utility of Ordinary Radar Reflectivity Measurements through Enhanced Subscripting

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By sheer mass of pages, the practitioners of polarimetric radar techniques tend to overwhelm those employing simpler techniques involving only reflectivity (and sometimes Doppler velocity) data. For example, compare Bringi and Chandrasekar (2001) with Doviak and Zrnić (1984, 1993), especially before the latter added polarization sections. Careful analysis has revealed a key factor in this situation: the subscripting procedures adopted in the notation for polarimetric quantities. Two basic rules appear to be at work:

1. Never use one subscript when two (or presumeably even more) will do.

2. Use redundancy freely.

To demonstrate this, consider the quantity known as differential reflectivity; apart from the unfortunate choice of Z as the primary symbol (because differential reflectivity does not have the same dimensions as Z), already noted by others, a single subscript would serve quite nicely: Z_d, for instance. But instead we have Z_{dr}, as dictated by Rule 1; and surely the Z stands for reflectivity (what else could it be?) and the subscript r merely repeats that, in accordance with Rule 2. The notation for differential phase, ϕ_{dp}, parallels this example quite closely; the ϕ indicates phase, the subscript d conveys useful information, and the subscript p is redundant with the primary symbol.

It appears that the utility of ordinary reflectivity measurements could be greatly enhanced (or at least the mass of pages could be increased) by following the same basic rules. Intensive research has already identified one highly promising candidate: we usually measure the equivalent (e) radar reflectivity factor (Z) at horizontal (h) linear (l) polarization (p). Slight rearrangement of the subscripts as a memory aid leads to the very appealing notation

$$Z_{help}$$

This clearly meets the dictates of Rule 1 (in spades!) but the redundancy (Rule 2) of h and l (p) is a bit wimpy. Adding a truly redundant subscript, in the style of the polarimetric notation, thusly

$$Z_{helpr}$$

is a possibility. Work continues to try to improve this, and a team has been assigned to investigate the value of capitalizing most or all of the subscripts.

Another team is investigating how the LDR has managed to escape the purview of these rules. The assistance of the community in these ongoing efforts would be most welcome.

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References

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