所別：大氣物理研究所碩士班 一般生 科目：天氣學

（注意：答案一律寫在「答案卷」上，寫在「試題卷」上者不予計分）

1. What is the MOS (Model Output Statistics) ? (10)

2. What are the differences between the conditional unstable and potential unstable? (10)

3. Please decide and explain the horizontal (width) scale (L), vertical (depth) scale (H) and time scale (T) of the following weather systems: **(a) surface front, (b) tropical cyclone, (c) land-sea breeze, (d) general circulation, and (e) thunderstorm.** Then mark them on the L-T diagram and the H-L diagram as Fig 3. (10)

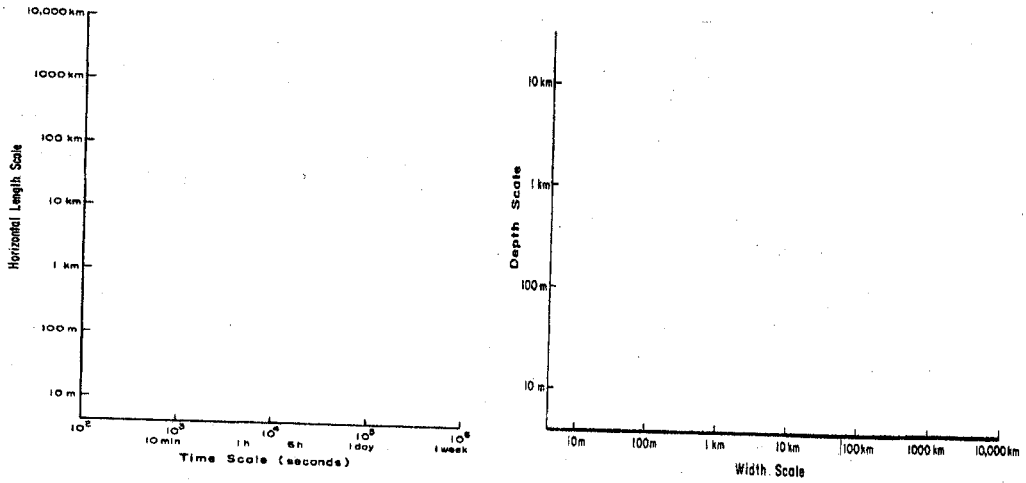

Fig 3

4. Please sketch the vertical profile of zonal mean zonal flow (Ug) according to Fig 4 and explain the reasons. (10)

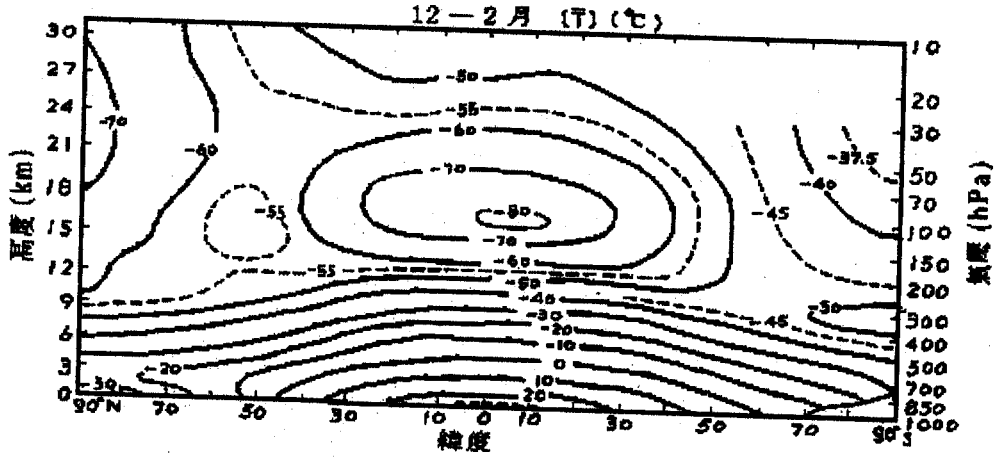

Fig 4. Vertical profile of zonal mean temperature field

注意：背面有試題

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5. (a) Fig. 5a shows a surface extratropical cyclone system. Please draw a schematic vertical cross-section (from surface to 100 hPa) of temperatures, zonal flows (u), and weather phenomena, respectively, along line AB. Then explain the reasons. (15)

(b) Fig. 5b shows a surface tropical cyclone (typhoon) system. Please draw a schematic vertical cross-section (from surface to 100 hPa) of temperature anomaly, azimuthal winds, and weather phenomena, respectively, along line CD. Then explain the reasons . (15)

(c) What are the differences between tropical cyclone and extratropical cyclone? (10)

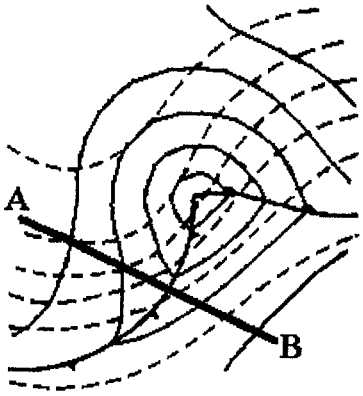

Fig. 5a. Solid lines indicate sea level pressure. Dash lines denote the height field on 500 hPa.

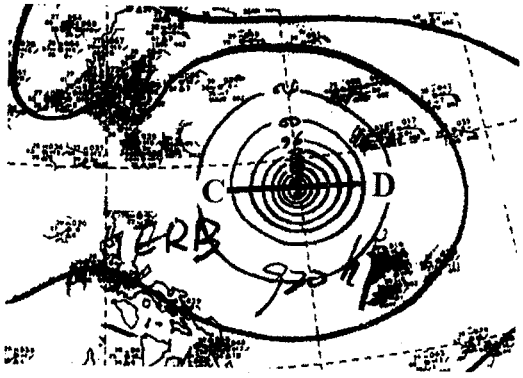

Fig 5b. Surface weather chart.

6. The 3-D frontogenesis function (F) can be defined as following,

$$F = \frac{d}{dt}(\nabla_3 S).$$

Let S = potential temperature (θ).

(a) Please show that the vertical component of F (F_z) can be written as

$$F_z = \frac{d}{dt}\left(\frac{\partial\theta}{\partial z}\right) = \frac{\partial}{\partial z}\left(\frac{d\theta}{dt}\right) - \left(\frac{\partial\theta}{\partial x}\frac{\partial u}{\partial z} + \frac{\partial\theta}{\partial y}\frac{\partial v}{\partial z} + \frac{\partial\theta}{\partial z}\frac{\partial w}{\partial z}\right),$$

and separately explain the effect of each term by a diagram. (10)

(b) Please show that the meridian component of F (F_y) can be written as

$$F_y = \frac{d}{dt}\left(\frac{\partial\theta}{\partial y}\right) = \frac{\partial}{\partial y}\left(\frac{d\theta}{dt}\right) - \left(\frac{\partial\theta}{\partial x}\frac{\partial u}{\partial y} + \frac{\partial\theta}{\partial y}\frac{\partial v}{\partial y} + \frac{\partial\theta}{\partial z}\frac{\partial w}{\partial y}\right),$$

and separately explain the effect of each term by a diagram. (10)