



A New Paradigm for Occluded Fronts and the Occlusion Process

David M. Schultz

Universities of Manchester and Helsinki, and Finnish Meteorological Institute

Geraint Vaughan

National Centre for Atmospheric Science, University of Manchester



TAKE THE TEST. HOW MUCH DO YOU KNOW ABOUT...

<p>The Norwegian Cyclone Model?</p> 	<p>1. An occluded front forms as a faster-moving cold front catches up to a warm front. TRUE OR FALSE?</p>	<p>False. An occlusion can happen even when the cold front and warm front move at the same speed because the differential rotation of isentropes around the cyclone leads to <i>wrap-up</i> of the thermal wave.</p> <p>Catch-up (which cannot increase the length of fronts) cannot explain the long spiral occluded fronts in intense cyclones, which are deformed and rotated by the strong flow.</p>		<p>Implications for a New Paradigm:</p> <p>A better definition of the occlusion process is the <i>wrap up</i> of the thermal wave, narrowing of the warm sector, and the increasing separation between the warm sector and the low center.</p> <p>Stronger cyclones are more likely to occlude, and weak cyclones may never occlude.</p>
<p>The Shapiro–Keyser Cyclone Model?</p> 	<p>2. Due to the T-bone in a Shapiro–Keyser cyclone (warm front perpendicular to the cold front), the occlusion process cannot occur. TRUE OR FALSE?</p>	<p>False. By defining occlusion to be the separation of the warm sector air from the low center, then the Shapiro–Keyser cyclone <i>does</i> occlude. Whether the angle between the fronts is acute (Norwegian), right (Shapiro–Keyser) or obtuse is not relevant to the big picture of the frontal evolution of the cyclone.</p>		<p>The occlusion process can be generalized to the life cycles of other cyclones.</p>
<p>Warm- and Cold-Type Occlusions?</p> 	<p>3. A warm-type occlusion forms if the air ahead of the warm front is colder than the air behind the cold front, whereas a cold-type occlusion forms if the air ahead of the warm front is warmer than the air behind the cold front. TRUE OR FALSE?</p> <p>4. Which are more frequently observed: warm-type or cold-type occlusions?</p>	<p>False. The relative temperature difference across the occluded front does not determine its structure, the relative static stabilities do (Stoelinga et al. 2002). Thus, a warm-type occlusion forms when the warm-frontal zone is more statically stable than the cold-frontal zone.</p> <p>Warm-type occlusions. Twenty-five cross sections of observed occluded fronts yielded only three cold-type occlusions (Schultz and Mass 1993). Because warm-frontal zones are generally more stable than cold-frontal zones, warm-type occlusions are favored. Cold-type occlusions should have weak or nonexistent warm fronts.</p>		<p>The Norwegian cyclone model <i>cannot explain</i> the vertical structure of occluded fronts and the predominance of warm-type occluded fronts.</p> <p>Yet, most textbooks still carry this description of occluded-frontal structures and require revision.</p> 
<p>Cyclogenesis and Cyclolysis?</p> 	<p>5. The formation of the occluded front signifies an end to the deepening phase of the cyclone. TRUE OR FALSE?</p>	<p>False. Many cyclones continue to deepen after occlusion. Indeed, 29 of the 91 northeast U.S. cyclones in Kocin and Uccellini (2004, Vol. II) deepen 8–24 mb 12–24 h after occluded front formation. Occlusion is not addressed by the QG height-tendency equation. Although low-level thermal advection may be weak, differential temperature advection, vorticity advection, and diabatic processes could still deepen the cyclone.</p>		<p>The merger of the cold front and the warm front is <i>not</i> the moment when the brakes of development are applied.</p> <p>Instead, an occluded front is the <i>byproduct</i> of the wrap-up of the thermal wave by differential rotation around the cyclone.</p>
<p>Clouds and Precipitation?</p>  <p>The AMS Weather Book (Williams 2009)</p>	<p>6. An occluded front has the prefrontal weather of a warm front (widespread clouds and precipitation) followed by the postfrontal weather of a cold front (clear skies). TRUE OR FALSE?</p>	<p>False. Precipitation bands embedded in widespread precipitation areas are often observed in occluded cyclones. Therefore, characterizing the prefrontal weather as “widespread” is an overgeneralization that ignores important mesoscale details. The dry airstream often runs aloft over the cold, warm, and occluded fronts at the surface. Therefore, any drying in the rear part of the cyclone is irrespective of the surface position of the fronts.</p>		<p>Be careful when analyzing fronts based on satellite imagery alone.</p> <p>Occluded fronts are regions of active frontogenesis and can be associated with heavy precipitation, particularly to the northwest of the low center.</p> 

Tell me more!

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