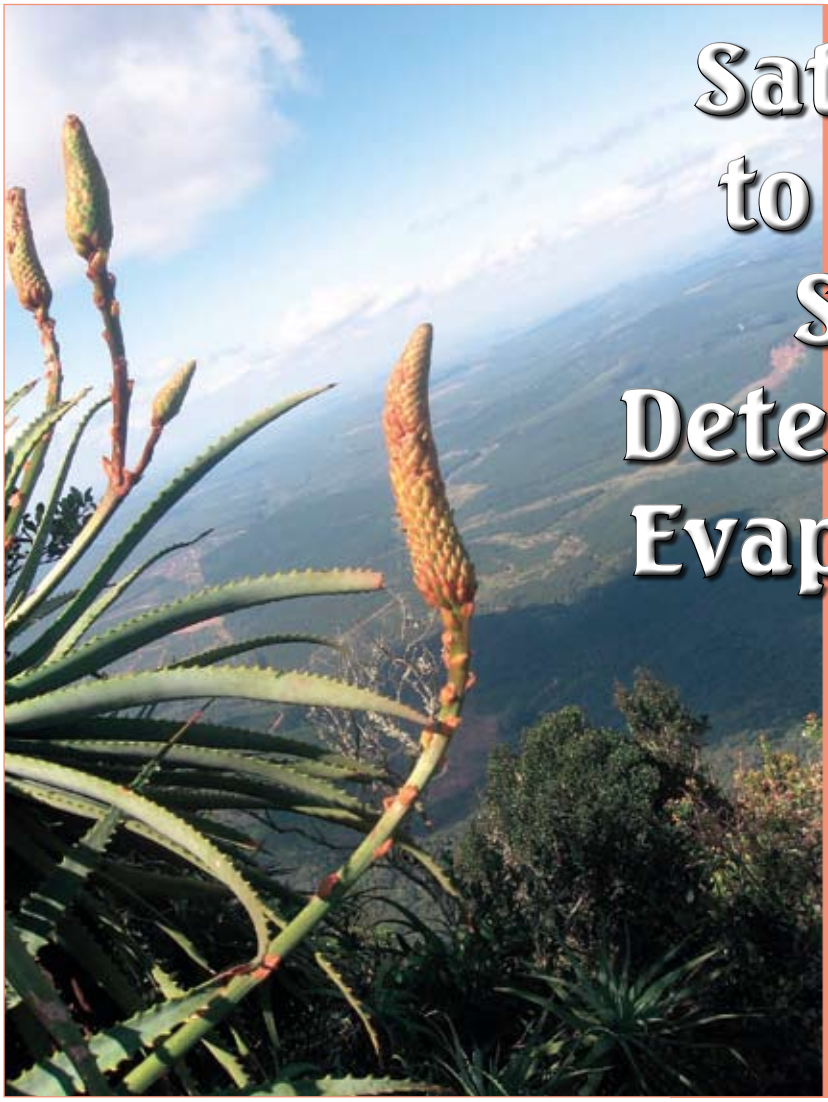

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Satellites to Assist SA in Determining Evaporation

The use of remote sensing to determine evaporation in South Africa has received a welcome boost following the signing of a Memorandum of Understanding (MoU) between CSIR and international scientific advisory firm WaterWatch. Lani van Vuuren reports.

Evaporation is generally the most significant water loss from a catchment. Types of vegetation and land use (e.g. forestry or agriculture) greatly affect evaporation, and therefore the amount of water leaving a catchment. Understanding the temporal and spatial distribution of evaporative losses is essential for managing water in catchments as this is the basis for evaluating how water is consumed and understanding potential tradeoffs related to the allocation of water for anthropogenic uses and the environment. Yet, evaporation remains expensive and difficult to quantify because it varies greatly in space and time.

