

# WHERE, WHEN AND HOW MUCH WATER EVAPORATES AT THE LAND SURFACE?

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## INTRODUCTION

Liquid water percolating below the root zone of agricultural fields or leaking from residential toilets is available for future use; however, water evaporated from the land surface is lost into the atmosphere forever.

Water resources cannot be managed optimally without knowing, at the field scale, where, when and how much water evaporates from vegetation and soil at the land surface.

The purpose of this poster is twofold:

I. Demonstrate that most transformative science has been completed to convert the digital measurements of Landsat satellites into evaporation maps;

II. Demonstrate that field scale, nationwide, evaporation monitoring requires a network of at least four Landsat satellites.

## STATE OF THE ART

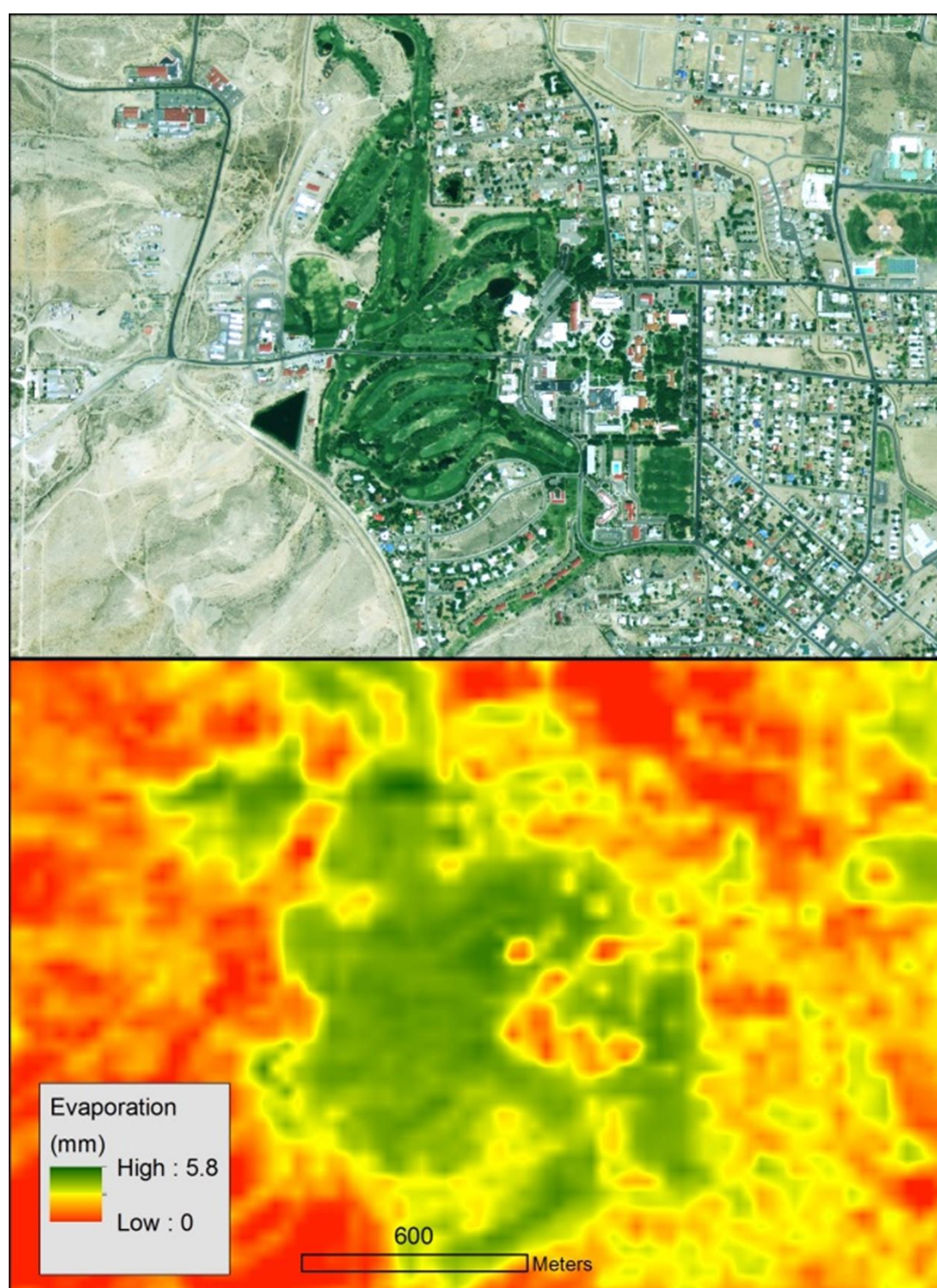
Transformational remote sensing solutions already exist to convert Landsat imagery into high fidelity daily, weekly, seasonal and annual evaporation maps with a spatial resolution of 30x30 m. We use the algorithm Mapping EvapoTranspiration (ET) at high Resolution with Internalized Calibration (METRIC), which is widely used for the monitoring of evaporation at the land surface by federal and state agencies, universities and consultants in Arizona, California, Colorado, Florida, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

