The Capability of AIRS to Capture Near-Surface Temperature Profiles Over Land

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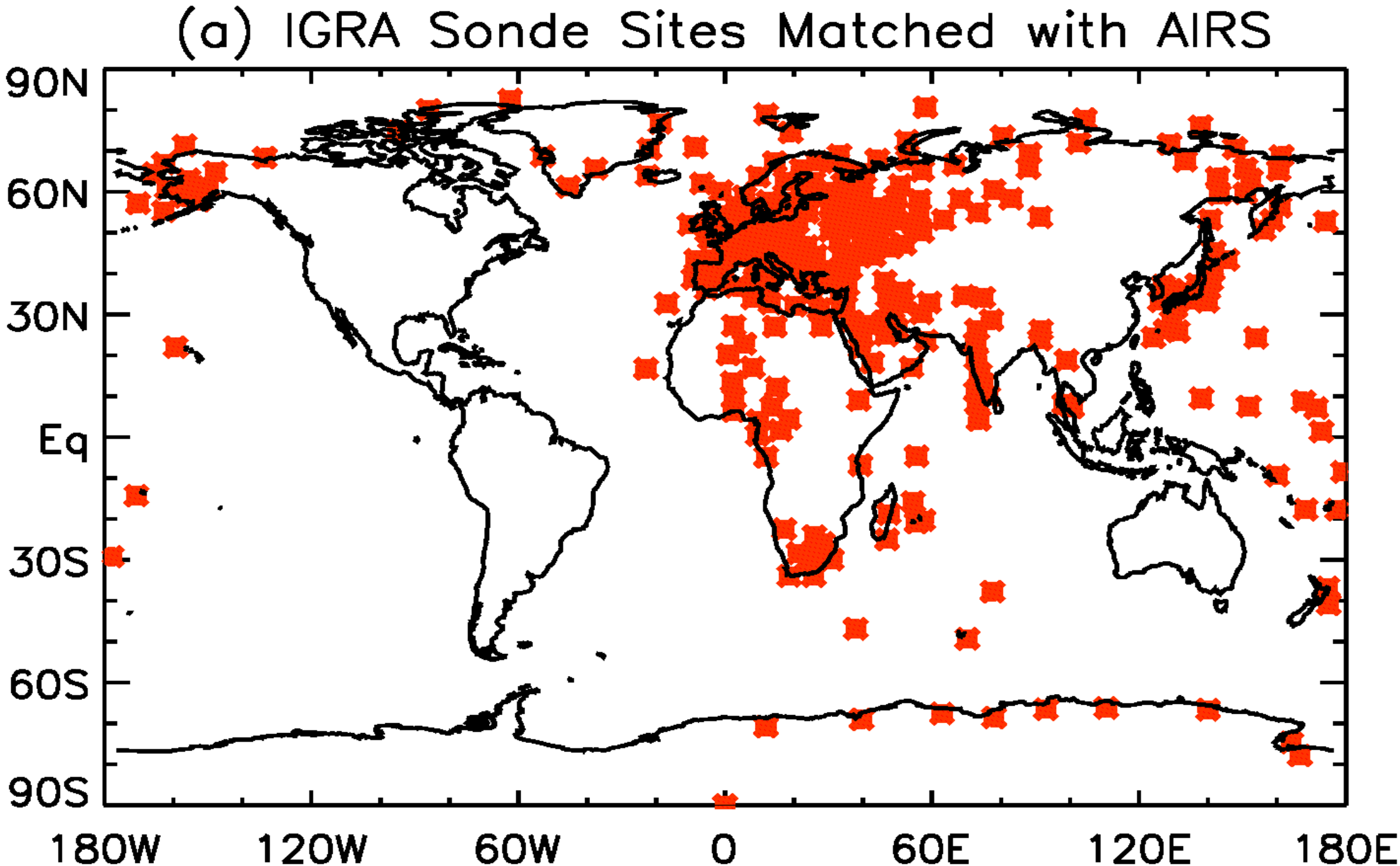
Rationale

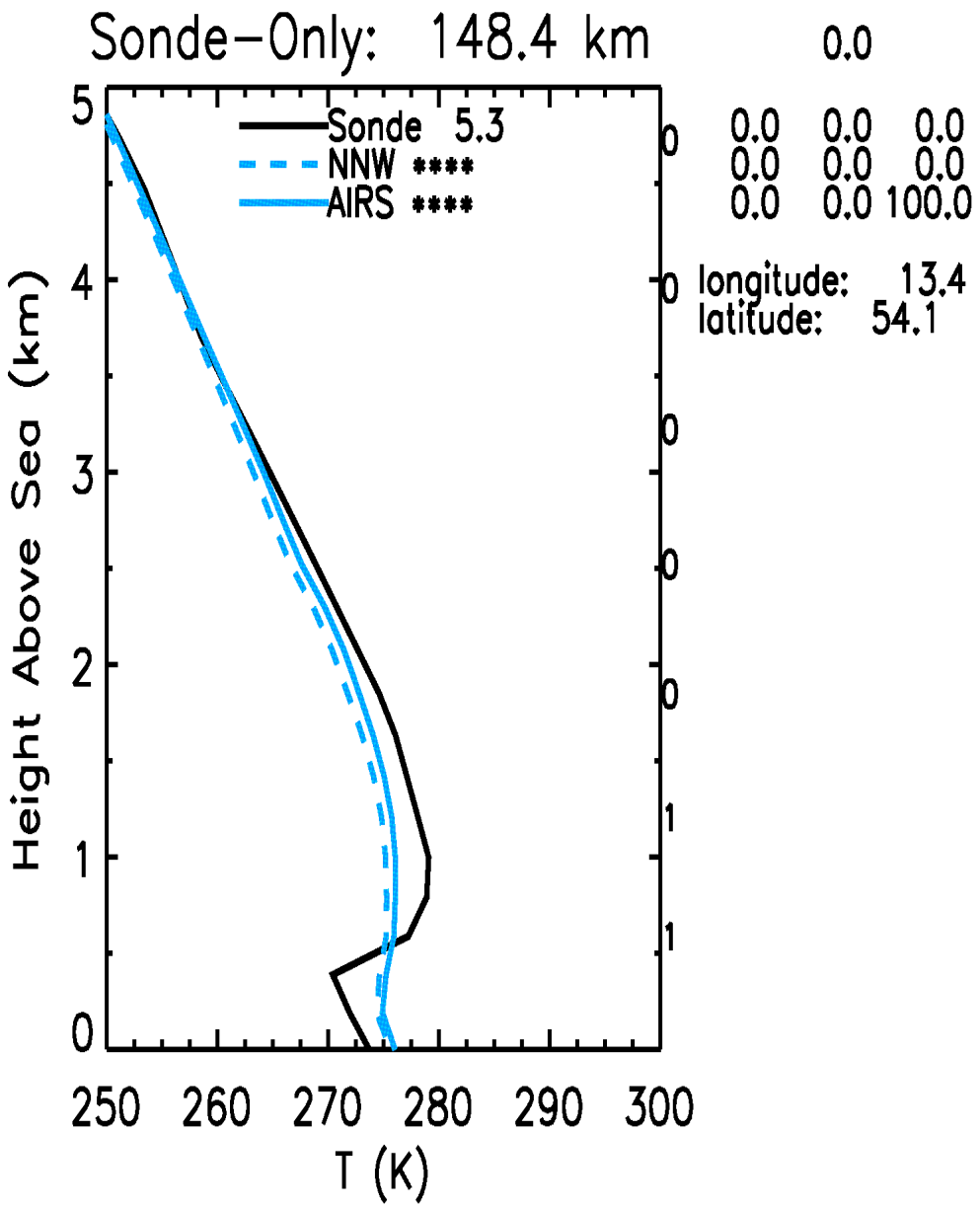
- Boundary layer inversion is important in both climate science (e.g., land-atmosphere interaction) and application (e.g., air pollution)

- Many application cases are interested in individual profiles. Statistical averaging is not useful here

