

HydroFacts

Percent of homes in the Tucson metro area built prior to 1985 with evaporative coolers: **70**
Percent of homes in the Tucson metro area built after 1995 with evaporative coolers: **less than 2**

Amount by which an El Niño's stronger wind patterns can slow the earth's rotation and increase length of day: **0.6 milliseconds**

Percent of the Earth's surface (land and sea) hidden from satellite view by clouds at any given time: **50**

Terabytes of data in the Earth Observing System Data and Information System from 30+ satellites: **10,000**
Number of books (text only) equivalent to 10,000 terabytes: **10 billion**

and can be initialized to measured real-time conditions, increasing their predictive accuracy. By contrast, numerical models are best suited for longer-term predictions, and unlike ANNs, they can explicitly predict responses at any location of interest. Kriging and other methods may also be used with ANN predictions to increase predictive capability, however.

ANN users must be careful to include data that span the expected range of system conditions, as ANNs generally do not extrapolate well outside of what they have been trained with. But the "data-driven" nature of the technology makes it highly amenable to retraining, even in real-time, so as new data become available, the generalization capability of the ANN model can be increased.

A frequent criticism is that ANNs require relatively large data sets on pumping rates and head values at points of interest. However, with the proliferation of automated data collection systems, these data sets are becoming increasingly common. NOAH L.L.C., a company formed by the Arizona researchers, is beginning to market ANN technology as a real-time groundwater management tool. As competition for diminishing water resources increases, and real-time data streams become increasingly common, ANNs will likely become a common groundwater management tool.

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