Only Landsat has thermal imagery at a fine enough spatial resolution (30x30 m = 100x100 ft) to allow mapping water consumption within individual fields and urban landscaping units.

## METRIC FIELD SCALE ET IN NEW MEXICO

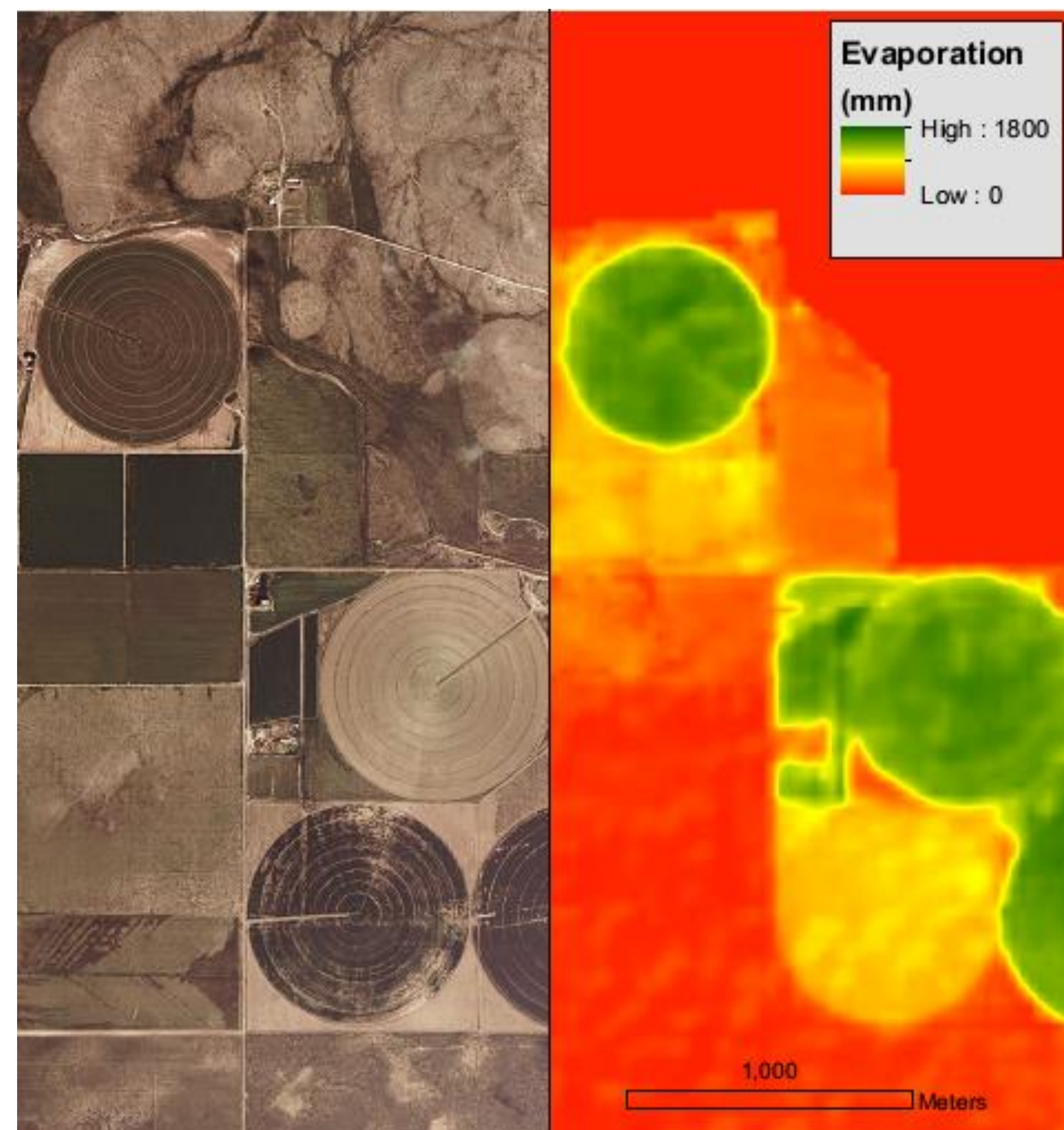
