National Transportation Safety Board

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ATTACHMENT 1 to the METEOROLOGICAL FACTUAL REPORT

WPR12MA034

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This is a typical high-wind case, occurring after the passage of a cold front to the north, in which a migratory high has merged with the subtropical high. Winds within the Pailolo Channel, separating the islands of Moloka ʻi and Maui, and the Kalohi Channel, separating Lāna ʻi and Moloka ʻi are expected to be much stronger than over the open ocean with frequent gusts as strong E/NE trades behind the cold front move through the ocean channels between the mountainous islands. Strong trades behind the cold front can also bring in trade-wind showers. Radar echoes at the time close to accident show that heavy trade-wind showers were present over the eastern and northern parts of Molokai with echo tops between 5000-1000 ft. This type of weather pattern is rather common during the winter months after the passage of a cold front.

To investigate the local conditions at the accident site, I asked my PhD student, Mr. Feng Hsiao, to set up a high-resolution nested model with the innermost domain covering Moloka ʻi , Western Maui and northern Lanai using a 1-km resolution. The 1-km model is nested in a 3-km model covering the entirety of Maui County. The model is initialized at 12 Z, November 10, 2011 using the National Centers for Environmental Prediction (NCEP) Final Analyses (FNL) as the initial and boundary conditions. The model output at 22 Z and 23 Z are plotted. The simulated winds at the accident site at 22 Z reach as high as 10-11 meters per second. Strong gusts are likely to accompany these winds. Strong winds (> 12 meters per second) are simulated in the Kalohi Channel, separating Lāna ʻi and Moloka ʻi (Fig. 1). There is no evidence to suggest strong turbulence induced by the nearby mountainous terrain, such as rotors or mountain wave activity at the crash site. The East-West cross section across the accident site at 22 Z shows that the moist trade-wind layer extends up to 2 km above the surface. In other words, trade-wind showers are expected to be rather shallow with tops around or below 2 km (or 6000 ft), consistent with radar observations. These trade-wind showers are embedded in a relatively moist environment with relatively humidity > 90% in low levels (Fig. 2); thus a microburst event at the time of the accident is unlikely. However, trade-wind showers drifting inland from the E/NE are expected to be enhanced by orographic lifting by the mountains over East Molokai with drier descending flow in the lee. The East-West cross section along the crash site at 23 Z shows saturated conditions with rising motion > 1 meter per second on the eastern side suggesting updrafts associated with trade-wind showers are likely to exist at the crash site which are enhanced by orographic lifting (Fig. 3).

Fig. 1. Surface winds (m/s) simulated from the 1-km WRF-ARW model valid at Nov. 11, 22Z, 2011.

Fig. 2. E-W vertical cross section of RH (%) across the accident site from the 1-km WRF-ARW model valid at Nov. 11, 22Z, 2011. Contours every 10%.

Fig. 3 E-W vertical cross section of vertical motion (m/s) across the accident site from the 1-km WRF-ARW model valid at Nov. 11, 23Z, 2011.

