University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

SEMESTER II EXAMINATION 2007/2008

MAPH 40410
Synoptic Meteorology

Extern examiner: Prof Keith Shine

Head of School: Prof Séan Dineen

Examiner: Prof Peter Lynch*

Time Allowed: 2 hours and 30 minutes

Instructions for Candidates

Answer **all (4)** questions.
Question 1 carries 15 marks.
Three additional questions each carrying 10 marks.
Total: 45 marks.

Instructions for Invigilators

Non-programmable calculators may be used during this examination.

Question 1 (15 marks)

You have been given two separate charts, labelled CA 80/6/1 and CA 80/6/2.

(a) Consider Chart 1 (80/6/1), which has already been analysed, and answer the questions below. In each case give a *reason* for your answer.

1. What is/are the air mass(es) over South-west England and Wales?

2. Would you expect much rain in Eastern Scotland over the next 6 to 9 hours?

3. Does the cold front conform to the Norwegian model? Explain your answer.

(b) Using Chart 1 (80/6/1) as a guide, draw up Chart 2 (80/6/2) putting on *fronts* and *isobars*.

(c) Comparing Chart 2 with Chart 1, answer the questions below. In each case give a reason for your answer.

1. How quickly is the Low centre moving at midnight?

2. In what direction is the Low centre moving?

3. Is the Low deepening or filling?

Question 2 (10 marks)

You have been given a 48 hour forecast chart valid for 0000 UTC on Saturday, 3rd May, showing the 250 hPa heights (dekametres) and wind speeds (knots).

(a) Identify, by clearly marking with a cross on the map, four areas where you might expect cyclogenesis to occur.

(b) Write a brief explanation of the relationship between jet streaks and regions of cyclogenesis. Use arguments based on *either* the ageostrophic wind *or* the simplified vorticity equation. Use the Dines two-level model to support your description.

Question 3 (10 marks)

Hurricane Katrina struck New Orleans in August, 2005. Between 1500 UTC on 26 August and 1500 UTC on 28 August, the hurricane intensified rapidly, the central pressure dropping from 981 hPa to 907 hPa.

(a) Calculate the *relative vorticity* of the hurricane at 1500 UTC on 26 August, when the maximum winds were observed to be $36\,\mathrm{m\,s^{-1}}$ at a distance of 12 km from the centre of the hurricane.

(b) Calculate the *relative vorticity* of the hurricane at 1500 UTC on 28 August, when the maximum winds had increased to $77\,\mathrm{m\,s^{-1}}$ at a distance of 18 km from the centre of the hurricane.

[Hint: You are asked for the *mean* vorticity within the core of maximum winds. Remember that the mean vorticity is the circulation per unit area. Assume that the hurricane is axisymmetric.]

Question 4 (10 marks)

The May Bank Holiday is approaching, and people are anxious to know the weather prospects. You have been given an EPS Meteogram for Dublin, based on the ECMWF analysis for 0000 UTC on Thursday, 1st May.

Using only the information contained in the EPS Meteogram, write a *brief* account of the likely weather conditions in Dublin for:

1. Saturday, 3rd May

2. Sunday, 4th May

3. Monday, 5th May

4. Outlook for week (Tuesday 6th to Saturday 10th May)

including the main parameters shown in the meteogram.

Comment on your confidence in the forecast, based on the spread of values indicated in the EPS meteogram.

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