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FillValue

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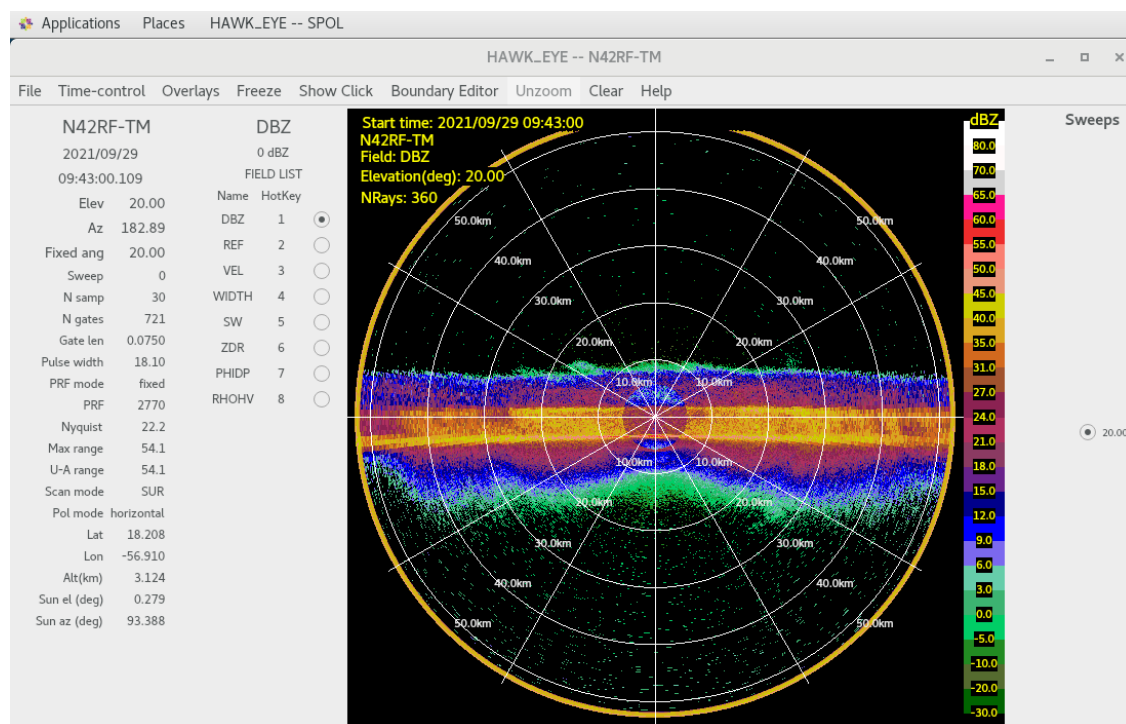
Thu, Feb 24, 2022 at 4:38 PM

Hi Joe,

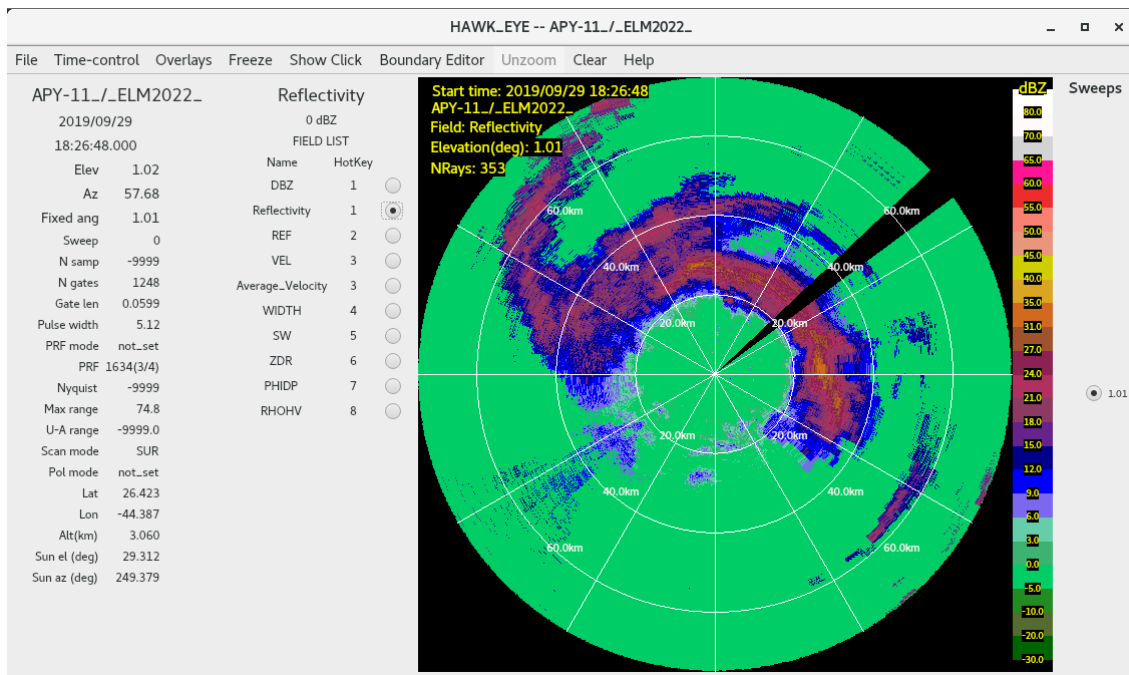
We had an internal discussion yesterday, looking back at a Lorenzo MMR HWX case from 2019 (...we couldn't find more recent in-storm HWX sweeps since NAW is used primarily...) using HawkEye. Three key bullet items to address:

