Producing, verifying and distributing synthetic evaporation and evapotranspiration data for Australia

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Location: Brisbane.

Principal investigator

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The need

Evapotranspiration is a critical component of the water cycle and an important component of many agricultural, hydrological and climate models. Consequently, it should influence management decisions at a broad range of scales. Despite this, there was no reliable, readily available, long-term Australian time-series of evapotranspiration data prior to this project. This project delivers potential evapotranspiration (PET) spatial time-series data. Gridded data covering the whole of Australia at 5km resolution has been generated for every day, back to 1910. The PET data are available to the community through NRMW's SILO web service.

How this project fits with MCV objectives

Biophysical modelling and monitoring of our natural resources are important management tools to achieve sustainability. Historically, many scientists have had to address the problems of grooming weather observations into a continuous data set—a significant task often done on a per project basis with the effort not assisting other projects. The SILO project has significantly addressed this problem by quickly and cost-effectively providing thousands of climate datasets. Prior to this project, these datasets did not include evapotranspiration. When complete, this project will support nationwide and local monitoring and modelling of evaporative demand, allowing those areas of natural resource and agro-meteorological research (many supported by MCV) to reap the benefits of SILO's data, becoming more productive, and hence increasing the effectiveness of MCV research funds.

Project objectives

Provide evapotranspiration data in a readily useable format, to be used by researchers and monitoring organisations across Australia.

Methods

The Penman-Monteith reference evapotranspiration (ETo), Morton's variants of evaporation, and a synthetic Class A Pan evaporation are calculated from data provided by the Bureau of Meteorology (BoM) and further enhanced by NRMW. The data used are all based on BoM's extensive observer network. These calculations have been grafted onto the SILO Patched Point Dataset and the DataDrill which are mature products available from http://www.nrm.qld.gov.au/silo.

Desired outcomes

The availability of reliable, up-to-date, historical PET data, in a readily usable form, will improve the efficiency of biophysical and hydrological modelling by researchers, and improve the information available to decision makers in our community.

Achievements to date

1. Calculated ETo according to the formula published in FAO-56[1]. We evaluated and reported the effects of using the default wind value of 2m/s instead of measured wind[2]

2. Calculated the Morton's [3] estimates of evapotranspiration, including point potential, areal actual, area potential evapotranspirations and shallow lake evaporation

3. Developed, calculated and evaluated a synthetic of Class A pan Evaporation[4]

All of these estimates are for sale through the SILO DataDrill and Patched Point DataSet, http://www.nrm.qld.gov.au/silo, as data for a single point anywhere in Australia. Spatial data covering Australia at a 0.05 degree spatial resolution are available on request.

4. Developed the Virtual Automatic Weather Station (AWS)—a combination of SILO data that cover a long time period, and short-term AWS data that represent local conditions better than do the SILO data. The virtual AWS was demonstrated at the CRC for Irrigation Futures annual research forum. The methodologies have been developed.

5. Developed a 7-day prediction of ETo based on Numeric Weather Prediction (NWP). The NWP is the output of BoM's Numeric Weather Prediction model. Evapotranspiration estimates have been derived from this dataset, evaluated and grafted onto existing SILO datasets. This product has been demonstrated to the SILO development team.

When these achievements are in production, the SILO Patched Point Dataset and the DataDrill's meteorological data will cover Australia and will extend from 1/1/1889 to 7 days hence, combining observed data from BoM, output from BoM's supercomputer numeric weather prediction model, recently computerised data from the CLIMARC project, the extensive archive of spatially interpolated data from NRMW, and the mature SILO data delivery system originally developed with assistance from LWRRDC and RIRDC.

What is left to do?

This proposal was partially funded and is seen as the first stage of a two-stage project. The second phase is to improve on the interim calculation of the FAO56 reference evapotranspiration by reconstituting a suitable daily synthetic wind-run dataset for all of Australia derived from all available data. Stage 2 remains unfunded. Therefore, the full benefit of investment in this project will be realised only when Stage 2 is completed.

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[1] "Crop evapotranspiration. Guidelines for computing crop water requirements" FAO Irrigation and Drainage Paper 56. R.G. Allen et al. 1998.

[2] "Sensitivity of the FAO56 Crop Reference Evapotranspiration to Different Input Data", Technical Report. March 2005. Li Fitzmaurice, Alan Beswick http://www.nrm.qld.gov.au/silo/pet/FAO56sensitivity.pdf

[3] "Operational estimates of areal evapotranspiration and their significance to the science and practice of hydrology", F. Morton, Journal of Hydrology, 66, 1-76, 1983.

[4] "Australian synthetic daily Class A pan evaporation", David Rayner at http://www.nrm.qld.gov.au/silo/documentation/AustralianSyntheticDailyClassAPanEvaporation.pdf