Basics of Formation

Frontogenesis → Thermal Wind Balance Destroyed → Transverse Ageostrophic Circulation Develops

The circulation and resulting band becomes more intense as stability above the frontal zone decreases. EPV or lapse rates above the frontal zone can be used to assess stability; EPV values near or just above zero indicate weak stability, negative values indicate instability.

Types of Bands

- **Laterally Translating**
  - Criterion: $45^\circ < \delta \leq 90^\circ$
  - Reflectivity outline of band ($t = t_0$)
  - Reflectivity outline of band ($t = t_0 + 1$ h)
  - Line tangent to band axis at centroid ($t = t_0$)
  - Centroid displacement vector

- **Hybrid**
  - Criterion: $10^\circ \leq \delta \leq 45^\circ$
  - Reflectivity outline of band ($t = t_0$)
  - Reflectivity outline of band ($t = t_0 + 1$ h)
  - Line tangent to band axis at centroid ($t = t_0$)
  - Centroid displacement vector

- **Laterally Quasi-Stationary**
  - Criterion: $0^\circ \leq \delta < 10^\circ$

- **Pivoting**

Required persistent aspect ratio of 4:1, reflectivity ≥ 25 dBZ and ≥ 10 dBZ above surrounding reflectivity, and total snowfall ≥ 6”

How Motion Affects Amounts

- **Snowfall Rate**
- **Snowfall Duration**
- **Snowfall Accumulation**

Mesoscale snowband motion influences whether pronounced snowfall accumulation gradients will be observed.

Note the tight gradient of snowfall amounts in the along-axis case to the left, with relatively uniform amounts in the cross-axis case.

Compiled by Keith Sherburn, WFO Raleigh

Adapted from Carlson (1998), courtesy UCAR

Source: NOHRSC
**Typical Features for Each Type**

<table>
<thead>
<tr>
<th>Field/Feature</th>
<th>Laterally translating</th>
<th>Laterally quasi-stationary</th>
<th>Pivoting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Position relative to surface cyclone</strong></td>
<td>East</td>
<td>North</td>
<td>Northwest, near thermal inflection point</td>
</tr>
<tr>
<td><strong>Position relative to upper-level jet</strong></td>
<td>Equatorward entrance region (oriented NW-SE)</td>
<td>Equatorward entrance region (oriented SW-NE)</td>
<td>West, sometimes associated with coupled jets</td>
</tr>
<tr>
<td><strong>Mid-level relative humidity</strong></td>
<td>Within region of near-saturation</td>
<td>Adjacent to horizontal RH gradient, near edge of precip</td>
<td>Near dry slot/comma head interface</td>
</tr>
<tr>
<td><strong>850-500 mb flow</strong></td>
<td>Diffluent, frontogenetical</td>
<td>Confluent, frontogenetical</td>
<td>Cyclonically curved, frontogenetical</td>
</tr>
<tr>
<td><strong>Position relative to 850-700 mb low</strong></td>
<td>Well east of closed cyclone</td>
<td>East of trough</td>
<td>Immediately north of closed cyclone</td>
</tr>
<tr>
<td><strong>Low-level temperature advection</strong></td>
<td>WAA along band; band occurs on cold side of WAA maximum</td>
<td>Weak/neutral temperature advection along band</td>
<td>Pivot zone within WAA, but west of max; warm/cold advection dipole along isotherms</td>
</tr>
</tbody>
</table>

**Key**
- 1000–500-hPa thickness isopleth
- 850–700-hPa streamline
- 850–700-hPa frontogenesis
- WAA 850–700-hPa warm advection maximum
- CAA 850–700-hPa cold advection maximum
- 850–700-hPa $Q_o$ vector
- 850–700-hPa $Q_s$ vector
- Upper-level jet $Q_o$ vector
- Hodograph location

**a)** Laterally translating  
**b)** Laterally quasi-stationary  
**c)** Pivoting


Thanks to M. Evans for additional comments and suggestions on an early version of this document.