THE MARINE ATMOSPHERIC BOUNDARY LAYER ENTRAINMENT ZONE: A BREEDING GROUND FOR SURFACE BASED RADIO FREQUENCY DUCTS

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Well-mixed marine atmospheric boundary layers are separated from the free atmosphere by a typically stably stratified entrainment zone. The water vapor in the free atmosphere is typically less than that in the mixed layer below leading to a negative gradient of the water vapor mixing ratio in the entrainment zone. This combination of thermal and humidity gradients tends to produce negative gradients of modified refractivity in the entrainment zone. If the thermodynamic gradients are large enough, the entrainment zone negative modified refractivity gradient will be larger in magnitude than the positive gradient in the well-mixed surface layer leading to formation of a surface based duct.

This paper will present the results of an application of a parameterization for normalized entrainment zone thickness to an equation for the gradient of modified refractivity in terms of potential temperature (q) and water vapor mixing ratio (w).

It is shown that the gradient of modified radio refractivity (M) is approximately equal to 0.128 km-1 in the well-mixed layer. This leads to a simple relationship for the maximum duct height (D) possible for the existence of a surface based duct as a function of the difference in temperature and humidity across the entrainment zone.

Similarly it is shown that for the duct strength to increase in terms of M below the surface value (Mbsv) for the same entrainment zone thermodynamic gradients, the duct height must decrease.

The implications of entrainment zone thickness on duct height, trapping frequency, critical elevation angle and skip zone dimensions are analyzed employing highly resolved marine atmospheric boundary layer profiles from the Persian Gulf and the California coast.

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2. F - Wave Propagation and Remote Sensing

3. (a)

4. C - Contributed Paper

5. No special instructions