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Comments on ‘On the development of orographic cyclones’, by D. Radinović

(October 1986, 112, 927–951)

By B. J. BURTON

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I refer to the article by D. Radinović entitled ‘On the development of orographic cyclones’, and in particular to the figures listed in his Tables 5, 6, 8 and 9.

I would point out that the figures given in those tables are not mutually exclusive, and that the values given for thickness change in Tables 8 and 9 can be derived from the values for geopotential change given in Tables 5 and 6. However, in this case comparisons of Table 5 with Table 8, and Table 6 with Table 9 do not reveal the expected correspondence. Also, Radinović gives values for thickness change in the 1000 to 500 mb layer which are not numerically equal to the sum of the partial thicknesses 1000 to 850, 850 to 700 and 700 to 500 mb, which he also lists.
In Tables 1(a) and (b) are the values for thickness change derived solely from the values for geopotential change given by Radinović in his Tables 5 and 6, against his values for thickness change, given in brackets. In my opinion, it may be of value to treat some of Radinović's conclusions concerning thickness advection with reservation.

I am planning to write at greater length in due course.

**TABLE 1. AVERAGE THICKNESS CHANGE (gpm) DURING, (a), THE FIRST 12 HOURS OF CYCLOGENESIS; AND, (b), NEXT 12 HOURS FROM AVERAGE GEOPOTENTIAL CHANGES DURING THE SAME TIME GIVEN IN RADINOVIC'S TABLES 5 AND 6. HIS CORRESPONDING VALUES FOR THICKNESS CHANGES ARE GIVEN IN BRACKETS.**

(a)

<table>
<thead>
<tr>
<th>Level (mb)</th>
<th>O</th>
<th>W</th>
<th>S</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-850</td>
<td>+12 (+2)</td>
<td>-32 (-12)</td>
<td>-4 (+2)</td>
<td>+4 (-3)</td>
<td>-46 (-16)</td>
</tr>
<tr>
<td>850-700</td>
<td>-1 (-9)</td>
<td>-18 (-19)</td>
<td>+5 (-3)</td>
<td>0 (0)</td>
<td>-19 (-19)</td>
</tr>
<tr>
<td>700-500</td>
<td>-23 (-38)</td>
<td>-28 (-42)</td>
<td>0 (-11)</td>
<td>-10 (+6)</td>
<td>-40 (-47)</td>
</tr>
<tr>
<td>1000-500</td>
<td>-12 (-55)</td>
<td>-78 (-61)</td>
<td>+1 (-25)</td>
<td>-6 (-6)</td>
<td>-105 (-78)</td>
</tr>
</tbody>
</table>

(b)

<table>
<thead>
<tr>
<th>Level (mb)</th>
<th>O</th>
<th>W</th>
<th>S</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-850</td>
<td>-12 (-8)</td>
<td>-28 (-9)</td>
<td>-11 (-7)</td>
<td>+7 (-2)</td>
<td>-15 (-4)</td>
</tr>
<tr>
<td>850-700</td>
<td>-16 (-13)</td>
<td>-16 (-15)</td>
<td>-14 (-6)</td>
<td>-8 (-9)</td>
<td>-16 (-13)</td>
</tr>
<tr>
<td>700-500</td>
<td>-27 (-36)</td>
<td>-25 (-27)</td>
<td>-21 (-24)</td>
<td>-10 (-17)</td>
<td>-22 (-21)</td>
</tr>
<tr>
<td>1000-500</td>
<td>-55 (-59)</td>
<td>-69 (-48)</td>
<td>-46 (-35)</td>
<td>-11 (-19)</td>
<td>-53 (-39)</td>
</tr>
</tbody>
</table>

Reply by D. RADINOVIC

I am grateful to Mr Burton for his interest in my paper. Mr Burton in his letter particularly pointed out that the data given in Tables 5 and 6, showing the geopotential changes, and in Tables 8 and 9, showing the thickness changes, do not reveal the expected correspondence. In my response I would like to refer to the first paragraph at page 928 of the paper which says: "Using the international ALPEK data bank, a series of hand-analysed charts for each of the eight cases of cyclogenesis has been produced. These have been used to study the statistical behaviour of the orographic cyclones in the western Mediterranean. The radiosonde and synoptic data were not subject to further quality control check or modified prior to use in the study". That means that all charts used in this study have been analysed independently and all data in Tables 5, 6, 8 and 9 are estimated from the charts at given locations. To be more clear, the thickness changes are not derived from geopotential changes but by reading from the charts of thickness for each layer independently. Therefore, the values for thickness change in the 1000 to 500 mb layer are not expected to be numerically equal to the sum of the partial thicknesses in that layer.

Differences in thickness changes shown in Mr Burton's letter came from three sources:
(1) quality of observations (during analysis some observations were considered to be wrong at some level or for some layer);
(2) subjective analysis (some patterns on certain charts had to be drawn without sufficient reliable observations);
(3) interpolation between isopleths.

Differences between data in Tables 8 and 9 in the paper and the corresponding values calculated by Mr Burton, on average, amount to 8 gpm. That is 2.5 times smaller than the interval between two adjacent isopleths, and is approximately the level of reliability that can be obtained by the method used to extract the data from the charts.

Another important point which should be stressed here is the fact that most of the data in Tables 8 and 9 in the paper, and those derived from Tables 5 and 6 by Mr Burton, have the same sign. In a few cases only, when thickness changes were very small, the sign is different. That means that differences in the thickness changes, obtained in two different ways, are mainly in intensity rather than pattern, and suggests that these differences do not affect the conclusions concerning thickness advection.

Finally, it should be mentioned that the series of charts used in this study has now been published (ECMWF and WMO), so that the data contained in the paper can be checked.