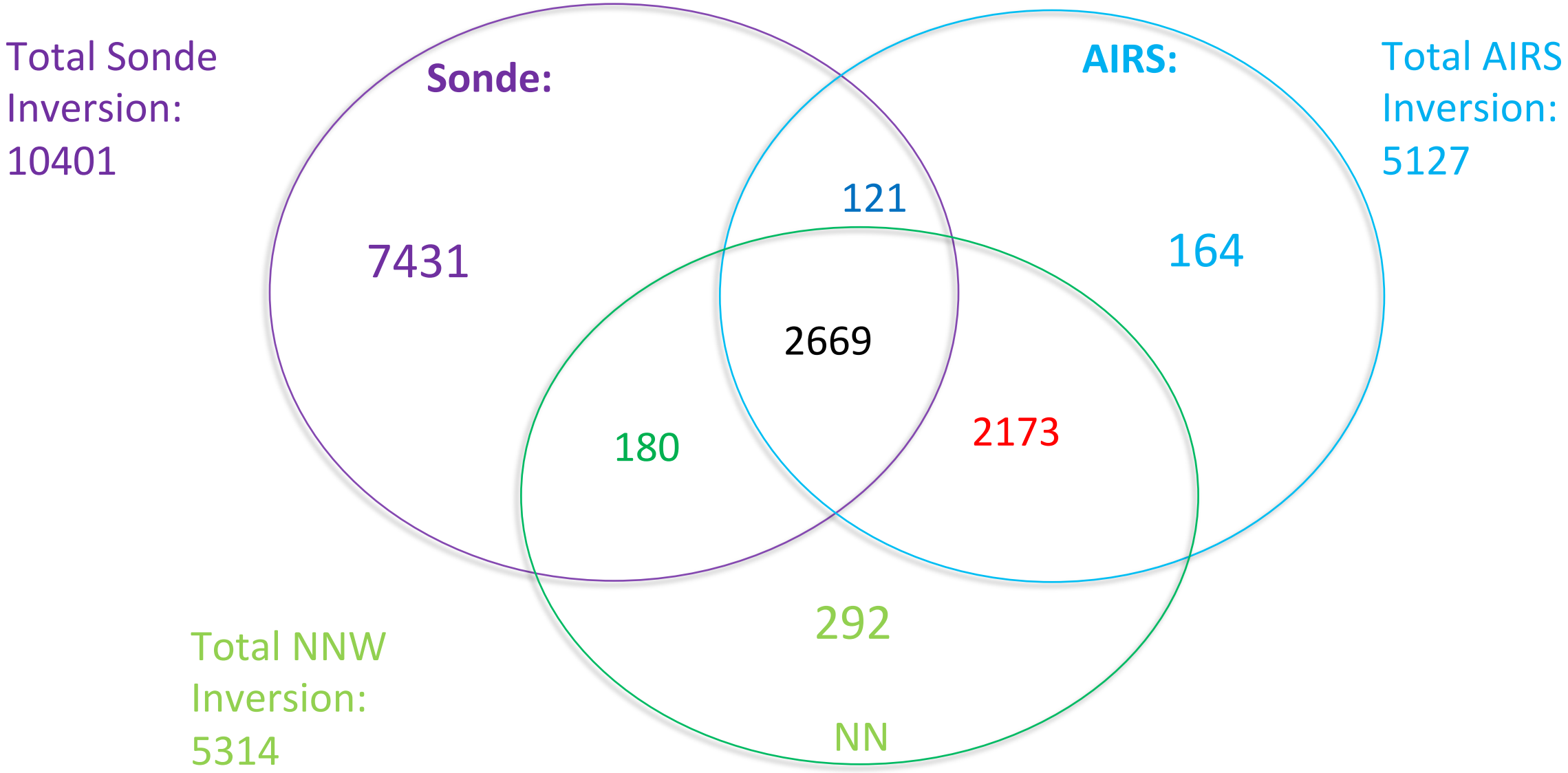
- The ability of AIRS T to capture boundary layer inversion

- Can quality flags tell whether the inversion is captured or not?

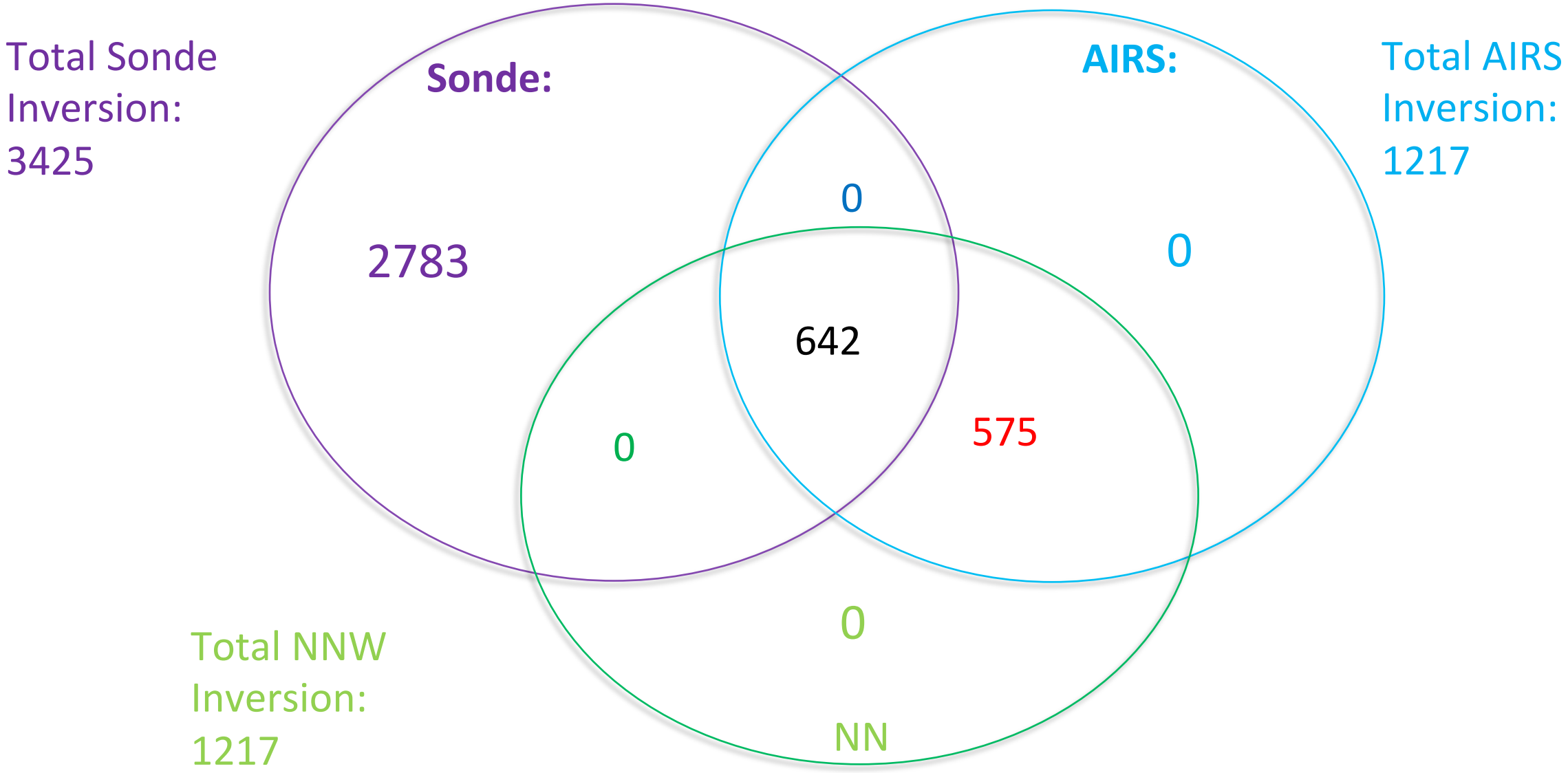

(a) IGRA Sonde Sites Matched with AIRS
90N
60N
30N
Eq
30S
60S
90S
180W
120W
60W
0
60E
120E
180E


