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SAR Remote Sensing for Crop Estimation

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ABSTRACT

Agriculture is area of great economic importance throughout the World. Therefore, an everlasting effort exists to develop tools that can support activities in this field. This Paper summarizes foundation, integration, practical applications and new opportunities of SAR remote sensing in agriculture. Remote sensing is a multidisciplinary technology. In remote sensing, Synthetic Aperture Radar (SAR) is an emerging technology. Recent technological advances in satellite remote sensing have shown that crop estimation can be measured by a variety of remote sensing techniques, each with its own strengths and weaknesses. In the recent years, SAR has increased importance in agricultural systems and agricultural practices. The remotely sensed data and data analysis techniques are used for crop mapping and monitoring. SAR imagery data could be used to monitor the plant growth, the crop yields and biomass. In the growing season, Agricultural targets are very dynamic, remote sensing is the useful technique for crop mapping and monitoring. The crop domain data is the important basis for making food policy and economy plan. Therefore, it is important to conduct the study on crop identification, mapping and monitoring. SAR remote sensing provides the effective monitoring of agricultural progress and abandonment. Also provides timely information for decision makers to evaluate upcoming food security, understanding global change issues and environmental consequences.

Keywords: SAR remote sensing, Crop Estimation

I. INTRODUCTION

Due to increasing global population, food security has become a major concern for the world.

In the literature many review papers are available. Which summarizes the current trends, techniques, increasing availability of satellite imagery and new opportunities in agriculture for crop mapping and monitoring. SAR technology has the potential to provide timely and accurate information about Crops which is useful for agricultural productivity and sustainability. Satellite remote sensing uses space-borne sensors and it is a modern technique that allows acquisition of data in a systematic way and comprehensive coverage [1]. The common aspect of all remote sensing systems is that they depend on the use of electromagnetic waves to cover the distance between the sensor and the object to be observed [2]. Microwave remote sensing techniques have shown great potential in agricultural applications such as crop yield forecasting, irrigation management, and issuing early warning of droughts [3]. Recently, satellite sensors are now orbiting not only frequently but can apply multiple sensor measurements, which means we can collect rapid data acquisition over given areas. Satellites such as the Sentinel-2 can better detect which SAR frequencies are emitted when there are multiple frequencies used

[4].Satellite-driven crop monitoring has become a main method to derive crop information at local, regional, and global scales by revealing the spatial and temporal dimensions of crop growth status and production. Most food security programs use approaches that combine satellite data with agro climate indices, which are calibrated and transformed into a final crop yield to predict food production. The ground data accessibility and the negative effects of knowledge-based analyses are two essential issues in crop monitoring that reduce the applicability of crop monitoring for decisions on food security [5]. Satellite remote sensing represents an alternative method for deriving quantitative estimates of crop production and grain yield with a number of potential benefits, including the ability to cover large areas, repeated observations and low costs [6]. The Synthetic Aperture Radar (SAR) technique first time used in India, hence the Risat-1 images will facilitate agriculture and disaster management because of its day-night, all-weather monitoring capability. The Risat-1 satellite will be used to estimate the agriculture. SAR images have extensive applications in remote sensing for the mapping of the surfaces of the earth. It has potential for agricultural mapping, environmental monitoring, resource mapping, disaster supervision, and military systems managements because of broad-area imaging at high resolutions. Synthetic aperture radar is used for a wide variety of environmental applications, such as monitoring of crop characteristics, deforestation, ice flows, oil spills, Road's network density, forest fire, mining, urban growth, etc. [7]. Due to the presence of multiple scatters within the crop volume scattering of radar energy occurs when the SAR beam penetrates the crop. In volume scattering multiple bounces and reflection from the different components of the crop occurs thus resulting in high backscattering values. Each crop has different date of sowing and growing pattern also having difference in crop biomass, moisture content, plant height, plant density per meter square [8]. Crop identification and crop planting area mapping are the most basic applications of agricultural SAR remote sensing. With the increasing availability of SAR imaging modes (e.g., PolSAR, Compact SAR, PolInSAR, Two-station/ Multi-station SAR, TomoSAR, and 3D/4D SAR), the SAR data sources available for agricultural remote sensing are increasingly growing. Recently, the imaging modes of SAR sensors are more and more abundant, which can provide various types of data sources for agricultural remote sensing applications. SAR applications in agriculture, particularly in crop type mapping, crop condition assessment, soil moisture estimation and crop yield estimation [9]. SAR is a complex system that measures the scattered wave of a target under an impinging incident wave that is transmitted by setting the probing frequency, polarization, and observing geometry. Essentially, SAR involves radar operation and image formation. The sensor coordinates and target on the earth's surface must be lined up to uniform coordinates of both time and space [10]. Food security is one of the most basic factors of our physical and intellectual wellbeing. It is a fundamental prerequisite for a healthy and happy life. Food security is a broad concept that goes beyond production because it requires accounting for spatial and temporal variability of food availability, as well as physical and economic access. Accurate and timely food production information is essential to food producers, traders and consumers [11]. Crop type mapping and geostatistical methods are two categories of methods to derive crop area estimations, while crop type mapping not only provides data to estimate crop area, but also provides baseline data for crop condition assessment and yield prediction. The accuracy of classification depends on the sensitivity of the used backscattering coefficients to the differences of the bio morphological structures of the plants, hence to the different interaction behavior between the electromagnetic wave and the structure of the canopy [12]. SAR technology is able to detect changes in moisture content, plant height, and biomass, allowing farmers to make better decisions about crop management [13]. Synthetic aperture radar (SAR) capable of monitoring ground objects throughout the day and all weather. Crop planting area information is one of the important factors for production estimation and national food security. The fast and accurate estimation results of crop acreage have important significance for national agricultural policy analysis

and macro grain decision making [14]. The technological improvements have played an increasingly important role in agricultural production around the world by helping farmers in increasing crop yield, reducing costs and environmental impacts, and managing their land more efficiently [15].

II. RESULTS AND DISCUSSION

Automatic crop classification using new technologies and techniques is known as one of the most important solutions in present farming improvement. Remote Sensing techniques and availability of satellite data are needed for global, regional and local environmental monitoring. Spaceborne SAR scan the earth with microwaves. SAR technology can be used to classify crops based on biomass, their moisture content, plant height, also to evaluate crop damage caused by natural disasters. This information can be used to determine the crop health and identify areas that may need additional attention. Thus, SAR technology can provide frequent updates of crops which can be helpful for crop management practices.

III.CONCLUSION

The main benefit of SAR technology is, it has the capability of Remote Sensing. SAR technology can synthetically produce higher resolution images in all-weather condition and all time. The remotely sensed data and data analysis techniques are useful for understanding global change issues. SAR technology is useful for crop monitoring, planning, its developments, yield estimation and making decisions. Crop Estimation with Synthetic Aperture Radar (SAR) has become significant tool for agriculture management.

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