### Urban ET

Daily ET (mm/day) in Socorro on June 16, 2002



### Agricultural ET

2002 Annual ET (mm/year) on fields in the Salt Basin

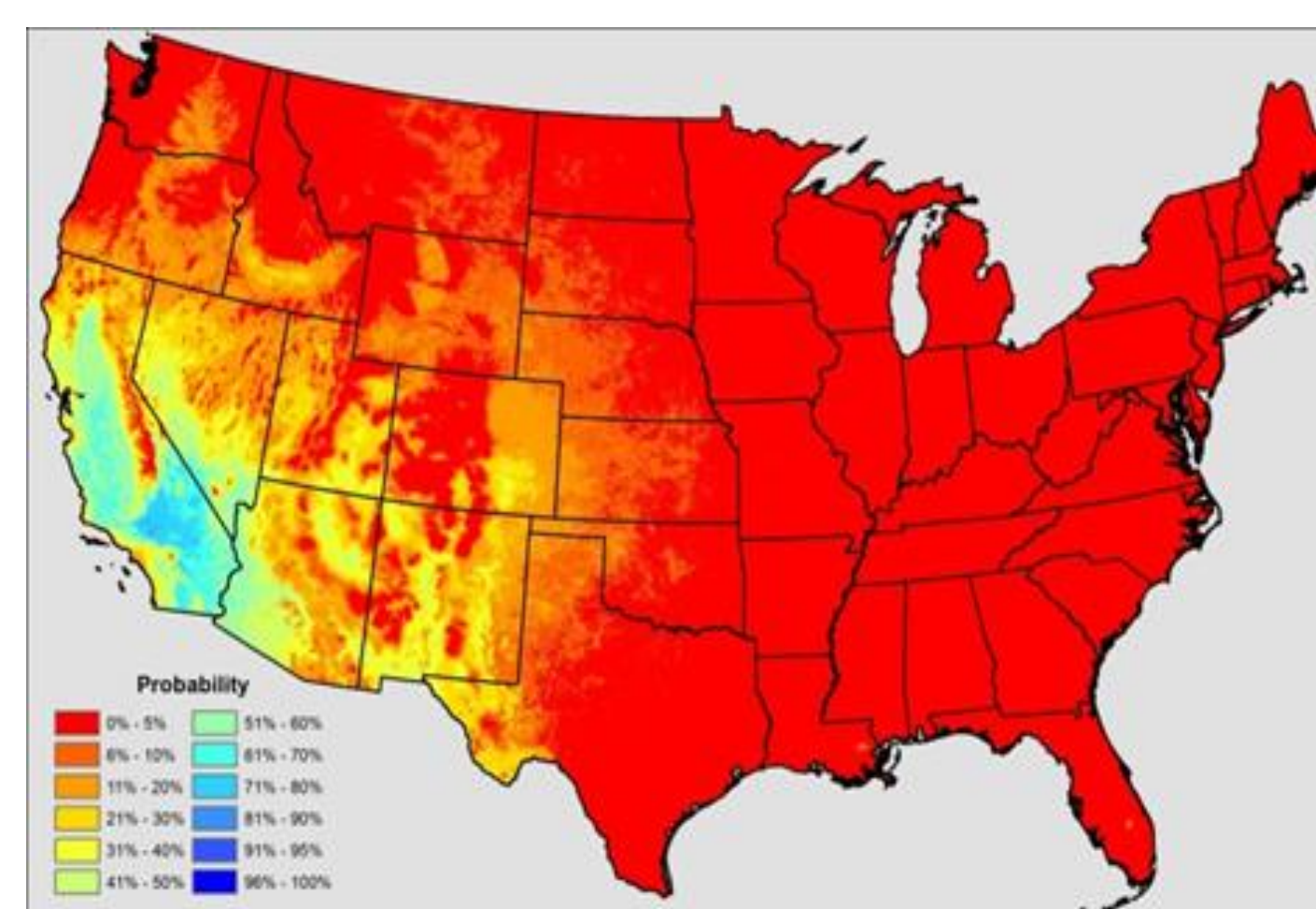


## FOUR LANDSAT SATELLITES ARE NEEDED

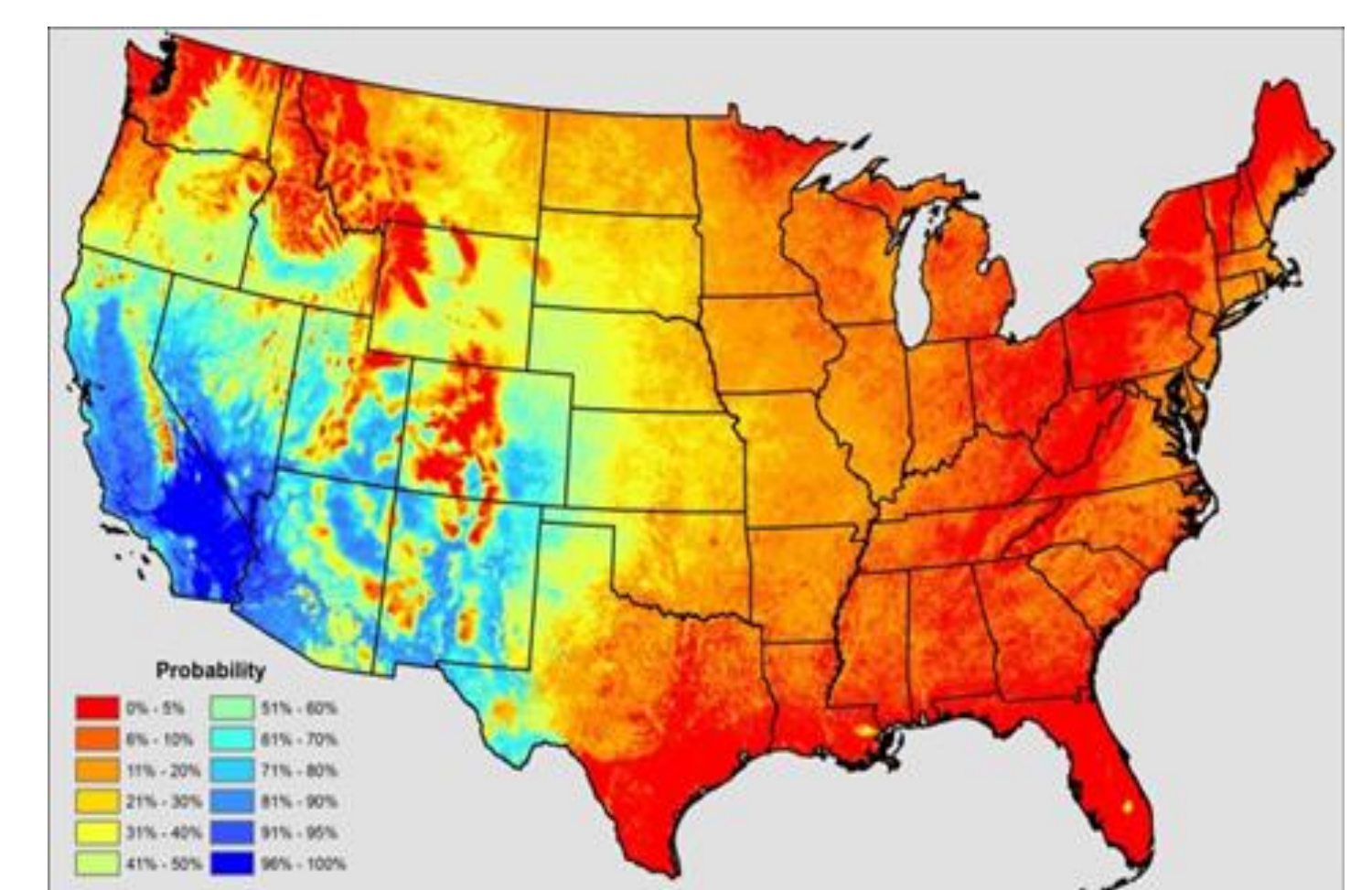
Four Landsat satellites are needed to reasonably assure cloud-free coverage. The present constellation of two Landsat satellites is not sufficient to monitor nationwide where, when and how much precious water is lost into the atmosphere.

