Abstract the field level, and provide information on

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AbstractSoil tillageis an agriculture management practice employed on nearly all cropland globally. Conservation tillage practices, which reduce tillage intensity and leave morecrop residue on the soil surface, have been proposed as potential climatechange mitigation measure because they may increase soil carbon storage andalter surface energy balance and soil moisture. However, the effects of differenttillage practices on processes related to cycling of carbon, water, and energy, particularly with regard to climate, are only weakly understood.

Moreover, although conservation tillage practices have been increasingly adopted inrecent years, broad-scale data on tillage practices at regional to globalscales is unavailable. Therefore, the objectives of this research are two-fold. The first component focuses on detecting differences and changes in tillagepractices on agricultural land. This research will examine novel remote sensingmethods for detecting broad-scale differences in tillage practices at the fieldlevel for a watershed in central Iowa. The second component will investigatethe effects of different soil tillage practices, particularly conservationtillage, on global climate. This will be accomplished by including tillagepractices in a major Earth System Model (ESM) used for simulating globalclimate, and allow for sensitivity testing of the Earth system to alterationsin tillage practices on croplands globally.

Introduction – Broad-scale remote sensing of tillagepracticesAccuratemonitoring and detection of changes in agriculture land use and managementpractices are essential for assessing the impacts of agricultural activities oncycling of carbon, water, and energy. Soil tillage is practiced on nearly croplandglobally, yet broad-scale monitoring and data on tillage practices, particularly regarding the areal extent of less intensive conservation tillage, are largely absent. Satellite remote sensing methods have the potential todiscriminate between different types of tillage at the field level, and provideinformation on tillage practices over broad geographic areas. These remotesensing methods typically rely on satellite indices that distinguish between disparatespectral signatures of crop residue and bare soil at the time of crop planting todetect differences among tillage practices.

In this regard, the minimumNormalized Difference Tillage Index (minNDTI) method has emerged as an approachfor accurately detecting crop residue cover (CRC) and tillage status atbroad-scales. The minNDTI method relies on moderate spatial resolutionsatellites, such as Landsat, to collect time-series imagery from early in thegrowing season, while crops are planted. However, widespread adoption of the minNDTImethod has been restricted because imagery is often obscured by excess cloudcover during the critical planting window. The combination of new moderate resolution satellites, such as Landsat 8 and Sentinel-2, portends the possibility of markedly improvingcapacity to obtain high-quality remotely-sensed imagery for many applicationswithin the Earth sciences. Characteristicsof Landsat 8 and the two Sentinel-2 are similar and facilitate easy comparison betweenimagery. Moreover, combining the two systems may reduce the temporal gapbetween which imagery is collected to as few as five days. Thus, combining imageryderived from Landsat 8 and Sentinel-2 ought to increase opportunities toacquire the sequential cloud-free imagery required for monitoring tillagepractices using the minNDTI method. Therefore, objectives of this research are to compareperformance of the minNDTI method using sequential imagery from: 1) Landsat 8Operational Land Imager (OLI), 2) the Sentinel-2A & Sentinel-2BMultiSpectral Instruments (MSI), and 3) combined data from Landsat 8 OLI andSentinel-2 MSIs.