Sonde-Only: 148.4 km
0.0
Sonde 5.3
NNW ****
AIRS ****
0.0 0.0 0.0
0.0 0.0 0.0
0.0 0.0 100.0
longitude: 13.4
latitude: 54.1
Height Above Sea (km)
T (K)
250 260 270 280 290 300
0 1 2 3 4 5

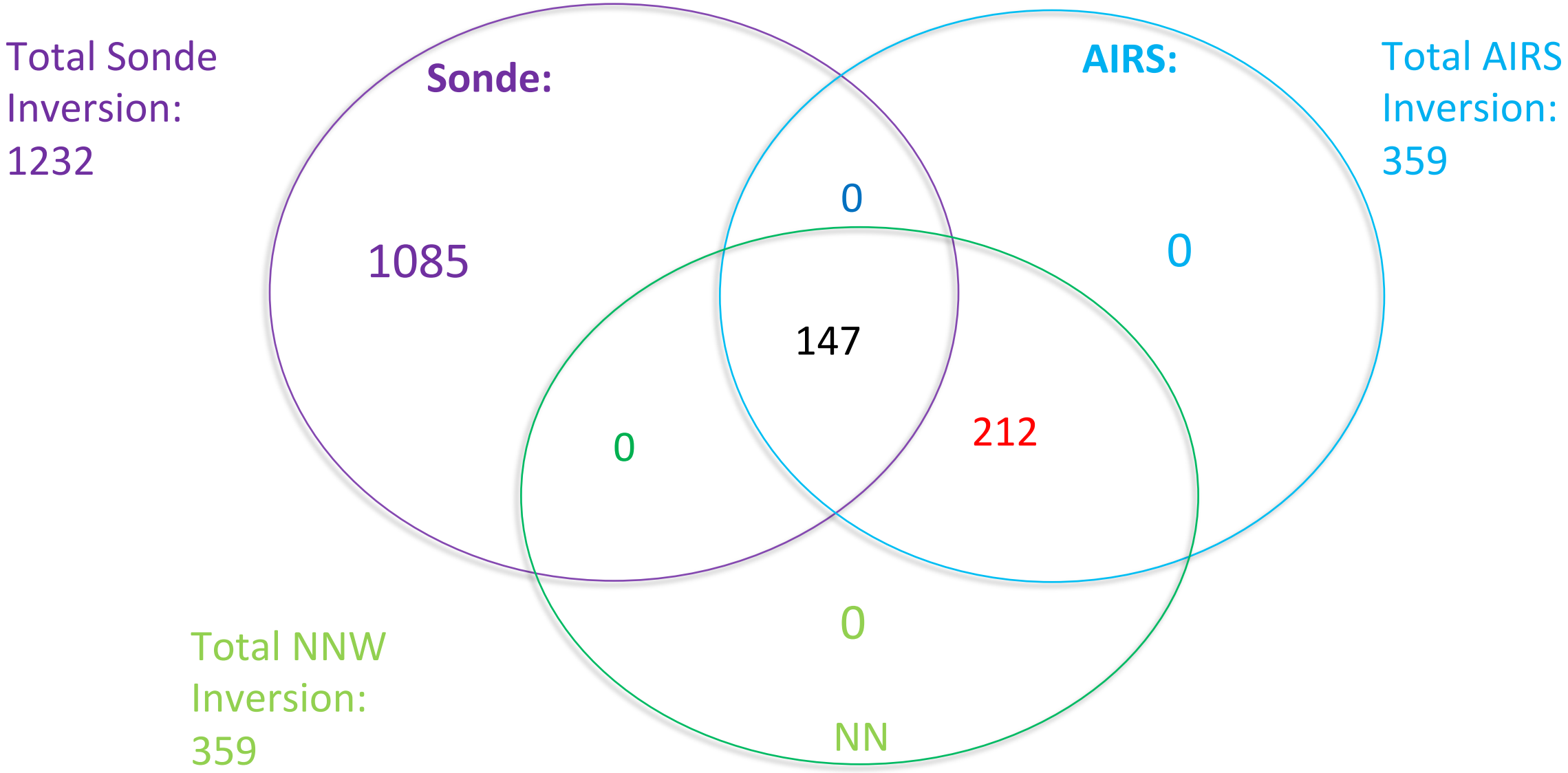
Total IGRA-AIRS-MODIS Match Ups: 94343
Inversion, Strength >= 0 K/km : 13030



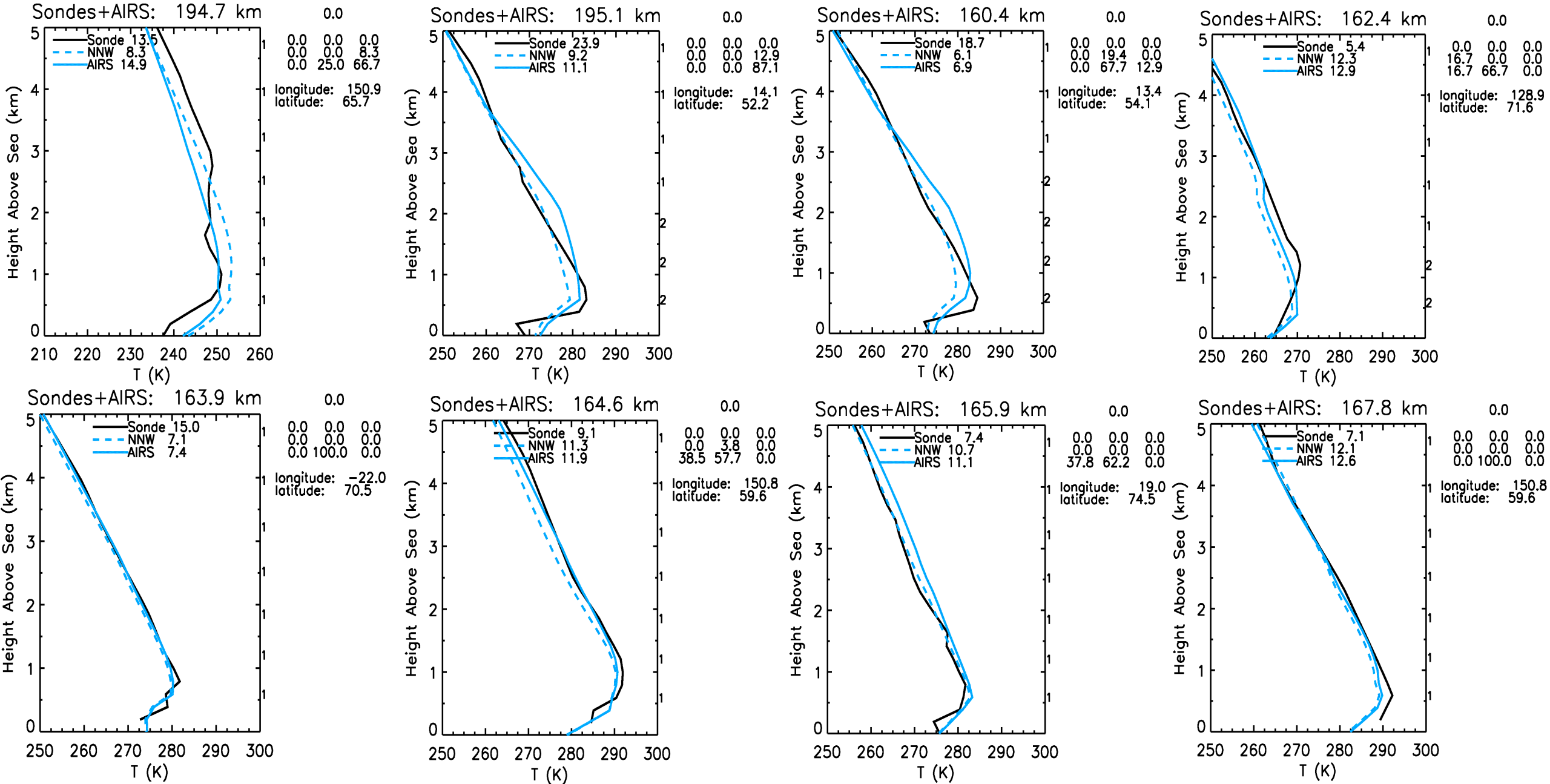
Total IGRA-AIRS-MODIS Match Ups: 94343
Inversion, Strength >= 5 K/km : 4000