### Probability of a Cloud Free Pixel at least every 32 Days

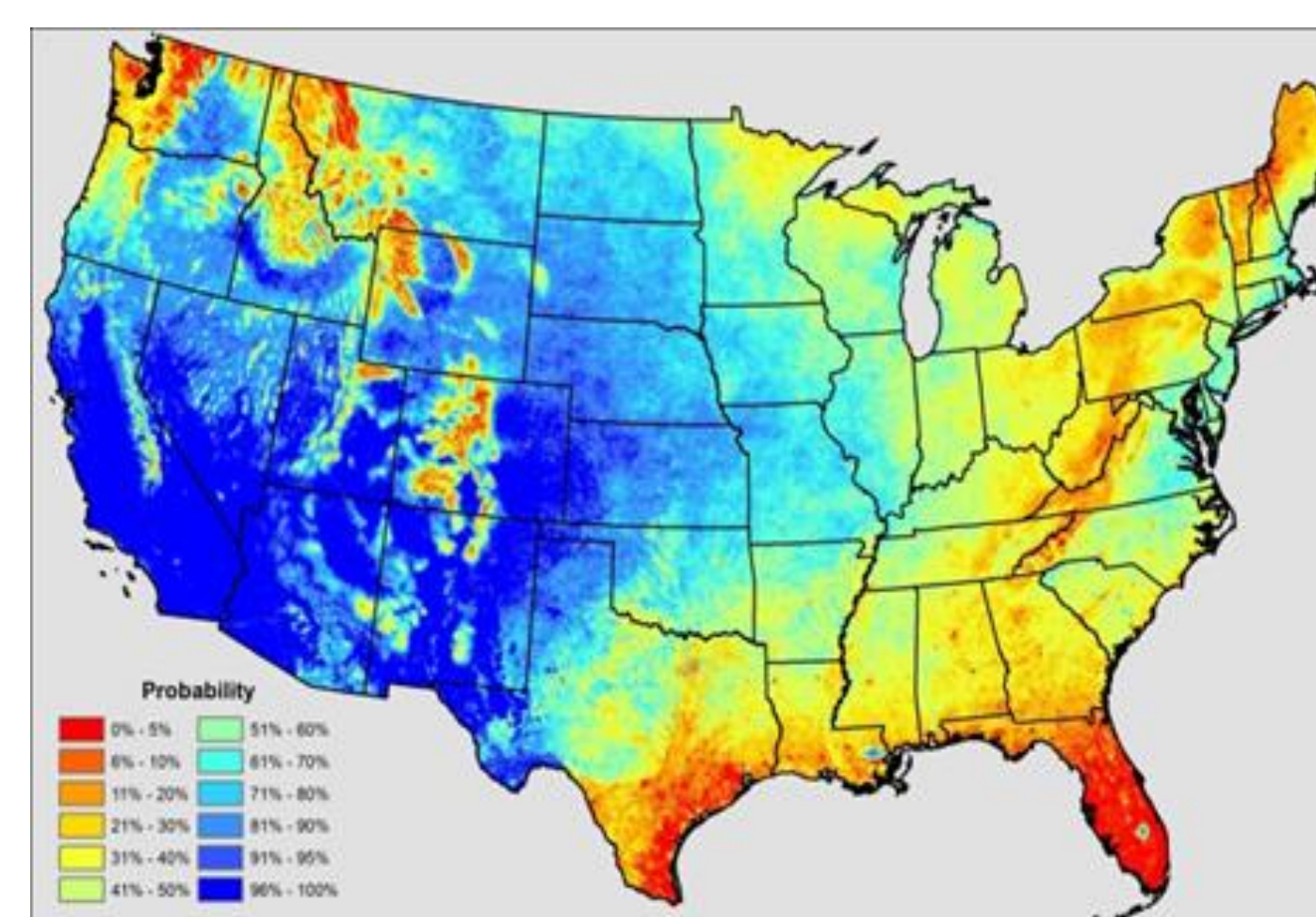
#### 1 Landsat is not sufficient



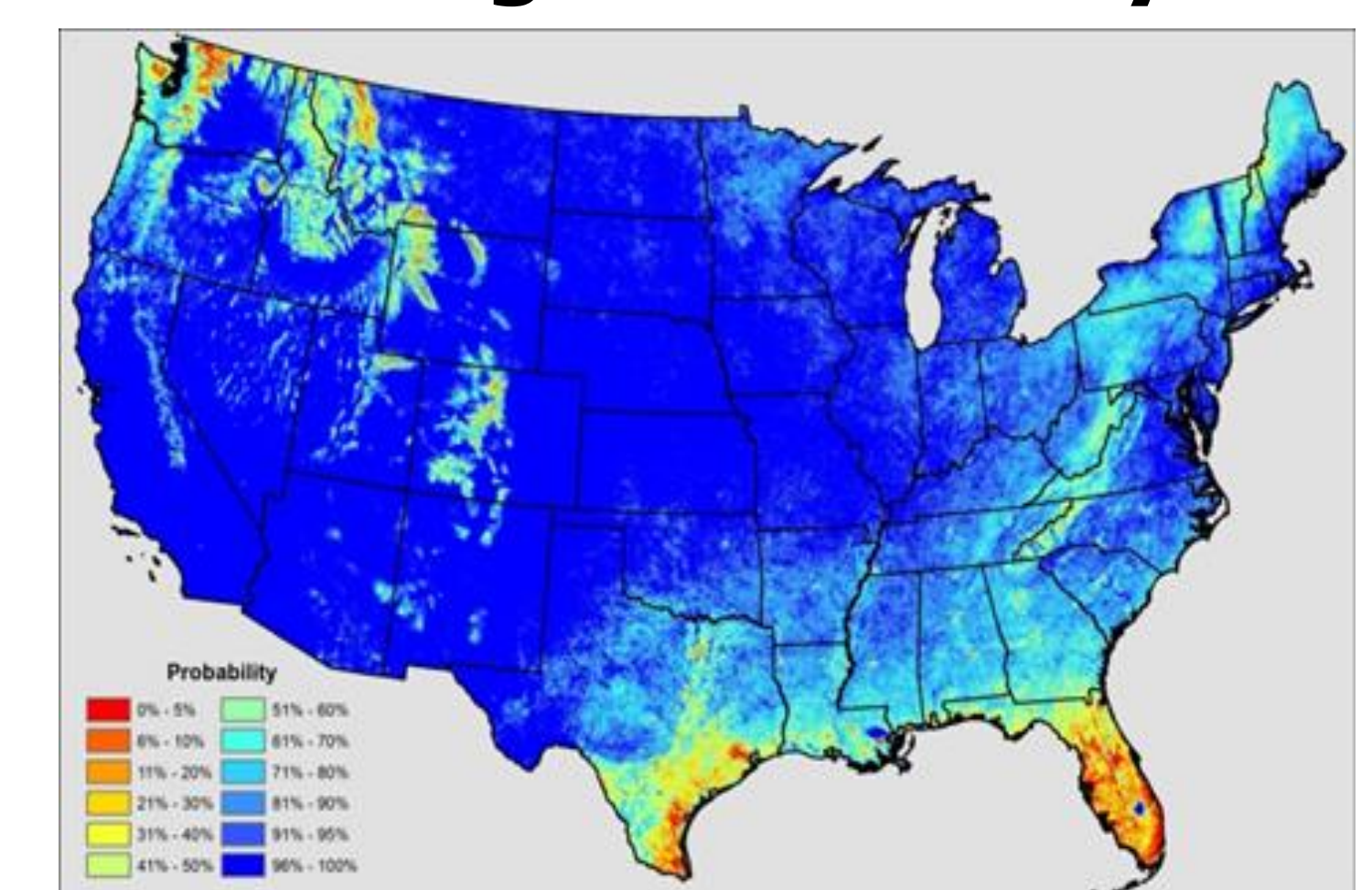
#### 2 Landsats



#### 4 Landsats are needed



#### 8 Landsats for backup and higher accuracy



## CONCLUSIONS

- Forty years of transformative science has led to operational algorithms such as METRIC that transform digital values collected by Landsat into evaporation maps that are critically needed for water resources management. It all started in September 1966, when Secretary of the Interior Stewart L. Udall, against all odds, had the Department of the Interior initiate its own operational satellite program now known as Landsat.
- Today another bold initiative is needed to build a Landsat Satellite network that will provide a continuous real-time stream of field-scale information necessary to define where, when and how much water is evaporated at the earth's land surface. Without that network, transformational solutions for water in the west will be hard to implement.
- Landsat needs to have enough satellites in orbit to provide fresh images every four days. That requires Four Landsats of the current design, or Two "double-wide" Landsat satellites. No other satellite system has the thermal band and necessary pixel size to map evapotranspiration at the field scale.