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Identification of the Planetary Boundary Layer (PBL) Using Upper Air Observation

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IDENTIFICATION OF THE PLANETARY BOUNDARY LAYER (PBL) USING UPPER AIR OBSERVATION

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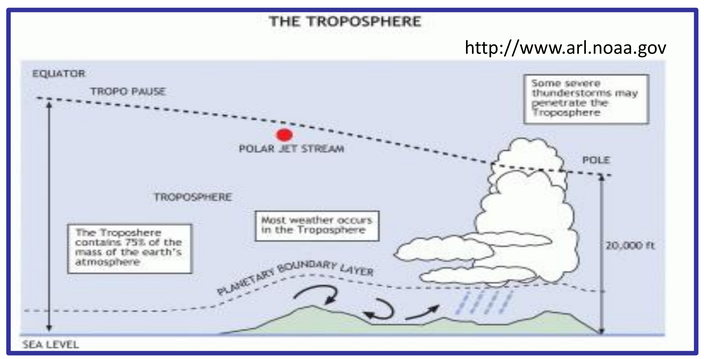
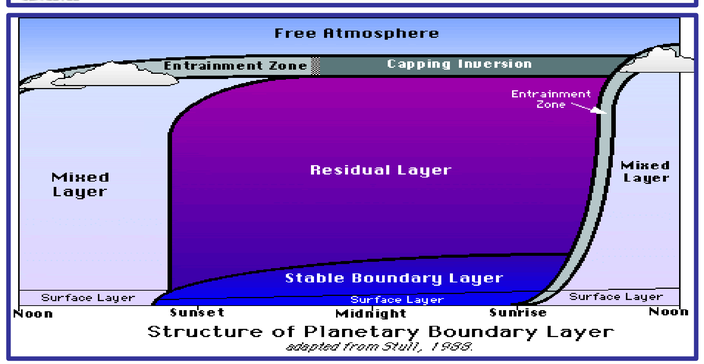
Introduction

The PBL is the lower part of the atmosphere and it's characteristics are affected by an interaction between the atmosphere and the surface of the earth. The PBL has an important role in weather and climate as a heat transfer, energy, and momentum from the surface to the atmosphere. Height of the PBL is vary based on season and topography of the area. The identification of height PBL is important in aviation due to weather formations such as turbulence and base clouds. Bayong (2015) states that "in the condition of weak turbulence and calm wind, the PBL can be identified as an inversion layer on the surface. The PBL is hard to identify as strong instability occurs in the atmosphere. In this case, the height of PBL can be defined as a mixing layer from the surface to the bottom of the clouds." (pg. 5)





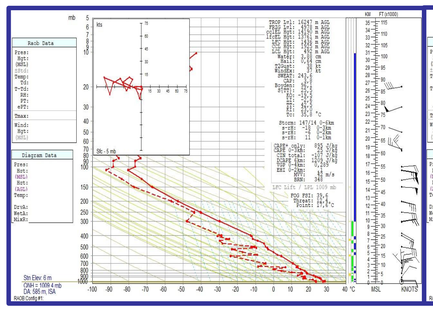
Thesis

Height of the PBL is higher at noon than at night and can be well identified using Radio Sonde Observation (RASON).

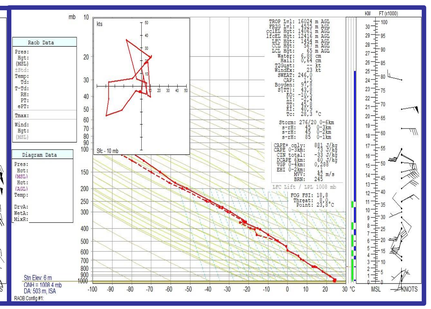
Methodology

- Classifying data to represent a stable and unstable atmosphere.
- Processing data using (RASON)
- Determining the high of inversion layer and Condensation Convection Level (CCL)
- Comparison and analysis

Clear Weather



Bad Weather



Mon/Day/Year	Time (LT)	High (m)
01/10/2016	07.00 am	1148
	07.00 pm	323
01/30/2016	07.00 am	1029
	07.00 pm	442
07/17/2016	07.00 am	4931
	07.00 pm	89
02/28/2016	07.00 am	2306
	07.00 pm	451
12/23/2015	07.00 am	2439
	07.00 pm	97

Mon/Day/Year	Time (LT)	High (m)
03/14/2016	07.00 am	843
	07.00 pm	2544
04/13/2016	07.00 am	913
	07.00 pm	1466
03/15/2016	07.00 am	523
	07.00 pm	993
06/22/2016	07.00 am	1945
	07.00 pm	44
07/7/2016	07.00 am	567
	07.00 pm	1551

** Red regtangle is in heavy rain condition*

Result

Height of PBL can be clearly seen in the table above. Clear weather table shows us that at noon when the sun radiation heats up the surface, height of PBL is rising about 1 km – 4 km. This condition happened in the clear air condition with few clouds are detected. We can assume this is the beginning of turbulence and convection process, as the clouds are rising and growing bigger through noon. While in the night in the absence of sun radiation, the heat is transferred down to the earth and make the height of PBL decrease about 80 – 400 m.

On the other side, the table of bad weather conditions shows us ambiguous information about the height of PBL. Three data shows height of PBL is above 1 km while the rest is around 500 m. Another tool like weather radar is needed to give more information to get a better conclusion in this condition.

Conclusion

- Height of PBL is higher in the noon around 1 km – 4 km. Decreasing in the night around 80 m – 400 m.
- In the bad weather conditions, height of PBL can not clearly identified using RASON

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