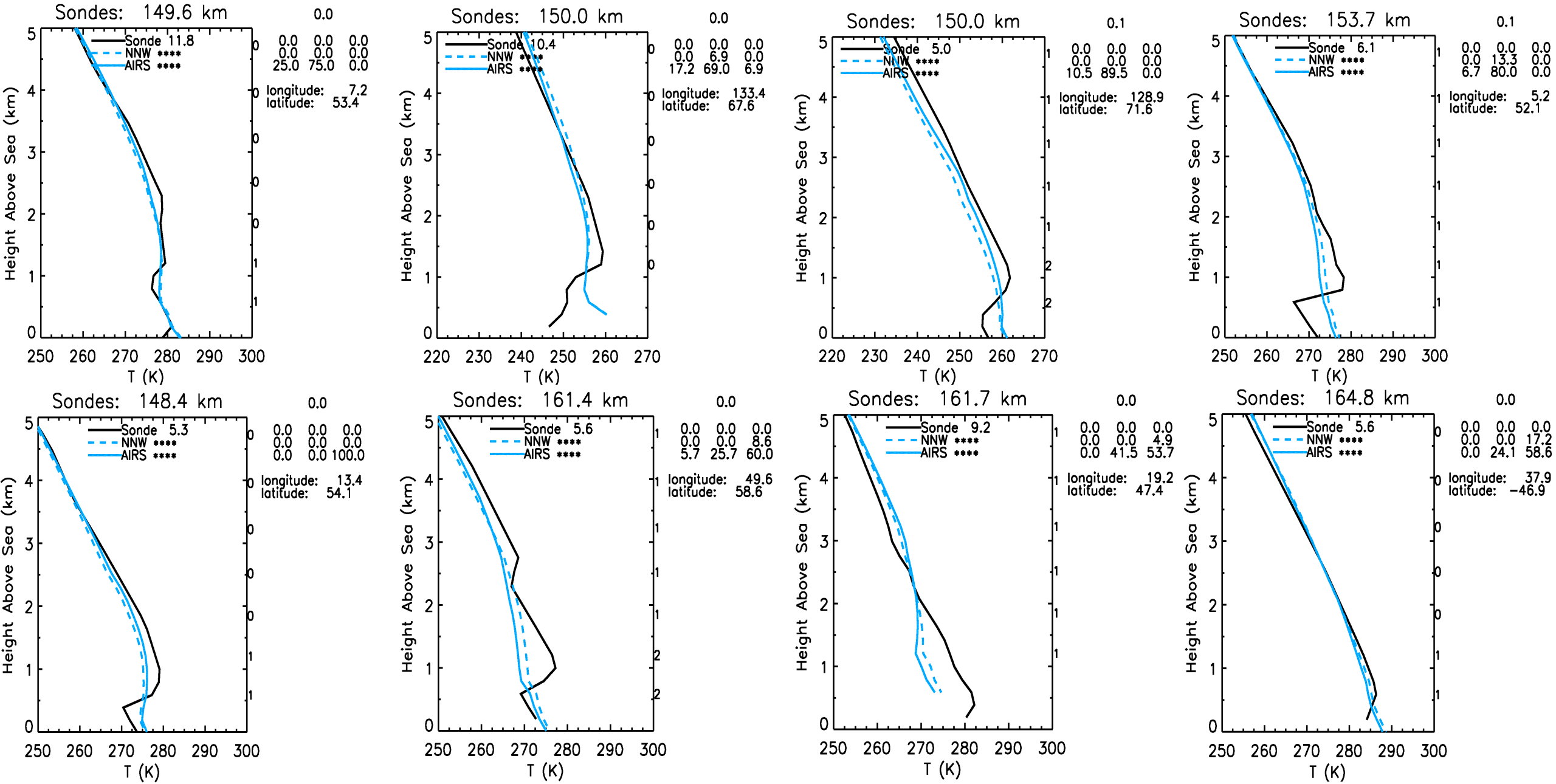
Total IGRA-AIRS-MODIS Match Ups: 94343
Inversion, Strength >= 10 K/km: 1444



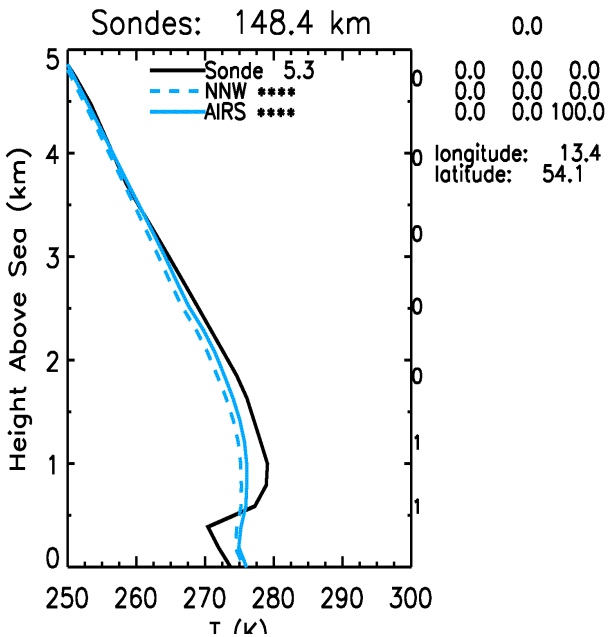
AIRS & Sonde, Strength > 5 K/km, St or Sc > 50%

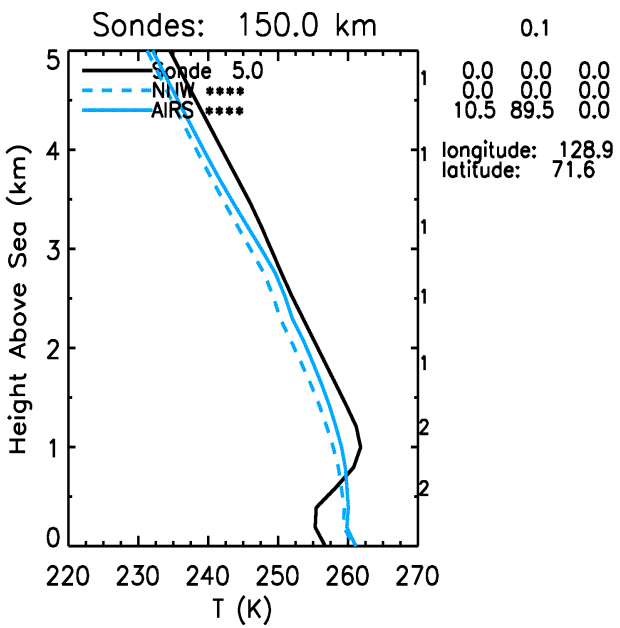


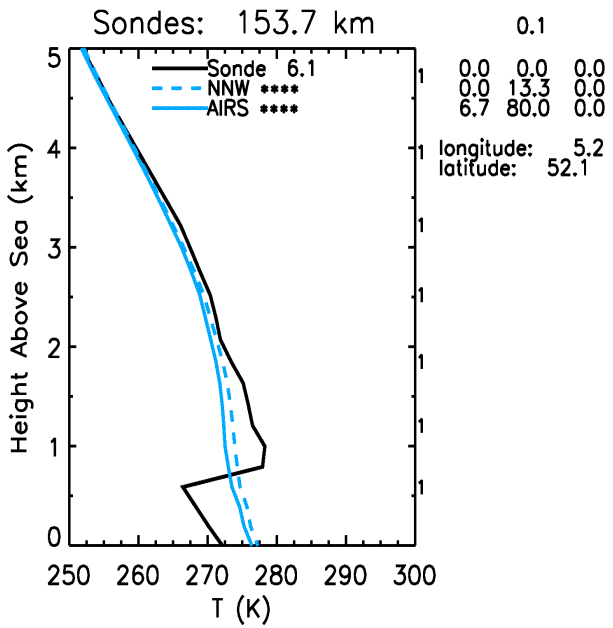
Sonde-Only, Strength > 5 K/km, Sc or St > 50%



