# Self-Weighting Clustering Analysis of Refractive Index Profiles

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Characterizing the vertical structure of the atmosphere's refractive index in a meaningful way poses a problem for radio propagation analysts. For a given time and location, the atmosphere can exhibit a wide variety of behaviors. The variations are of critical importance. Simple averaging looses important information. Recombining averaged duct heights and duct strengths can produce un-physical states of the atmosphere. In addition, different users may be concerned with different aspects of these variations. Certain aspects of the atmospheric profiles may be of greater interest than others.

This paper presents a technique for 'unbraiding' a set of typical states of the atmosphere in order to determine a small set of 'typical' atmospheric states. A self-weighting, auto-sigma level, k-means clustering algorithm was developed. For a given location, time, date and set of years, historical data is examined and grouped into clusters of similar profiles. A representative profile is determined for each of these sets. The algorithm analyses the data, determines from it what weighting scheme to use, and what sigma levels to consider. In addition, by allowing the user to specify selection criteria the algorithm then selects an appropriate representative for use in propagation models.

This method is flexible and can be used to address a variety of atmospheric scenarios. By including the appropriate surface data with each atmospheric profile, this algorithm can resolve profiles which include extrapolated boundary layer data. Further, it can be used to characterize the state of the atmosphere over an extended path. It is also applicable to suitable sets of radiosonde data.