11.1 REJUVENATING REFRACTIVITY PROCESSING TO IMPROVE RETRIEVAL QUALITY WHILE REDUCING LABOR-INTENSIVE MAINTENANCE NEEDS

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Doppler radars have the potential to use ground targets to estimate the refractive index of air near the surface. Few forecasters can use that information directly, and enthusiasm for that new measurement has been low (mea culpa!) primarily because of 1) the complexity of the processing needed to obtain refractivity information up to a limited range and especially 2) the labor-intensive work required to obtain reliable measurements. Yet in the context of data assimilation, refractivity can provide a key constraint on humidity for convective but also mesoscale models if the data from many radars are combined.

To help resolve this problem, the 20-year old processing approach used to estimate refractivity by radar was rejuvenated:

- The flat Earth approximation of the original algorithm was replaced by an approach where varying topography and target heights are specifically taken into account in an attempt to retrieve refractivity at a specific level above the surface;

- The retrieval approach is now based on a variational approach that uses past retrievals as first guess for the initial retrieval and takes target phase, not its range derivative, as measurement constraints. A new approach to handle the aliasing of phase is implemented that does not try to dealias phases but instead considers all possible solutions by weighting them based on their probability of occurrence;

- The task of target selection and tuning and that of meteorological calibration have been automated so as not to require human decision-making. Instead of relying on two one-time process, target selection and tuning becomes a continuing process in an attempt to account for changes in targets on the ground; calibration can also be made a continuing process and now relies on longer-term comparisons between surface data and radar retrieval instead of hoping for a "perfect" situation of uniform N.