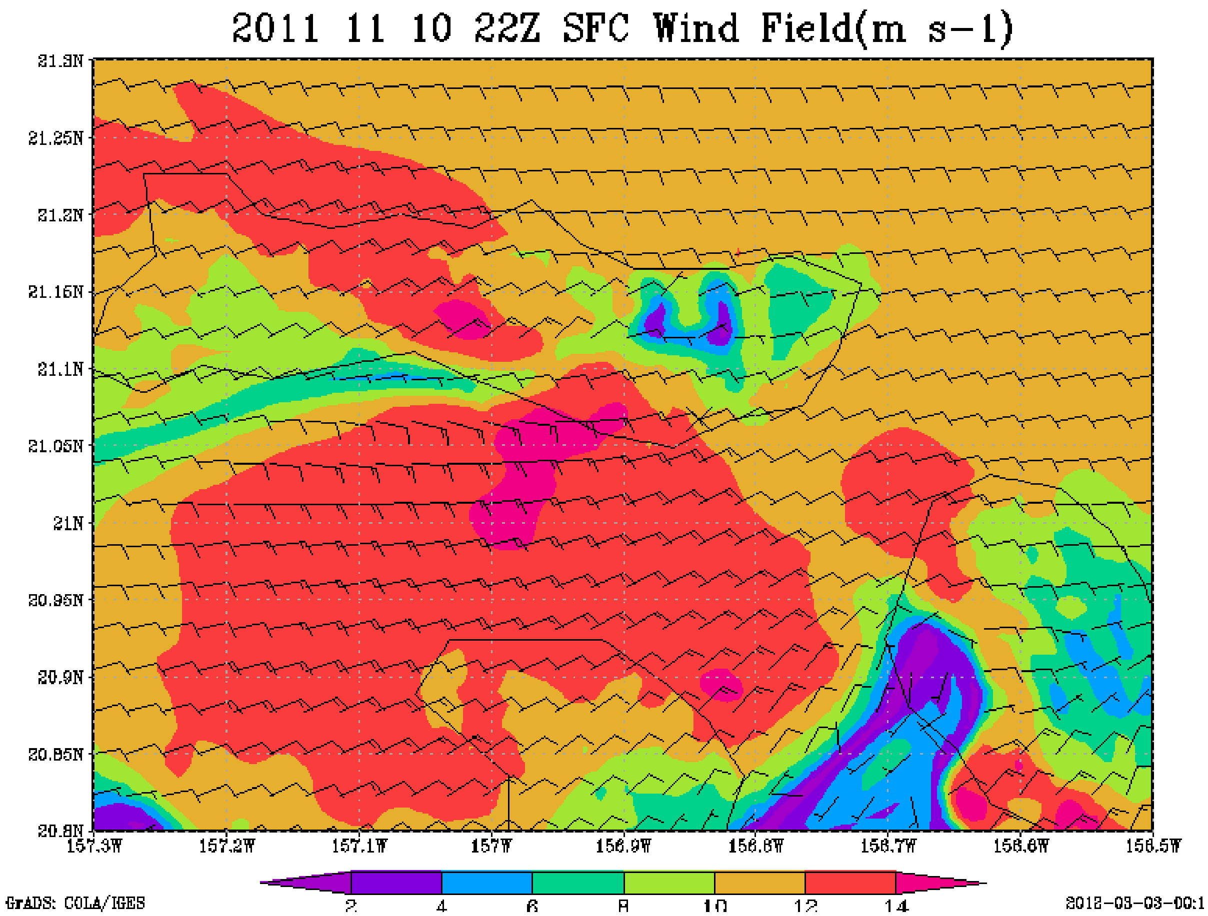

Figure 1 – November 10, 2011, 2200Z surface wind

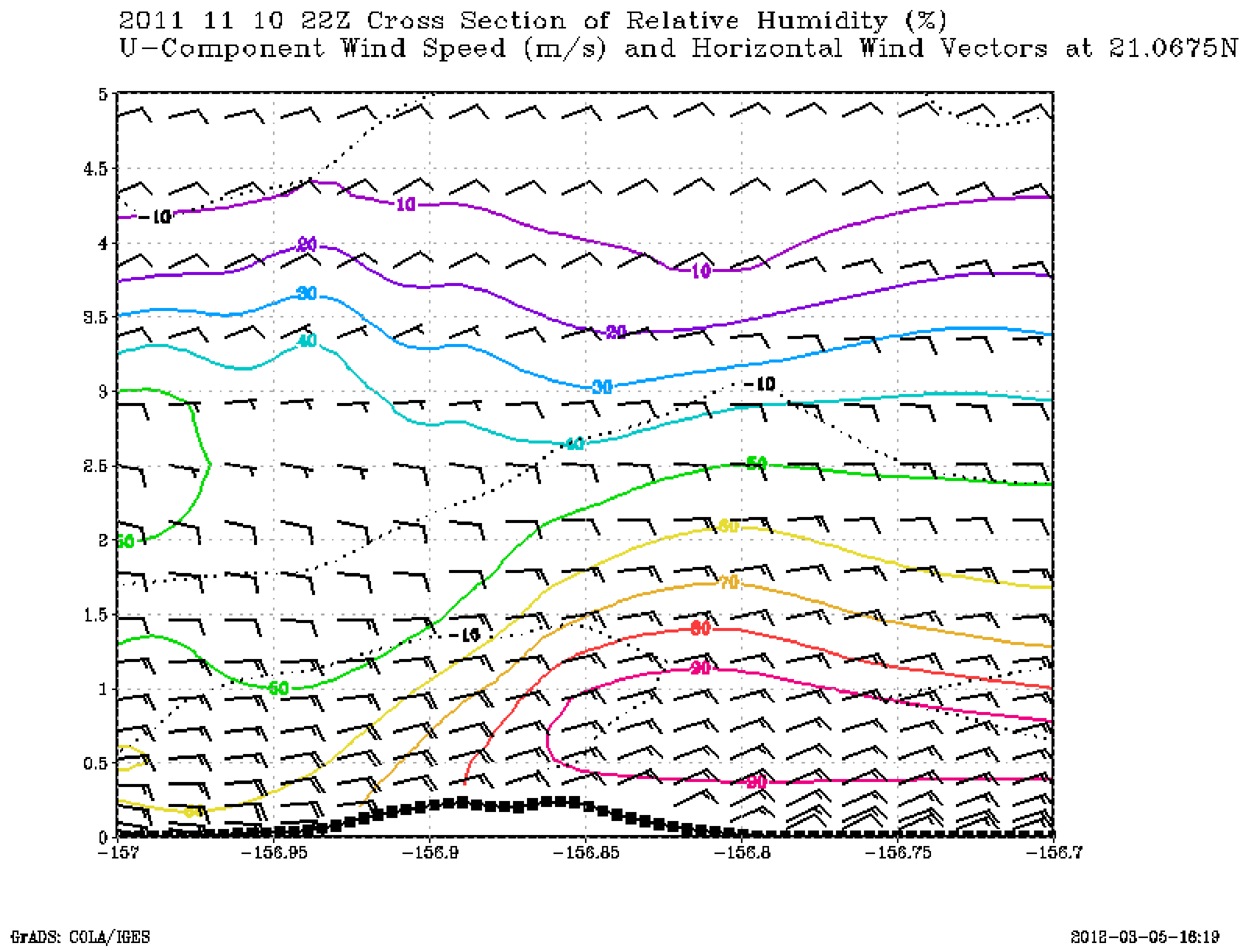

