



University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

SEMESTER II EXAMINATION 2008/2009

MAPH 40410
Synoptic Meteorology

Extern examiner: Professor Keith Shine
Head of School: Professor Mícheál Ó Searcóid
Lecturer: Professor Peter Lynch*
Lecturer: Dr Rodrigo Caballero

Time Allowed: 2 hours

Instructions for Candidates

Answer **all (4)** questions.
Question 1 carries 30 marks.
Three additional questions each carry 10 marks.
Total: 60 marks.

Instructions for Invigilators

Non-programmable calculators may be used during this examination.

Question 1 (30 marks)

You have been given two separate charts, labelled Chart No. 1 and Chart No. 2. They are synoptic charts for northwest Europe for a particular December day at 1800 Z and six hours later, at 0000 Z the following day.

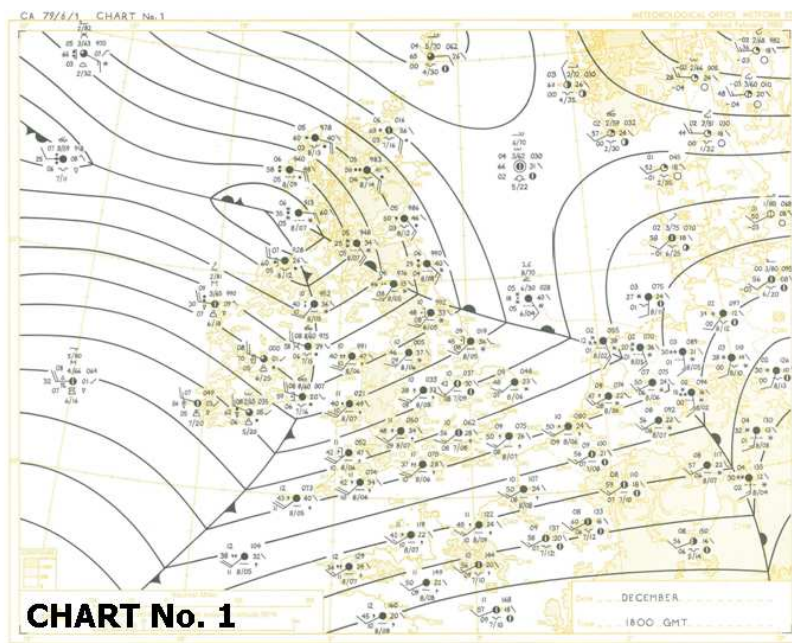
(a) Consider Chart No. 1, which has already been analysed, and answer the questions below.

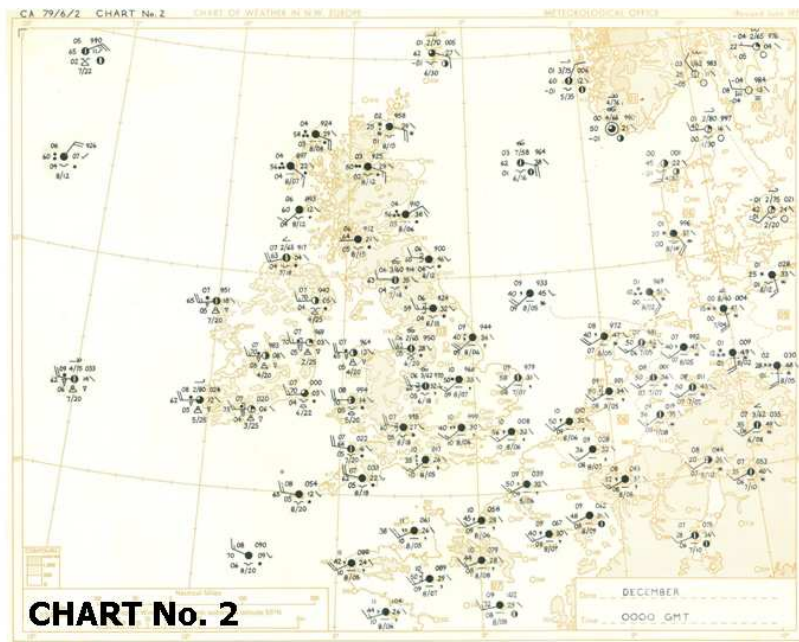
1. Describe the synoptic situation over the British Isles.
2. What kind of airmass is over Ireland? What kind of airmass is over England and Wales?
3. Describe the weather conditions at Holyhead at 1800 GMT.

(b) Using Chart No. 1 as a guide, draw up Chart No. 2 putting on *fronts* and *isobars*. Draw isobars every 2 hPa as in Chart No. 1.

(c) Comparing Chart No. 2 with Chart No. 1, answer the questions below.

1. How quickly is the cold front moving in the vicinity of Wales?
2. Is the Low west of Scotland deepening or filling? By how much?
3. Describe the weather conditions at Holyhead at 0000 GMT.

