

Videogrammetry: a practical method for measuring vegetation motion in wind demonstrated on wheat^{*}

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Abstract

Plant motion in wind is a common phenomenon but has rarely been quantified. Among other effects, plant motion is known to affect the quality (or “coherence”) of interferometric radar images although the loss of quality is so far only understood qualitatively. The videogrammetry technique reported here was developed to obtain measurements of wheat plant motion in wind through a growing season to enable quantitative modelling of radar interferometric coherence for wheat fields, and so to improve our understanding of the radar imaging process for real vegetation.

Videogrammetry using standard consumer camcorders was used to measure plant motion since it is a practical field technique which does not disturb the plants significantly. Small targets placed on the plants are tracked in 3D using stereo pairs of video images and allow the motion of individual plant elements to be measured. Local wind measurements were recorded in parallel with the video data. Examples of the data obtained and their analysis are presented. Specific results are shown for the amplitude of wheat plant motion vs windspeed, the variation of the plants’ oscillation frequency through the growing season, and the spatial coherence of the motion of neighbouring plants.

The results demonstrate that videogrammetry using “high-street” consumer equipment is a practical technique for the measurement of plant motion in wind.

Key words: wheat, vegetation motion, wind, radar, videogrammetry

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