

S06-6

Use of Microwave Imagery and Scatterometer Data as an Aid to the Dvorak Analysis

Roger T. Edson

WFO Guam (NOAA/NWS), Tiyan, Guam

The Dvorak tropical cyclone intensity estimation technique remains the primary method used by tropical cyclone analysts and forecasters to determine intensity, as well as an estimation of positioning as part of the process, for tropical systems occurring in most of the global ocean basins. This satellite-based approach which allows an analyst to determine initial intensity, development, peaking and weakening stages of the tropical cyclone life cycle has been very successful since its inception in the 1970s. Even in the Atlantic Basin where aircraft reconnaissance is routinely used, the Dvorak technique has shown its value as a supplement to the aircraft data; and conveniently as a way to compare this indirect technique with the in situ measurements taken from aircraft. The results are quite good; however, these comparisons also reveal some of the strengths and weaknesses that have been suspected by Dvorak users in the other basins without verification for quite a long time. Some of these results have been summarized in publications such as Velden et al, 2006 (BAMS); and Brown and Franklin, AMS 26th Conference on Hurricanes and Tropical Meteorology, 2004; and Knaff et al, 2010 (Weather and Forecasting).

The data used exclusively to conduct the Dvorak intensity technique are the visual and infrared satellite imagery. Although the technique originated from available visual polar orbiting data, the continuous and readily available global coverage of the infrared imagery from the geostationary satellite is now the primary source used to conduct this analysis. With the availability of the Himawari-8 satellite over the western Pacific Ocean, even greater availability with higher resolution data, especially in the infrared, will soon be available. Scientist and forecasters, alike, are eagerly anticipating a plethora of new information and capabilities that will be soon available with this new unprecedented data source. And yet, a basic physical fact remains: In the absence of a well-defined eye or an exposed low level circulation, both visual and infrared imagery often have difficulties in seeing through the thick cirrus canopy to locate the requisite surface circulation or to reveal the underlying convective structure, knowledge that is necessary to properly perform the Dvorak technique.

This paper addresses this basic issue and demonstrates several existing and new techniques that use microwave imagery and scatterometer data to supplement the infrared data to more accurately conduct the Dvorak analysis. Existing methods will be recapped and shown using 85GHz and 37GHz microwave imagery to help position potential unseen surface circulation center(s). In addition, uses of microwave data to help indicate potential intensity change, including rapid intensification and peaking will also be demonstrated. Furthermore, this paper will show how scatterometer data from the European ASCAT A and B instruments and from the RapidSCAT instrument on the International Space Station can be used to supplement the Dvorak analysis. In particular it will be shown how the directional ambiguities and the two very high resolution data and the normalized radar cross-section (NRCS) displays developed at Brigham Young University (Williams and Long, IEEE Geoscience and Remote Sensing Letters, 2008) can help clarify confusing wind vectors in the wind retrieval process and how these may become important tools in the tropical cyclone analysis. Examples will be presented that illustrate how these additional microwave data can complement the new higher resolution geostationary data to help make a better Dvorak analysis; and thus a better tropical cyclone evaluation and forecast.