



Practical Scintillometry in the Yellow River Basin

There is a growing world-wide interest in monitoring surface heat fluxes, the energy balance and evapotranspiration. This is fuelled by the increasing need for the efficient management of drinking water and improving weather forecast models to predict extreme weather. The Dutch remote sensing company Environmental Analysis and Remote Sensing (EARS) has developed an Energy and Water Balance Monitoring System (EWBMS) which utilises Kipp & Zonen Scintillometer systems for measuring sensible heat flux and evapotranspiration.

The Yellow River, or Huanghe, is the second longest river in China. It has its source in China's far west, it loops north, bends south, and flows east for approximately 5,500 km until it empties into the sea, draining a basin of 745,000 km², which nourishes 120 million people.

In the past 10 years the Yellow river has frequently fallen dry due to insufficient information and lack of control on water distribution.

Current hydrological models are sophisticated, but that their performance is restricted due to lack of input data. Current measuring stations are too far apart to create a fair representation of the rainfall field.

The EWBMS of EARS, is currently being used in China to predict the Yellow River runoff and to measure the distribution of drought in the Yellow River basin on the basis of satellite data. It is the first system in the world to map the evaporation of water from the Earth's surface. Important EWBMS output files are

daily evapotranspiration and daily and 6 hourly rainfall maps of the basin at 5 km resolution. The rainfall and evapotranspiration information is used to feed the water resources hydrological model developed by UNESCO-IHE in Delft. With this information the allocation of scarce river water is tuned to the needs in a cost-effective way.



In the initial stages of the implementation of EWBMS, validation of the satellite output plays a vital role. This is performed using four Large Aperture Scintillometer Evapo-Transpiration (LAS-ET) systems from Kipp & Zonen. These systems provide near-real time measurements of the path averaged sensible heat flux, net radiation and Evapotranspiration over a path of approximately 5 km. This path length approximates the satellite pixel size. Therefore the measurements from a LAS-ET system can be used to validate satellite data of sensible heat flux, net radiation and evapotranspiration.



A scintillometer measures fluctuations in the density of air. These fluctuations are caused by heat and moisture fluxes exchanged between the Earth's surface and the lower part of the atmosphere. Combined with standard meteorological measurements like wind speed, temperature and humidity, the sensible heat flux is derived. Additional measurement of the net radiation balance and the soil heat flux yields the evapotranspiration. The LAS-ET systems provide an all in one solution. It contains all the required measurement instruments and data acquisition. The included EVATION[®] software package offers a very user friendly interface for processing all the measured data, easy data storage and graphical representation at the click of a button. Furthermore Kipp & Zonen can provide extensive technical support due to years of experience in the field of scintillometry.

For more information on LAS-ET Systems please visit our website.

For more information on the EWBMS please contact EARS: www.ears.nl

