CA#3

B11209013 大氣一 甘祐銓

Data Source: 46810-2018072100.edt.txt

1. Virtual Potential Temperature（虛位溫）：, plot and discuss it.

Virtual potential temperature combines the effect of pressure and humidity of an air parcel.

The constants in the equation have values as follow:

Suppose in the equation is .

一張含有 圖表 的圖片

自動產生的描述The profile of this feature likes below:

The profile shows that there are two main sections of the distribution. The lower part is governed by both humidity distribution and pressure. Otherwise, the upper part is mainly governed by pressure decreasing.

一張含有 圖表 的圖片

自動產生的描述To show the guessing above, the plot below shows the profile of potential temperature and virtual potential temperature.

This figure shows that:

In the higher level, potential temperature is almost the same as virtual potential energy. This may because of the humidity is almost close to zero. By the equation of virtual potential temperature:

When close to zero, .

一張含有 圖表 的圖片

自動產生的描述

The figure shows that: the difference between potential temperature and virtual temperature almost the same in higher altitude, which supports our guessing above,

1. 一張含有 圖表 的圖片

   自動產生的描述Please plot in height coordinate, try to determine tropopause with it and discuss what you see. (You can smoothen the profile by using moving average.)

This is the graph shows that when using the moving average with 100 items forward and backward.

The green line in the plot represents the lapse rate of , the orange region is possible region of tropopause. The reason is that: lapse rate difference transfers from greater than -6 to less than -13.

The most possible altitude for tropopause is 16330 m. By the profile of temperature as altitude of atmosphere, there is a section upper than tropopause that has no temperature change. Thus, the lapse rate of that section is 0, which is the intersection of the blue and green line on the plot above.

1. The hypsometric equation describes the relationship between pressure and height. Please use the hypsometric equation to finish the question below. Notice that the ideal gas law is P = , so you should use in the hypsometric equation. Calculate the physical depth (in meter) of a 10-hPa-thick air column for every 50hPa (1000 hPa – 990 hPa, 950 hPa – 940 hPa, ..., 150 hPa – 140hPa). Also, calculate the result with the virtual temperature profile 10 K warmer. Plot the profile of the depth difference (pressure for vertical, ∆z(warm)−∆z for horizontal coordinate) and make a brief discussion. (Hint: You may choose the closest data point to calculate, or interpolate the data.)

To solve this question, the hypsometric equation is needed, the equation is:

The factor of is simplified into , because there is no direct function that virtual

This topic can be written in two ways: close data point or interpolate.

This figure below uses close data point method to get difference of physical depth.

一張含有 圖表 的圖片

自動產生的描述

By the equation, in higher altitude, will become greater. Also, the virtual temperature is higher in stratosphere. Thus, as the altitude increasing, the physical depth will also increase.