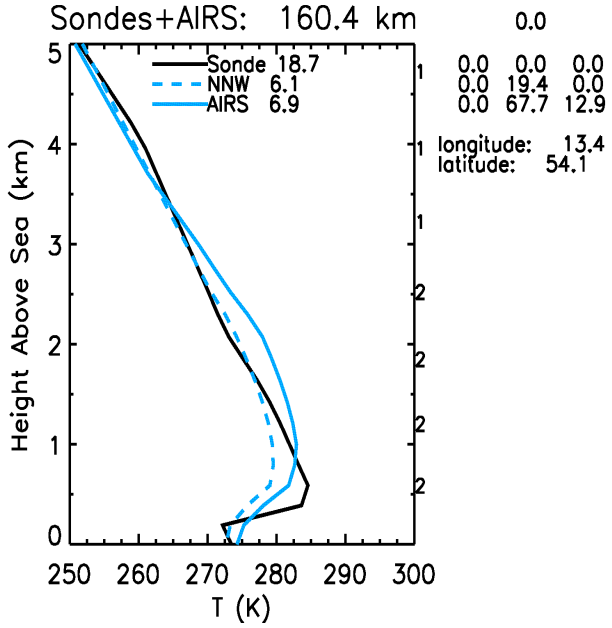
Strength > 5 K/km, Sc or St > 50%

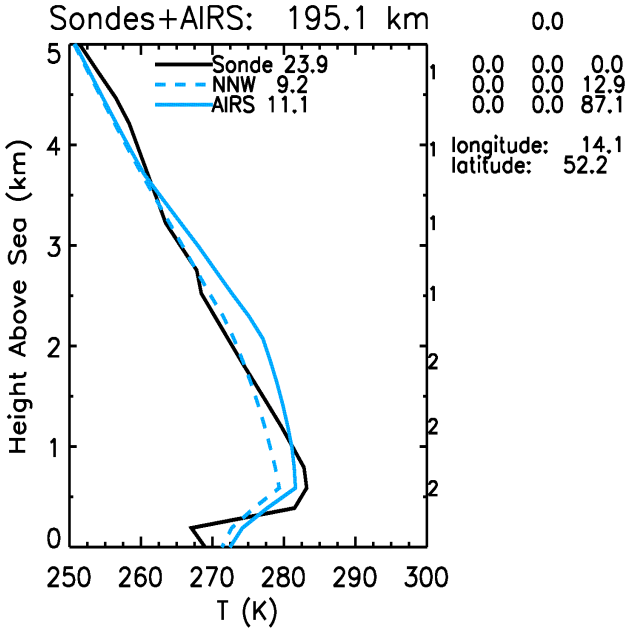


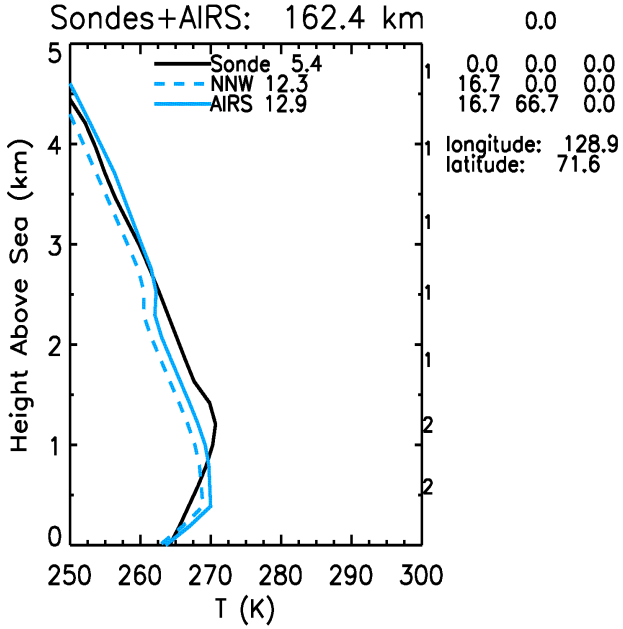




AIRS misses inversion, but may flag 1

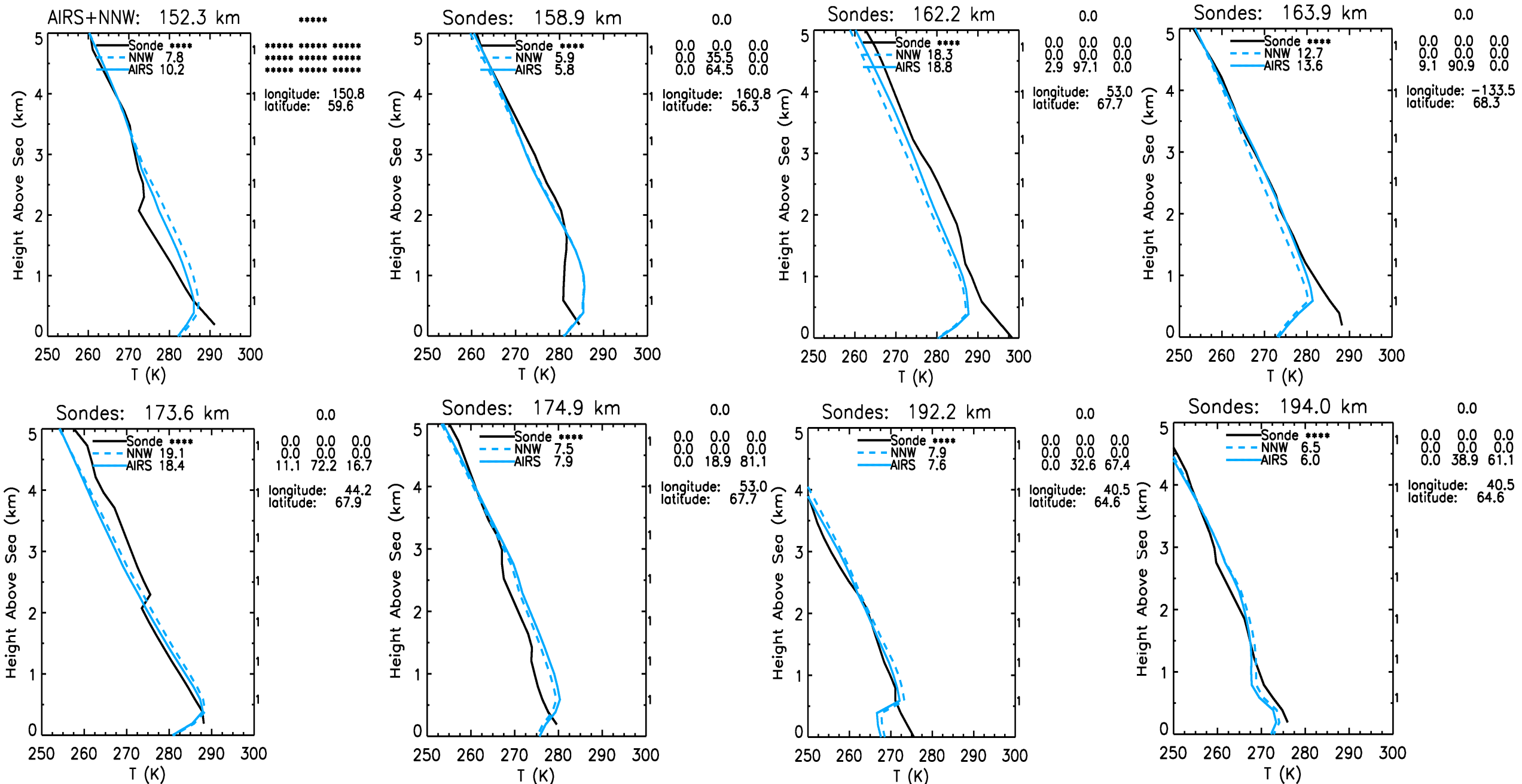






AIRS has inversion, but flags 2