Traditional methods to determine evaporation in South Africa have included the water balance method, energy balance methods (e.g. the Bowen ratio, Eddy covariance, scintillometry) and the heat pulse velocity technique. Other methods such as lysimetry, porometry, stem steady state, the cut stem technique as well as semi-empirical and empirical methods have also been used. These techniques estimate evaporation mostly at point scale or small spatial scale. However, better large-scale techniques are required to measure evaporation over, for example, an entire catchment.

A model such as SEBAL (Surface Energy Balance Algorithm for Land), which estimates evaporation using remotely-sensed data offers a possible solution to this challenge. It is described as an indirect evaporation technique in that it involves using a set of equations in a strict hierarchical sequence to convert the spectral radiances measured by satellites or aeroplanes into estimates of actual evaporation. It does not require prior knowledge on soil, crop or management conditions.

WaterWatch, which is headquartered in the Netherlands, developed SEBAL. The model determines both actual and potential evapotranspiration on a pixel-by-pixel basis by solving the energy balance at the earth's surface using spatially distributed, visible, near-infrared and thermal infrared data as supplied by certain satellites. The SEBAL model has

already been used successfully by WaterWatch to help determine the water use efficiency of the wine and table grape industry in the Western Cape. WaterWatch is also currently applying it to determine the water use of invasive alien plants in the Western Cape and KwaZulu-Natal in a project funded by the Working for Water programme.

"The advent of the possibility to indirectly measure fundamental evapotranspiration processes from satellites has radically changed our abilities in the area of water resources management," says WaterWatch Director Prof Wim Bastiaanssen. "Spatial coverage is available at the variety of scales needed: from field to basin."

While used widely overseas, the use of remote sensing technology to estimate evaporation has been extremely limited in South Africa to date, explains Dr Caren Jarmain, researcher in the ecophysiology group of CSIR Natural Resources and the Environment (NRE). "There is currently no known group in this country that estimates evaporation operationally in South Africa," she tells the Water Wheel. This also means that at present hardly any capacity exists in the country to undertake evaporation estimation using remote sensing.

Therefore the MoU signed between CSIR and WaterWatch to facilitate more work between the two parties and in the use of the SEBAL model in South Africa is seen to be of great benefit to the country. "Local researchers will be trained in the use of SEBAL, which will build much needed capacity in the use of state-of-the-art technologies, such as remote sensing, to estimate evaporation." It is especially the skills of agrometeorology, micrometeorology and hydrology which are required.

In the long term, it is hoped that this agreement will open up the way for the establishment of a national remote sensing centre where evaporation will be estimated operationally (in near real time) for different water resources management applications, such as catchment water balance modelling, calculating the efficiency of water use, and determining the needs of the Environmental Reserve, among others. However, such a centre will require significant infrastructure (including fast computers, and access to satellite and weather data) and CSIR hopes to involve other partners, such as government departments, in the process.

Lani van Vuuren

Signing the Memorandum of Understanding on behalf of CSIR and WaterWatch is Dr Pat Manders, Director of CSIR NRE and Prof Wim Bastiaanssen, Director of WaterWatch while CSIR researcher Dr Caren Jarmain looks on.

THE WESTERN CAPE GRAPE PROJECT

The economically important grape sector of the Western Cape puts significant pressure on the scarce water resources of this province. The challenge is for the grape industry to remain economically viable while simultaneously saving water.

WaterWatch was contracted by the Western Cape Department of Agriculture (DoA) to undertake a study in six grape-growing areas (the Hex River Valley, Worcester, Paarl, Franschhoek, Stellenbosch and Somerset West). The aim of the study was to understand the spatial and temporal variation of water use efficiency in table and wine grape vineyards in the Cape winelands using remote sensing technology. Water consumption, biomass production, yield and water use efficiency were estimated for the grape growing seasons (September to April) between 2004 and 2007. This information was used by the DoA to inform growers on how productively they are managing their water resources.

SA Tourism

For more information, go to www.waterwatch.nl/grapes.