

National University of Lesotho
BSc. and BSc. Ed. Examination
PG 3413 – Synoptic Meteorology

May, 2023

Marks: 100

3 Hours

Instructions:

- Answer any **four (4)** questions.
 - Where applicable illustrate your answer with equations and diagrams.
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Question 1

- a) In climate and weather prediction, theoretical models are considered to be more powerful than empirical models. Why is this the case? (10)
- b) Why is it possible to give a climate outlook for an entire rainy season and yet a forecast beyond **ten (10)** days is considered inaccurate? (15)

[25]

Question 2

- a) Briefly explain the relationship between low and upper level airflow. (5)
- b) Describe the typical pattern of precipitation over the tropical oceans including the role of surface winds and ocean currents. (10)

[25]

Question 3

- a) According to Macron et al, 2014 a significant amount of Southern Africa summer rainfall is attributed to the occurrence of synoptic-scale tropical-temperate-troughs.
What are tropical-temperate-troughs (TTTs)? (5)
- b) Discuss **two (2)** major differences between midlatitude and tropical atmospheric circulatory systems. (10)
- c) Besides the easterly tropical disturbances and the westerly temperate disturbances, briefly discuss **two (2)** other systems which are responsible for summer rainfall over southern Africa? (10)

[25]

Question 4

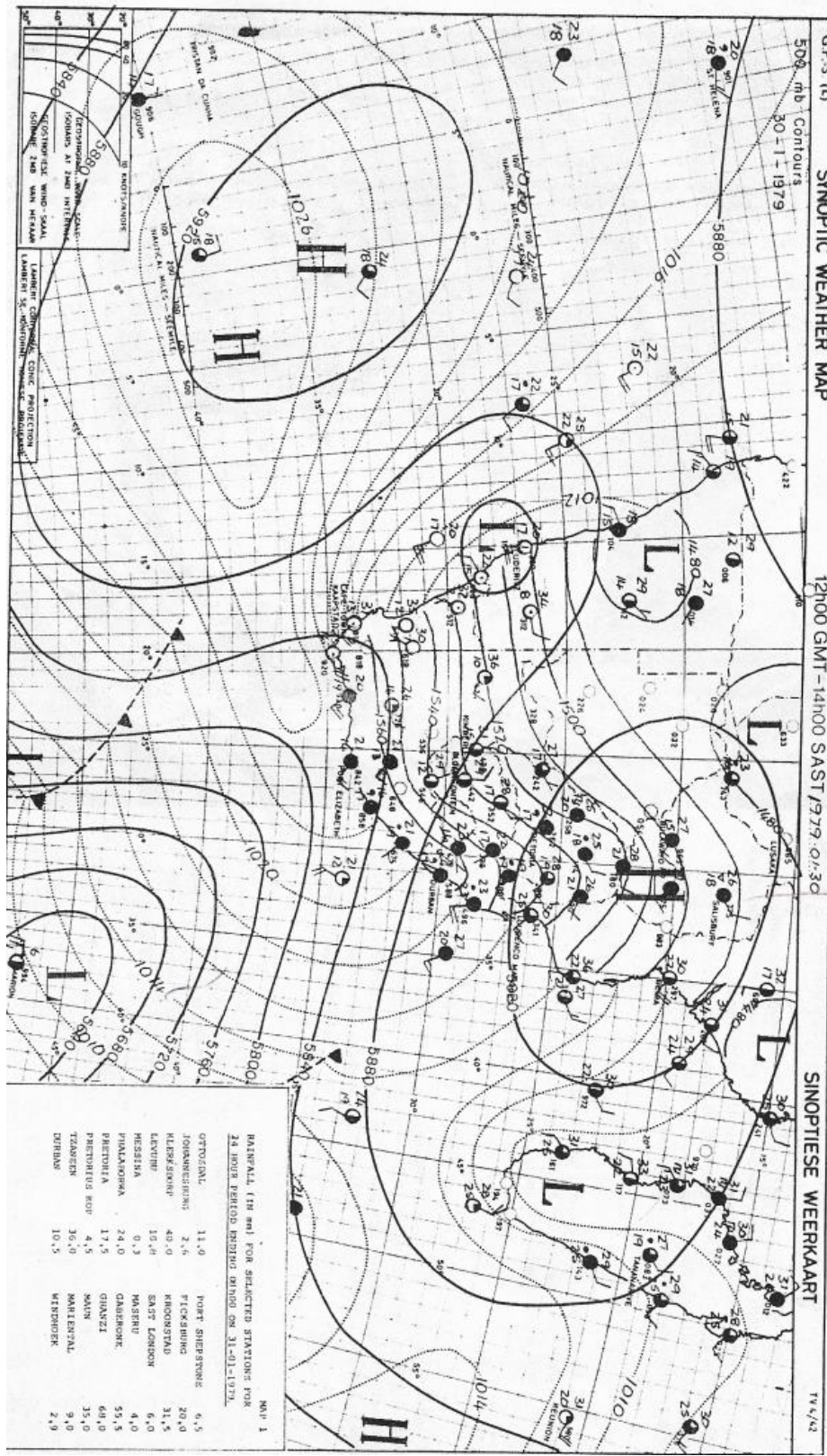


Figure 1. Synoptic Weather Map 30 January 1979 14:00 SAST

- a) On the basis of figure 1, describe the circulatory systems that gave rise to the weather conditions that prevailed over southern Africa. (10)

N/B There are three levels on the synoptic weather map; 500 hPa pressure level, sea level and the surface level.

- b) Explain in detail the origin, structure and stages in the development of a single cell storm. (15)

Question 5

- a) Briefly explain any **five (5)** necessary conditions in the large scale environment for tropical cyclogenesis to occur. (10)

- b) Outline the different stages in the development of a mid-latitude cyclone. (15)

[25]

Question 6

Use the accompanying plotted (T- Φ) tephigram in figure 2 to determine the following:

- a) The relative humidity at the 750 hPa pressure level. (3)
b) The height of the base of the lowest cloud. (5)
c) The thickness of the inversion layer. (5)
d) The freezing level. (2)
e) The height of the base of the lowest cloud (5)
f) The saturation vapour pressure at the 850hPa pressure level.(5)

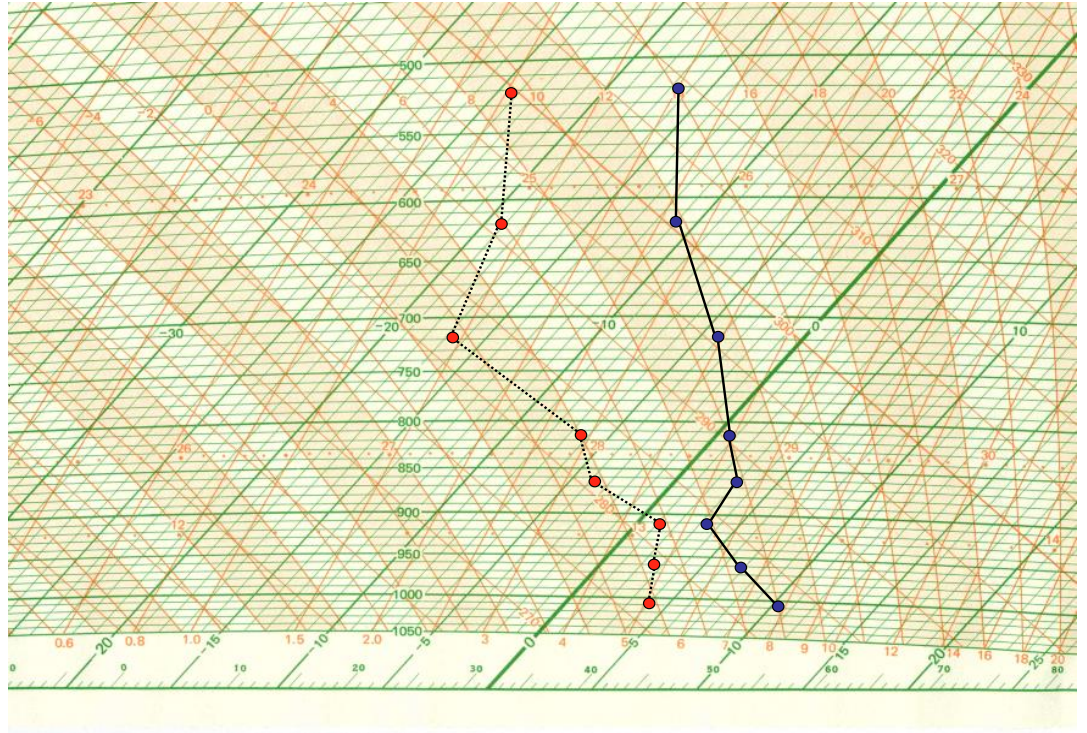


Figure 2. Plotted (T- Φ) tephigram

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