AIRS & NN: Strength > 5 K/km, St + Sc > 50%



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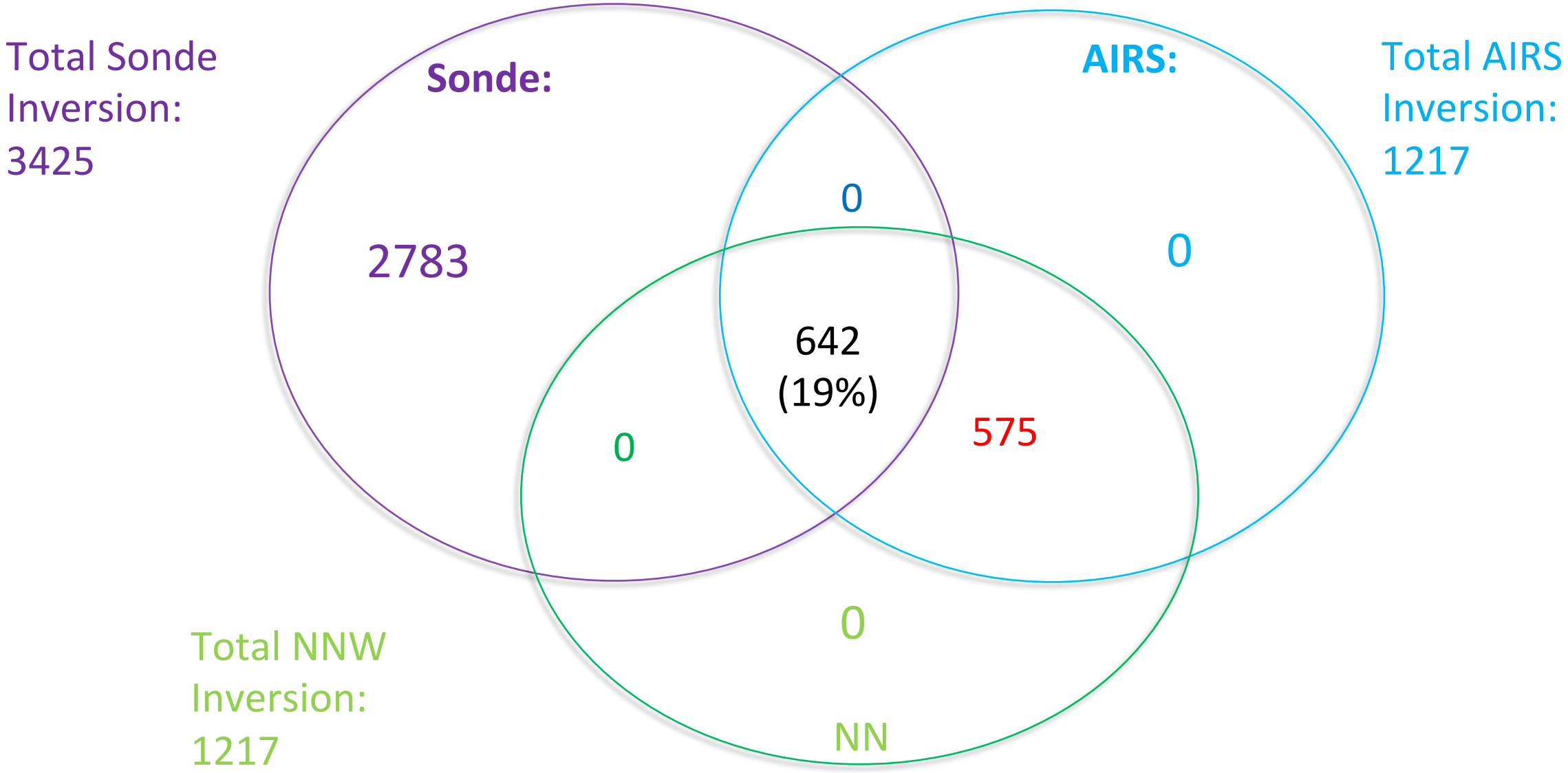

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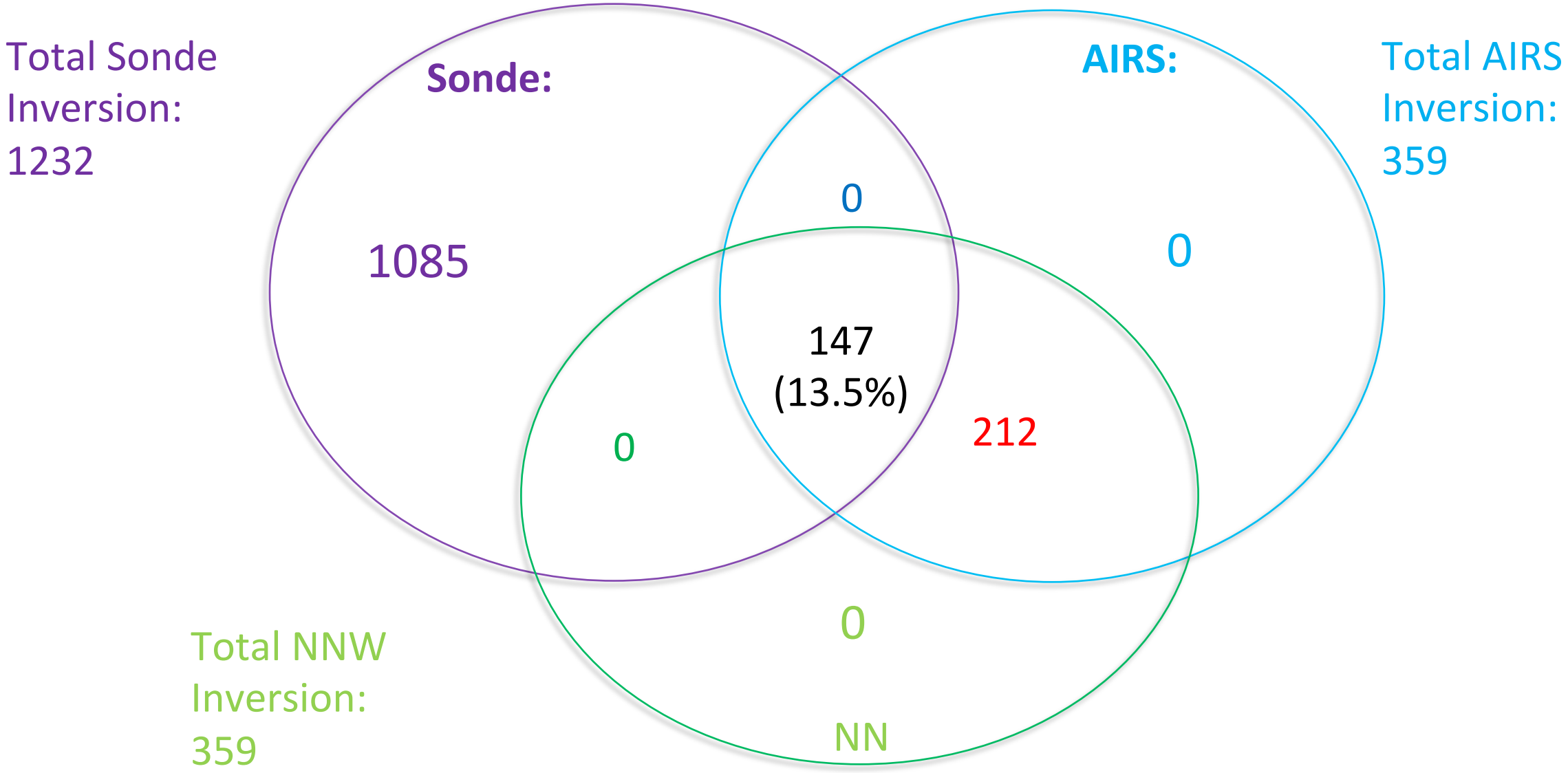


Conclusion:

