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Simultaneous and co-located MST and Cloud-radar observations

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This study discusses a set of simultaneous observations made with the NERC MST radar at Aberystwyth, UK, and the RAL Millimetre Wave Technology groups co-located Cloud radar. Two case studies show a clear anti-correlation between Cloud radar signal return power and NERC MST radar signal return power. Ancillary weather radar suggests this relationship is not associated with precipitation. Examination of satellite imagery and the lack of attenuation in the cloud radar observations suggests that this relationship may be partly associated with changes in the balance of liquid to ice water content in the clouds observed. These conclusions are also supported by ancillary evidence from radiosonde soundings. The variations in the returned signal power observed by the NERC MST radar are then examined using Principal Component Analysis (PCA). PCA of the VHF radar signal return power suggests that the first two PC's, which account for more than half of the variance in the data, are associated with the cloud structure. A simple model of the VHF radar return signal power based on radiosonde observations suggest humidity and the fraction of ice to liquid water content in the cloud may help account for these observations. The small difference between the modelled signal power when using a saturated vapour pressure over ice and water suggests that any change in the signal can only be partially explained by changes in the fraction of liquid to ice water cloud.