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An observational Study of Convective and Penetrative Plumes during sea breeze at Visakhapatnam

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Abstract: *In urban areas there is essential air pollution. Aucostic Sounders are for tracing out the environmental problem and air pollution. It is used to estimate the inversion depth and density. Remote sensing of the lower atmosphere by acoustic are electromagnetic Waves involves the interaction of the waves with the atmosphere. Acoustic sounder FM-CW, radar and lidar(laser radar) using acoustic radio and optical waves ,respectively are the three remote sensing techniques that are being used for lower atmospheric research. Among the various remote sensing techniques acoustic sounding is more sensitivity to changes in the atmospheric parameters and is simpler both in electronic circuitry and maintenance.*

Tyndall (1875) show the scattering of sound by atmosphere fluctuations in the laboratory and over the sea. Acoustic back scattering was the detected by Tyndall from temperature and wind structure in the atmosphere which he attributed to acoustic clouds and also demonstrated that air heated by a flame could attenuate the direct propagation of sound. The basic difference in a acoustic back scattering from continental boundary layer to that from marine boundary layer is in respect of the contribution of the humidity fluctuations. A monostatic sodar was set up at Visakhapatnam to study the coastal boundary layer with the special reference to sea breeze (Rao et al,1981).

This scattering of sound by temperature in homogeneities was explained by Bachelor(1957). The scattering theory was experimentally proved by Kallistrotova(1959,1959a,1961)and Monin(1962). The acoustic sounder used in the present study is pulsed sounder which sense out a brief burst of Acoustic energy. Back scattered energy is then detected by the receiver and is amplified and recorded. We used sodar to observe the various Meso- materiological phenomena.Acoustic sounder data is presented in the form of three-dimensional facsimile recordings of time, height and reflected signal strength for several phenomena like convective plums penetrative to convert to plums during sea breeze circulation with a capping inversion layer connective plums during sea breeze circulation.

Keywords: *Doppler sodar- Acoustic back scattering, sound absorption- sodar parameters,-FM-CW radar.*

Introduction: The pattern of the sounder records obtained at the continental locations on days of fair weather conditions, compresses of surface based layer related to nocturnal radiation inversion which disappears in the following morning with the onset of convective plums.

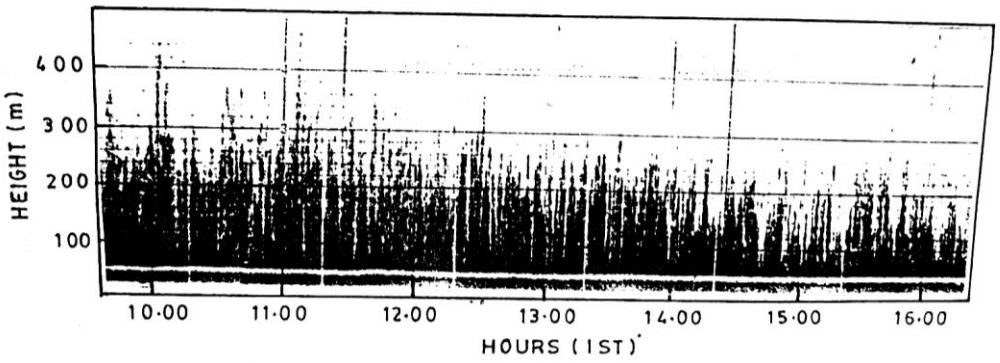
Relatively, very little amount of data is available on coastal boundary

layers using acoustic sounders. One of the most important and characteristic features of the atmospheric environment in coastal regions is the formation of internal boundary layer when air flows across the surface discontinuity between land and sea. Internal boundary layers may be primarily caused by differences in surface temperature or by difference in surface roughness but are typically caused by difference in both properties. Over most continental areas, The atmosphere is mostly unstable in summer and stable conditions prevail in winter. Air pollution levels will be lower in summer and higher in winter. But the coastal area differ in several ways which affect the dispersive capability of the atmosphere in the first few hundred meters.

Observation of convective plums:

When the surface of the earth is heated by the sun, it becomes much warmer than the surrounding atmosphere, Hyundai super- adiabetic lapse red develops in the lower fuel meters of the boundary layer.

Yeah, typical fest mail record of the monostatic acoustic probing of convective plums obtained between 10.00 and16.00IST easy shown in figure 1. There is fairly uniform distribution of acoustic echoes within the columns of the plume and the echoes are strong and broad at the base, but we can attend to taper to the vanishing points at the top. Search forums typically reach maximum development shortly after soon. The disappearance of the plume with height on the fecsimile record fig 1. He's not necessarily because the mixer layer extends no higher. Yeah both several hundred meters. The temperature fluctuations are much vehicle than near the ground, and there is additional absorption of acoustic energy at a longer ranges, making the echoes indiscernible on the facsimile record. By significantly increasing the transmitted acoustic power to 1000 W are more, It is possible to improve the signal to noise ratio and record monostable acoustic equals to heights of a few kilometers.

