# 周波数領域干渉計によって観測された下層大気層状構造の観測

## On the interpretation of the layered structures detected in the lower atmosphere by FDI technique

**# Hubert Luce [1], 山本 衛 [1], 深尾 昌一郎 [1], M. Crochet [2]**
# Hubert Luce [1], Mamoru Yamamoto [1], Shoichiro Fukao [1], M. Crochet [2]

**[1] 京大・超高層, [2] LSEET, Univ. of Toulon Var, CNRS**
[1] RASC, Kyoto Univ., [2] LSEET, Univ. of Toulon Var, CNRS

大気観測用レーダーにおいて2つの周波数を用いるdual Frequency Domain Interferometry (FDI)法を用いることによって、50〜20mの厚さを持つ乱流層が観測可能である。この方式はレンジ分解能を向上する有力な手段ではあるが、観測レンジ内に層が1つだけ存在することを仮定している。本研究では、乱流層の傾きや広がりがパラメータ推定に与える影響を理論的に考察する。また最近の気球観測より、レーダー観測で1層とされる乱流層が実際には10m程度の厚みの非常に薄い層の積重ねである事実が分かっているため、この状況がFDI観測に与える影響に関して議論を行い、3つ以上の周波数を用いて複数の乱流層の位置と厚みを推定する観測手法を提案する。

The dual Frequency Domain Interferometry (FDI) technique applied to Stratosphere-Troposphere (ST) radars pointing vertically permitted to detect apparent layered structures ("FDI layers") of 50-200 meters in thickness in the lower atmosphere. This technique introduced by Kudeki and Stitt (1987) is based on the transmission of two closely spaced frequencies. It really improves the accuracy of the radar measurements only if a single horizontally stratified atmospheric layer largely extended in the horizontal plane mainly contributes to the radar echoes at a given range gate. However, the effects of the limited extent of the layer and the effects of tilts which can skew the scattering layer away from overhead have not been taken into account in the estimations of layer position and thickness. Estimations of the biases produced by these effects will be presented. It will be seen that, in some cases, the biases can be substantial. Moreover, because of the ambiguity of the FDI technique due to the use of only two frequencies, an FDI layer can also be interpreted as a group of distinct atmospheric scattering layers as thin as temperature sheets (Luce et al., 1999). These statically stable structures observed by high resolution balloon technique are typically thinner than ten meters (Dalaudier et al., 1994). It is worth understanding the relation between these two kind of observations since temperature sheets are very probably responsible for the main part of the radar echoes in vertical incidence at VHF (Luce et al., 1995). From this result, it seems natural to refine the FDI technique in order to detect several very thin layers within a given radar range gate. For this objective, the multi FDI technique can be developed by applying techniques used in antenna processing. In particular, the Capon's method reintroduced by Palmer et al. (1999) for coherent radar imaging could be applied in the frequency domain and will be discussed.

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