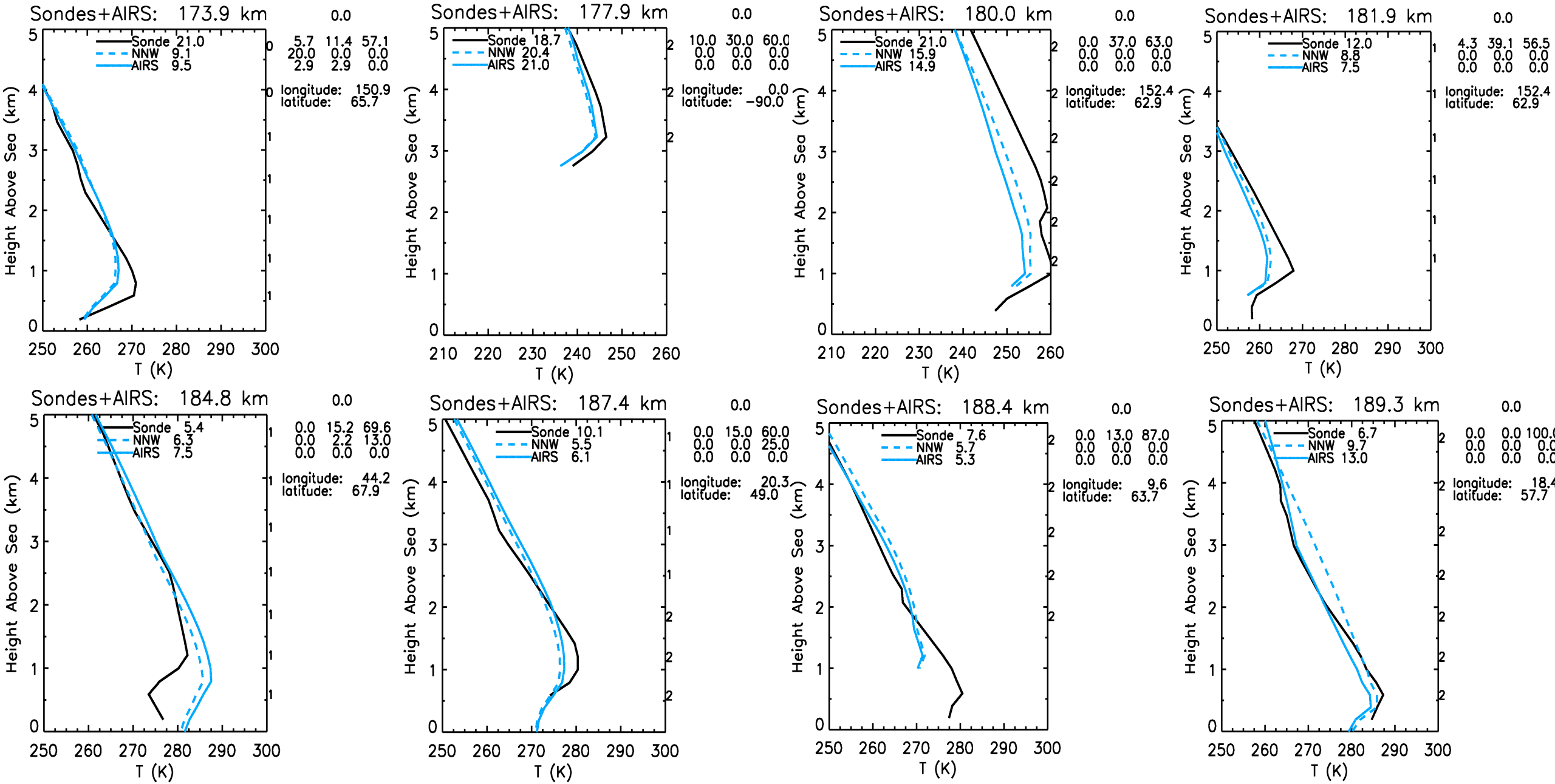
- AIRS can capture about 19% of inversion that observed by IGRA sondes for strength > 5 K/km, and 14% for strength > 10 K/km

- Whether inversion is captured or not cannot be told simply by looking at the quality flags

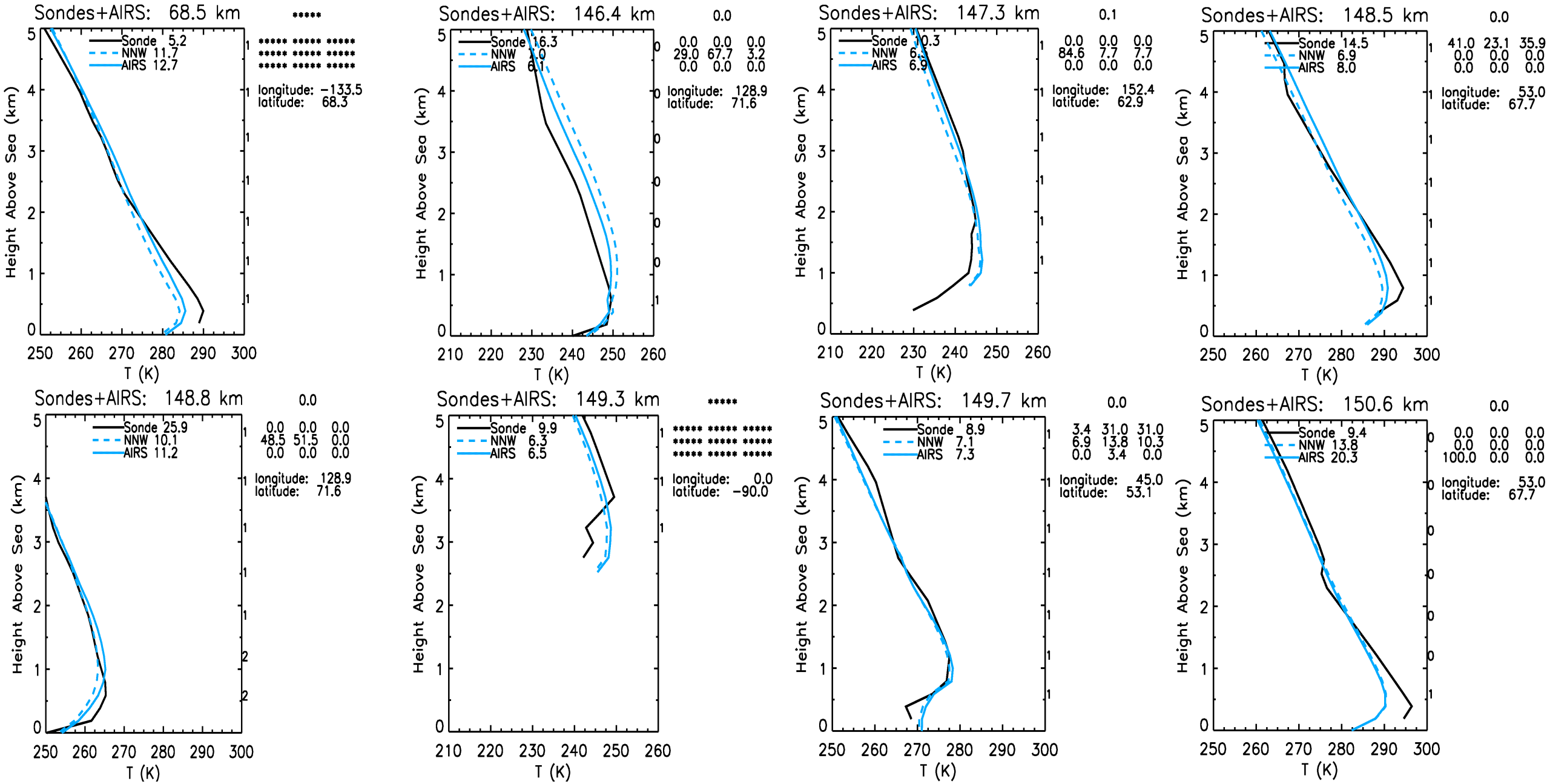
- For strong inversion (strength > 5K/km), AIRS and NN simultaneously see inversion or not. Inversion is captured by NN in the first priori.