*Thresholding

I believe we may have misunderstood what the ELTA Harris software is doing. Let me explain... With the TDRs, a signal to noise thresholding is performed on the aircraft such that bins not meeting that threshold are assigned a flag value when the data is written to file. This is fairly standard procedure for research radars. The lowest values of measured reflectivity depend on the sensitivity, but -10 to -5 dB (at 10-km range) is typical for the TDRs. Here is a TDR sweep in HawkEye ... notice the black regions well above the surface. These are regions where bins were assigned flag values. Some speckles of noise do remain.



What appears to be the case for the MMR is that ALL reflectivity measurements are written to the CfRadial files, but no value <0 dB is permitted. Therefore, regions where reflectivity might have sufficient signal to noise, but with values <0 dB, are simply set to 0 dB ... and regions where reflectivity is significantly <0 dB and probably just junk (in terms of signal to noise) are also set to 0 dB. Does ELTA Harris think this is a fair characterization of what is done? Below is an MMR sweep (HWX_2019_09_29_18_26_48.nc) in HawkEye ... notice that, aside from the wedge (which we *think* is where there aren't any MMR rays in that sweep), the domain is mostly filled with 0 dB values.



In looking at the Doppler velocity for the CfRadials shown above, we noticed that there are *coherent* structures in velocity that fall within the "sea of 0 dB". Users will be unable to apply standard reflectivity thresholding algorithms in such regions of uniform "0 dB" data. Does ELTA Harris think this is an accurate conclusion? The CfRadial attributes (see below) and documentation should make this clear to the user.

*Metadata (attributes)

Given the above (that measurements are reported everywhere for better or worse), we think that a "_FillValue" actually makes no sense. It appears that missing values (see the TDR sweep above for reference) aren't permitted, or at least that's what we're now gathering. Therefore, we would recommend, if accurate, the following for any reflectivity variable (DBZ and NAW_Range_Vector_Map): (As we noted before for CfRadial 1.3, a conversion between byte and float values should be provided in the attributes so that the user can easily retrieve the physical reflectivity values ... Float value = (integer value) * scale_factor + add_offset)

```
byte DBZ(time, range) ;
  DBZ:long_name = "DBZ" ;
  DBZ:_FillValue = ?? ;
  DBZ:scale_factor = ??f ;
  DBZ:add_offset = ??f ;
  DBZ:units = "dBZ" ;
  DBZ:comment = "Reflectivity less than 0 dB has been assigned a value of 0 dB"
```

```
byte NAW_Range_Vector_Map(time, range) ;
  NAW_Range_Vector_Map:long_name = "Range_Vector_Map" ;
  NAW_Range_Vector_Map:_FillValue = ?? ;
  NAW_Range_Vector_Map:sampling_ratio = 1.f ;
  NAW_Range_Vector_Map:coordinate = "time range" ;
  NAW_Range_Vector_Map:grid_mapping = "grid_mapping" ;
  NAW_Range_Vector_Map:scale_factor = ??f ;
  NAW_Range_Vector_Map:add_offset = ??f ;
  NAW_Range_Vector_Map:units = "dBZ" ;
```

NAW_Range_Vector_Map:comment = "Reflectivity less than 0 dB has been assigned a value of 0 dB"

We don't believe there's any reason for a "_FillValue" attribute if data aren't being flagged. Inclusion of this attribute may only confuse users. *This likely holds true for the other variables as well.* ELTA Harris can confirm, is there ever any instance where a value is written to a variable that is not a measured value? We want to make certain of this before recommending removal of "_FillValue". And, to be clear, by "_FillValue" we intend "missing data flag" (not padding of arrays).

***Range Delay**

Regarding: "The range to center first gate being zero, it is correct for sea_roughness since that is a map. Do the researchers see zero in NAW? In HWX?" ... In a 2019 file it was 0 m, which inspired our original question. However, we checked a 2021 NAW file and saw: range = -29.5, 120.39, 270.28, ... and "range_to_center_of_first_gate" listed as "-29". Does ELTA Harris think they could have a negative range delay?

--Paul

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