SEMESTER I EXAMINATION 2009/2010

MAPH 40500
Synoptic Meteorology

Extern examiner: Professor Keith Shine
Head of School: Professor Micheál Ó Searcóid
Lecturer: Professor Peter Lynch

Time Allowed: 2 hours

Instructions for Candidates
Answer all (5) questions.
All questions carry equal marks.
Total: 100 marks.

Instructions for Invigilators
Non-programmable calculators may be used during this examination.
Question 1 (20 marks)

In Figure 1, synoptic reports for six Irish weather stations, valid at 0600Z, 17 October 2009 are given. From these, supply the following information:

(a) Temperature and dew point at Roches Point

(b) Mean sea level pressure at Valentia Observatory

(c) Wind direction and speed at Cork Airport

(d) Visibility at Shannon Airport

(e) Pressure tendency at Casement Aerodrome

(f) Height of cloud base at Dublin Airport

(g) Rainfall over previous 12 hours at Valentia

(h) Present weather at Shannon Airport

Include signs and units as appropriate.

SYNOPS from 03952, Roches Point (Ireland) | 51-48N  008-13W | 40 m
SM 17/10/2009  06:00-#  AXXX 17062 03952 3577 73503 10074 29267 30280 40331 57007
       333 20073 3/004=--

SYNOPS from 03953, Valentia Observatory (Ireland) | 51-56N  010-15W | 9 m
SM 17/10/2009  06:00-#  AXXX 17061 03953 12681 39000 10092 29071 30291 40328 57009 69902 81502
       333 20094 31003 55000 82630 92429=--

SYNOPS from 03955, Cork Airport (Ireland) | 51-51N  008-29W | 153 m
SM 17/10/2009  06:00-#  AXXX 17061 03955 12570 10102 10065 29057 30121 40339 57009 69902 81500
       333 20080 31003 55098 61624=--

SYNOPS from 03962, Shannon Airport (Ireland) | 52-42N  008-55W | 14 m
SM 17/10/2009  06:00-#  AXXX 17061 03962 11859 00601 10074 29067 30312 40337 57010 69902 7:011
       333 20051 3/000 55022=--

SYNOPS from 03967, Casement Aerodrome (Ireland) | 53-18N  006-26W | 97 m
SM 17/10/2009  05:00-#  AXXX 17061 03967 12279 12502 10009 20009 30225 40345 57011 69902 8:600
       333 20004 31102 55025 61703 92600=--

SYNOPS from 03969, Dublin Airport (Ireland) | 53-26N  006-15W | 68 m
SM 17/10/2009  06:00-#  AXXX 17061 03969 12580 10000 10032 20032 30234 40342 56012 69902 8:500
       333 20022 31102 55038 81628 92600=--

Figure 1. Synoptic reports for 0600Z, 17 October 2009 for six Irish stations
Question 2 (20 marks)

Consider the plotted observations in Figure 2. One or more of the six lines AA', BB', CC', DD', EE', FF' and GG' separates different air masses?

For each line selected:

- (a) Give detailed reasons why it represents such a division
- (b) Describe the air mass on each side of the line
- (c) State what kind of front it represents.

![Figure 2](image)

Question 3 (20 marks)

A tephigram with vertical profile of temperature and dew point is shown in Figure 3. From the given data, deduce the following values:

(a) Pressure at the freezing level

(b) Temperature, dew point and wet bulb temperature at 1000 hPa
(c) Potential temperature and wet bulb potential temperature at 850 hPa
(d) Equivalent potential temperature and relative humidity at 500 hPa

Specify units in every case.

Figure 3 (A large format colour version will be provided).

Question 4 (20 marks)

In Figure 4, four synoptic charts are shown, labelled (A), (B), (C) and (D). In each case, describe the synoptic situation in Ireland.

For each of the four charts, write a summary in a form suitable for a radio weather bulletin. Using only the information in the chart, include the following details:

(a) General description of the pressure pattern
(b) Expected wind direction or directions
(c) Temperature, relative to the seasonal average
(d) Likelihood of occurrence of precipitation
(e) Any other expected weather phenomena (fog, thunder, etc.).
Figure 4. (C) and (D)
Table 1: Passage of Warm Front

<table>
<thead>
<tr>
<th></th>
<th>Before front</th>
<th>At front</th>
<th>After front</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>Backs slowly</td>
<td>Sharp veer</td>
<td>Steady again</td>
</tr>
<tr>
<td><strong>Dew Point</strong></td>
<td>Slow increase</td>
<td>Sharp rise</td>
<td>Steady</td>
</tr>
<tr>
<td><strong>Pressure</strong></td>
<td>Falling</td>
<td>Steady</td>
<td>Usually steady</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Steady</td>
<td>Falls in rain</td>
<td>Milder</td>
</tr>
<tr>
<td><strong>Cloud</strong></td>
<td>Increasing and</td>
<td>Thick layers</td>
<td>Thin layers,</td>
</tr>
<tr>
<td></td>
<td>lowering in rain</td>
<td></td>
<td>some breaks</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>Good becoming</td>
<td>Poor in rain</td>
<td>Moderate or</td>
</tr>
<tr>
<td></td>
<td>moderate</td>
<td></td>
<td>poor</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>Rain becoming</td>
<td>Short burst of</td>
<td>Damp and drizzly</td>
</tr>
<tr>
<td></td>
<td>moderate or heavy</td>
<td>moderate rain</td>
<td></td>
</tr>
</tbody>
</table>

**Question 5 (20 marks)**

Table 1 (above) shows the pattern of changes in various atmospheric variables associated with the passage of a warm front. The following variables are given: wind, dew point, pressure, temperature, cloud cover, visibility and weather. The generic behaviour of each variable as the front approaches, as it passes and after the frontal passage is given.

Construct a similar table for the passage of a cold front. Include all the variables: wind, dew point, pressure, temperature, cloud cover, visibility and weather. Give the expected changes as the front approaches, as it passes and after the frontal passage.

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