- There are cases where AIRS and NN see inversion while the sondes do not

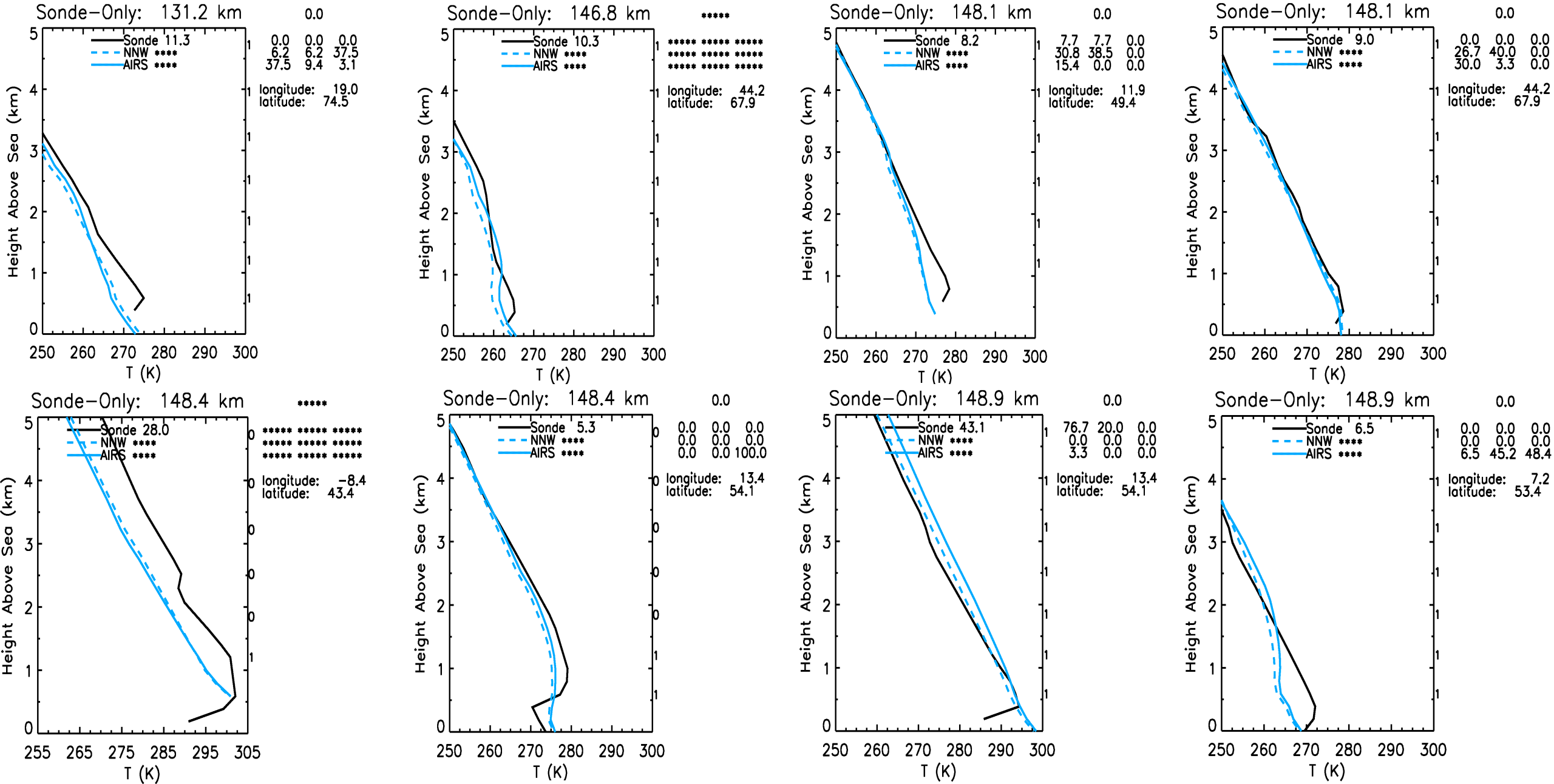
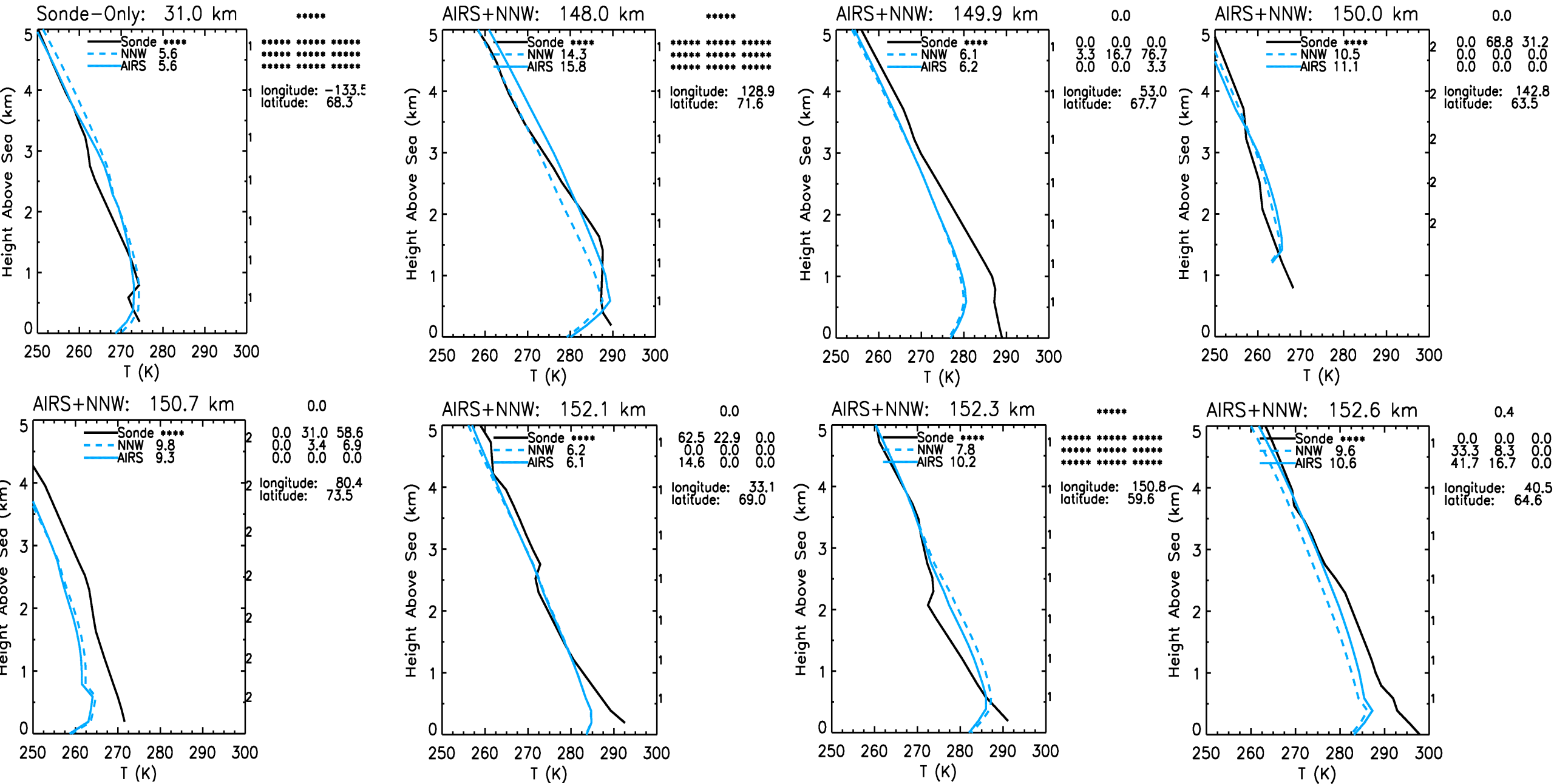
AIRS & Sonde, Strength > 5 K/km, Cb > 50%



AIRS & Sonde, Strength > 5 K/km



Sonde-Only, Strength > 5 K/km



AIRS & NN: Strength > 5 K/km