Figure 2 – November 10, 2011, 2200Z relative humidity (%) east-west

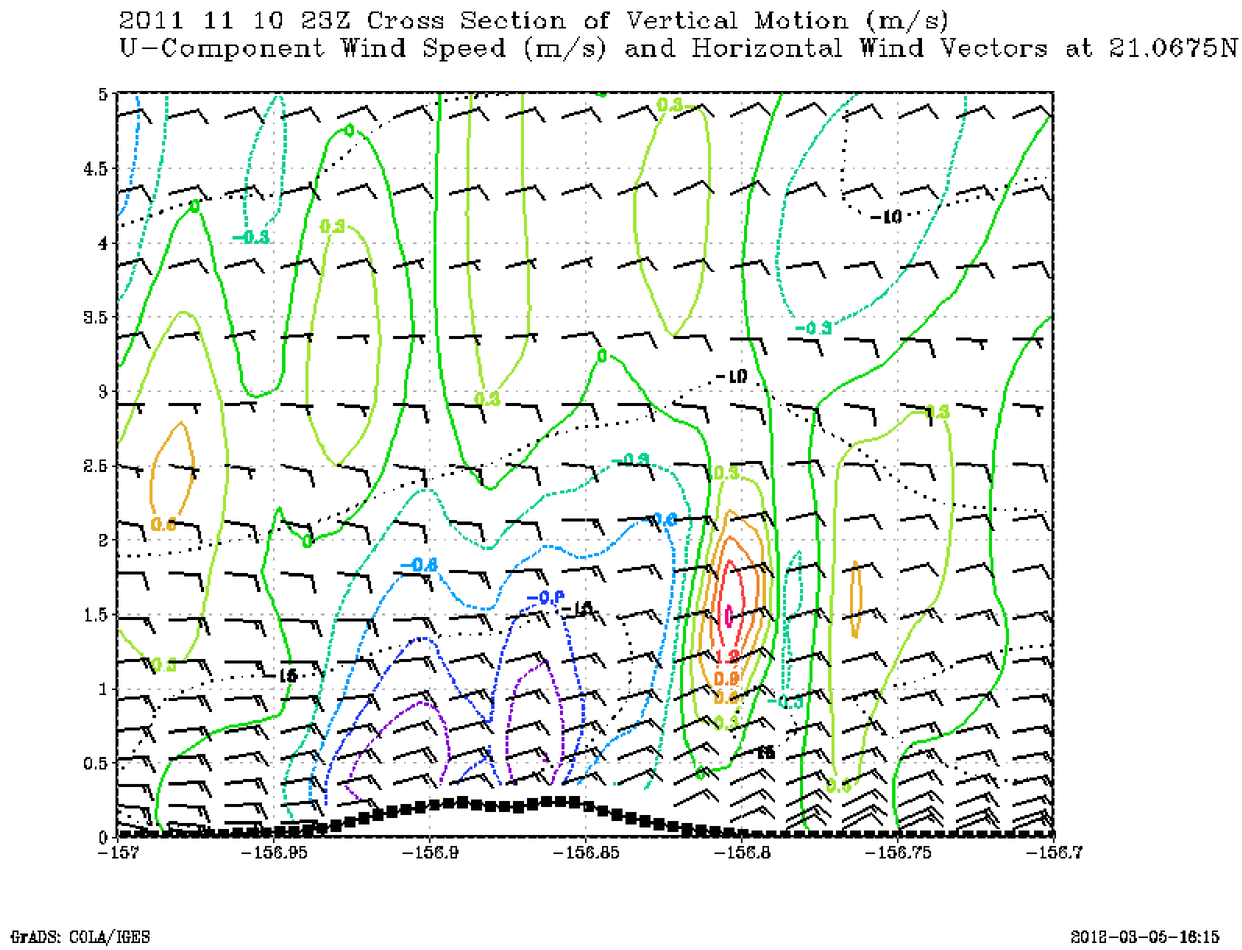

Figure 3 - November 10, 2011, 2200Z vertical motion (m/s)