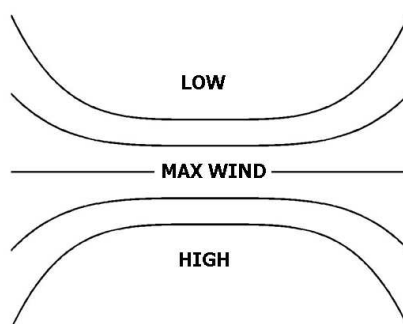




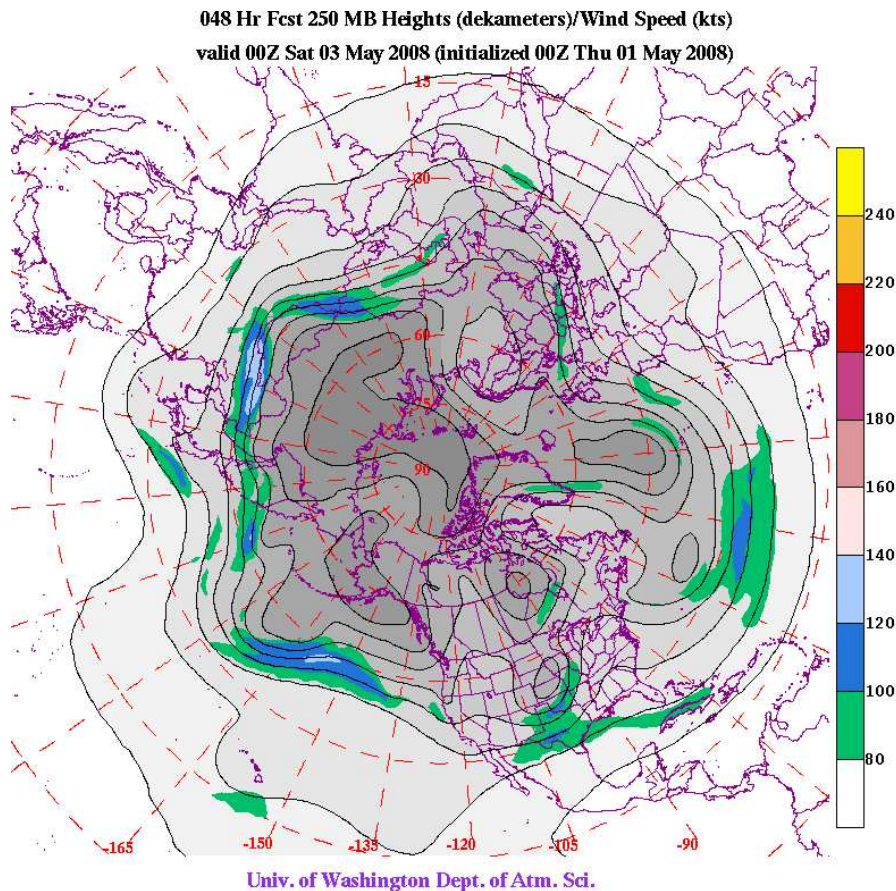
(Large format copies of the charts will be provided).

Question 2 (10 marks)

(a) Using the schematic diagram below, 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.



(b) The chart below is a 48 hour forecast chart valid for 0000 UTC on Saturday, 3 May 2008, showing the 250 hPa heights (dekametres) and wind speeds (knots). Identify, by clearly marking with a cross on the map, two areas where you might expect cyclogenesis to occur.



(A large format copy of the chart will be provided).

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 ms^{-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 ms^{-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)

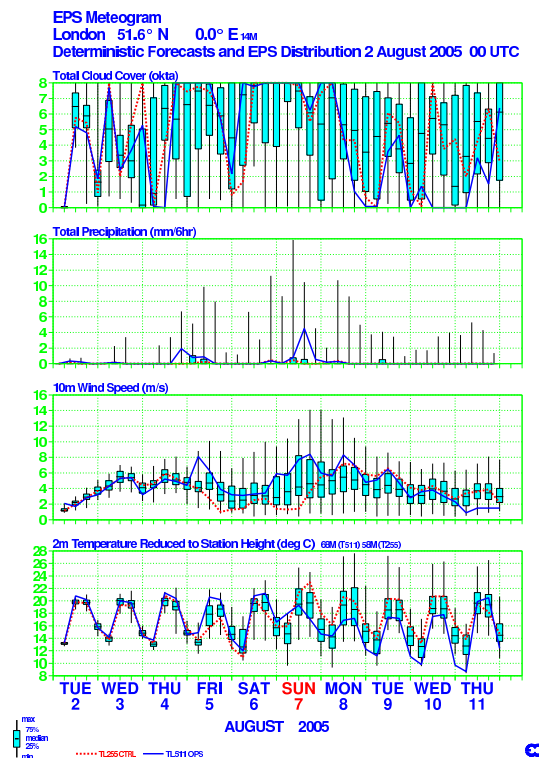
An EPS Meteogram for London, based on the ECMWF analysis for 0000 UTC on Tuesday, 2 August 2005 is shown below (a large format version will be provided).

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

1. Tuesday 2 August
2. Wednesday 3 August
3. Sunday 7 August

including the main parameters shown in the meteogram.

Comment on your confidence in the forecast for Sunday 7 August, based on the spread of values indicated in the EPS meteogram.



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