

Anomalous propagation: Examination of ducting conditions and anaprop events in SW-Germany

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The propagation of electromagnetic waves in the atmosphere depends on the refractivity, which is governed mostly by pressure, temperature and humidity. Assuming a mean value for the refractivity profile a standard correction of refractivity yields the 4/3 earth radius proving sufficient in most cases for operational purposes.

However, under certain circumstances the standard procedure fails.

Especially when we deal on the one hand with partial beam filling one needs to know the exact path of the ray. Superrefraction leads to strong overestimation of reflectivity in these cases. On the other hand, even ducting with so called Anaprop-Echoes seems to occur frequently in several situations, which is especially a problem when one runs an automated QPE.

In order to estimate the number of events with ducts and anaprop possibility, we searched for ducting layers in the temperature and humidity profiles to find out how normal 'normal' is and how deep, strong and high possible ducting layers are. The profiles are taken from an operational radiosonde station operated by the German weather service in Stuttgart (South-West Germany). We found, that even in central Europe ducting layers are more common than we expected. Whereas there is a maximum of duct numbers in May and June, the ducts' strength is largest in November and December.

Further, we examined some special cases of Anaprop-Echoes, observed in our radar data (KIT radar in Karlsruhe, 80 km west of the radiosonde site). Calculating the propagation paths by solving the exact differential equation showed that even with the crude operational radiosonde data we were able to confirm the extraordinary bending, caused by an inversion.