ESTIMATION OF POST TORNADO DAMAGE PATTERNS IN AGRICULTURAL CORNFIELDS

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Wind-induced hazards and tornadoes frequently occur in the agriculturally dominated areas of the US, since rural areas account for the majority of land area. Following a storm, damage investigations infer valuable details about the storm's path, destruction, and population exposure. However, while structural damage serves as a proxy approach to estimate wind speeds for tornadoes, known damage indicators (DIs) are not readily available for agricultural fields and infrastructure. This is due to the vastly different environment in agricultural communities, where croplands are common and structures few. One common occurrence is cornfields, which due to its commonplace can infer near-surface wind estimates and velocity structure over large areas. In-situ and radar measurements of near-surface winds, less than 10 meters above ground level (AGL), are difficult to obtain. Consequently, ground and aerial surveys can be conducted to understand the near-surface wind characteristics.

One of the more common methods to collect, preserve, and reconstruct three-dimensional damage scenes is the use of an unmanned aerial system (UAS), commonly known as a drone. While drone flights are more commonly performed for structural and infrastructure surveys, flights at very low levels can provide sub-centimeter level data to understand and estimate the response of cornfields. These digital surveys can be achieved through onboard photographic payloads which permit scene reconstruction via structure-from-motion (SfM).

Following the July 19-20, 2018 tornado event, the authors assessed a cornfield just north of Bondurant, Iowa to document and analyze the cornfield failure patterns. This was accomplished using both a more traditional ground survey as well as a supplemental UAS-SfM dataset. In this work, the datasets are analyzed to investigate both the quantitative and qualitative post-tornado damage using localized depth maps, fall pattern directions, and surface geometric analyses.