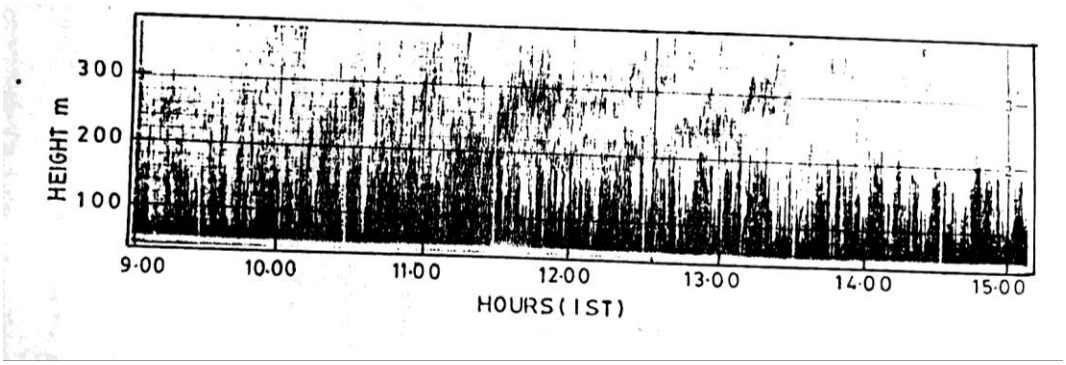


Observation of penetrative convection;

After sunrise, the convective boundary layer typically develops quickly to a depth of few hundred metres. When the capping inversion is strong and subsidence is large, the convective boundary layer grows so slowly that the capping inversion remains below the maximum height range of the sodar .One such case is presented in fig 2.

The sodar facsimile record presented in figure 2 provides valid and useful information on atmosphoric mixing processes.
This information is of the following types:

* Information on the height of the inversion base, frequently called the depth of the mixer layer, and
* Information on the bigger of mixing within the mixer layer indicated by the presence of convective plume echoes at the surface.



Observation of convection during sea breeze:

Seabreeze circulation is one of the most prominent mesoscale phenomena in coastal areas. Naturally, the sea breeze is the strongest on clear and hot summer days. Thus near the cost there are two stable or near stable regions about the interval boundary layer.

* a stable or slightly stable region of the undisturbed marine flow and
* a subsidence inversion region at the mixing zone

These stable regions tend to create thermal turbulence provided a mechanism is present for generation of mechanical turbulence. April and May are the hottest months at Visakhapatnam.

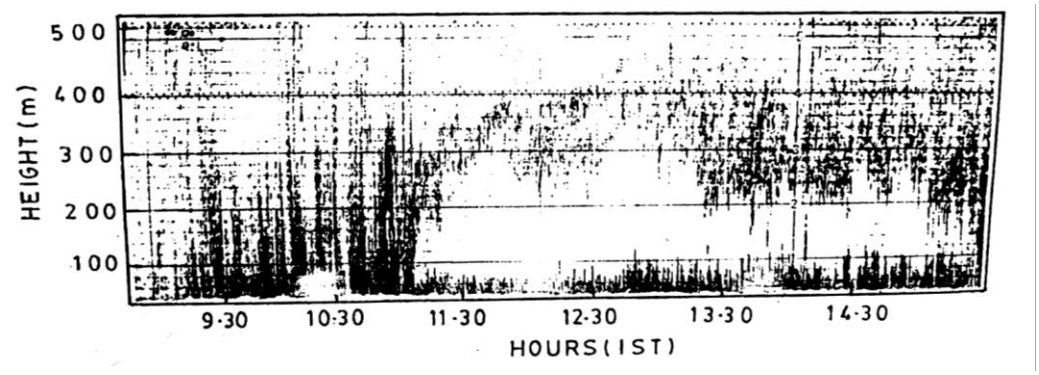
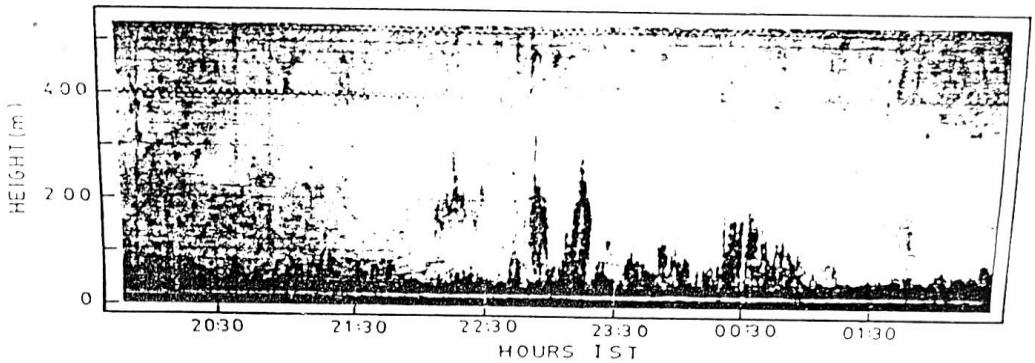


Fig.3, is the absence of the capping inversion layer above the convective plume structures. There were several occasions on which the presence of sea breeze at the site was recognized by the detection of quanched convective plume structures alone.

Observations of nocturnal convection:

The convection plume structure, characteristic of daytime boundary layers were occasionally observed during nights in summer when sea breeze continued till late into the nights are throughout the nights. The acoustic sounder facsimile record obtained between 20.30 and 0230 IST. he is presented in figure 4. The sunset was at 18.24 IST. The fecsimile record clearly depicts the convective film structures reaching to heights of about 100 m till 22.30 IST. The eco pattern in the first 100 m height up to 22.30 resembles to that of reported in the earlier facsimile records presented in figure 3. Because of absence of elevated capping layer on the sodar facsimile record, it is difficult to know about the depth of the sea breeze circulation. The sudden appearance of yeah relatively weak scattering region between 150-200m heights the range for about 30 minutes from 22:00 to 22:30IST maybe due to the re-establishment of onshore flow.



Conclusions:

The operation of a monostatic acoustic sounder in a coastal environment resulted in the detection of variety of mateorological phenomena. The ficsmile records presented and discussed in the foregoing sections clearly showed the versatility with which the acoustic sounder reveals the atmospheric boundary layer process. Observation of convert to plums under various types of atmospheric flows points to the fact that the characteristics of the water laying air mass are important for the growth of the mixed layer.

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