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Perspective

Brief Note on Microwave Remote Sensing

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DESCRIPTION

The basic reason for the use of microwaves for remote sensing is that they are different. That sounds a rather trivial statement, but is true nonetheless. By using the microwave region of the Electro Magnetic (EM) spectrum we benefit capabilities that complement remote sensing techniques used in different spectral regions microwave interactions, in general, are governed through different physical parameters to those that effect different types of EM radiation. For example, the amount of microwave energy of a particular wavelength scattered off a green leaf is proportional to its size, shape and water content, rather than the amount of chlorophyll. Microwaves have further advantages which can penetrate clouds and can even get through the top layer of dry soils or sand (through as much as a few metres in some circumstances). And because thermal emission is observed in passive imagers with active imagers, the measurements may be made at any time with out relying on background sources such as the Sun. A further advantage for atmospheric remote sensing over, say, infrared techniques is that microwave wavelengths may be selected such that ice clouds and different particulates (which include aerosols) have negligible effects on the signal.

The long wavelengths mean that large antennas are required even to acquire the kinds of spatial resolutions appropriate for regional-scale studies. And active microwave systems, such as Synthetic Aperture Radar (SAR) devices, tend to be the heaviest, largest, most energy consuming and most data prolific instruments which are ever likely on Earth observing satellites. In addition, as will become apparent later in these notes, the interpretation of data from such devices is rarely simple. The term "microwave" is used throughout this text as a generic term to include centimetre, millimetre and submillimetre wavelength regions of the electromagnetic spectrum. Within the context of imaging radar this definition can also be stretched a little into the radio wave region when we additionally consider wavelengths up to a metre or longer. On a rather general level, we may also distinguish types of microwave remote sensing instrument that are active and passive. Passive sensors or radiometers, measure the microwave energy that is radiated (through thermal emission) or reected (from the sun or other radiating objects) through the Earth's surface or atmosphere. A careful selection of observing frequency will permit measurements of the atmosphere, the ground, ice or rain Active sensors, such as radar systems, generate their own illumination by transmitting pulses of microwave radiation and then using a specialized receiver system to measure the reacted signal from the area of interest. They primarily use wavelengths greater than 3 cm (10GHz) in which the atmosphere will become virtually transparent.

CONCLUSION

The microwave emission from objects are mainly based upon the objects physical temperature and its dielectric properties. That it is practical to define the measured microwave intensities in terms of temperature-like properties. The dielectric properties are associated with the physical made-up of the object i.e. the materials it is made from. For most practical applications of passive imagers (for land observation and sea ice) the most substantial factors effecting the measured intensities are temperature, salinity and liquid water content. The surface roughness also has an inuence on the directivity of the emission.

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