RESOURCE & TECH

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Clayton Matheny (presenting author)
Shawn Malone
Rounak Kharait
Ørsted Americas

TMY vs Time Series for Solar Energy Modeling: Which is Better?

BACKGROUND

Typical Meteorological Year (TMY) data contains one year of hourly data that acts as a representative snapshot of the long-term meteorological conditions of a location. This data format has historically been the standard resource file utilized in solar energy modeling. However, as modeling has become more sophisticated and computing power has increased, it is time to reassess the strategy of using TMY data rather than the long-term time series from which they're derived.

OBJECTIVE

This research seeks to compare the modeling impact of using TMY vs time series data across of a range of climatologically varied locations on energy basis.

This poster provides insights into:

a) Is it time for the industry to move to time series modeling?
b) Is there a regional bias when comparing production for TMY vs time series?
c) Are there differences/trends that are identified among different satellite data vendors?

METHODS

We have modeled a standard utility scale project in DNV's Solar Resource Compass Energy API with the below configuration:

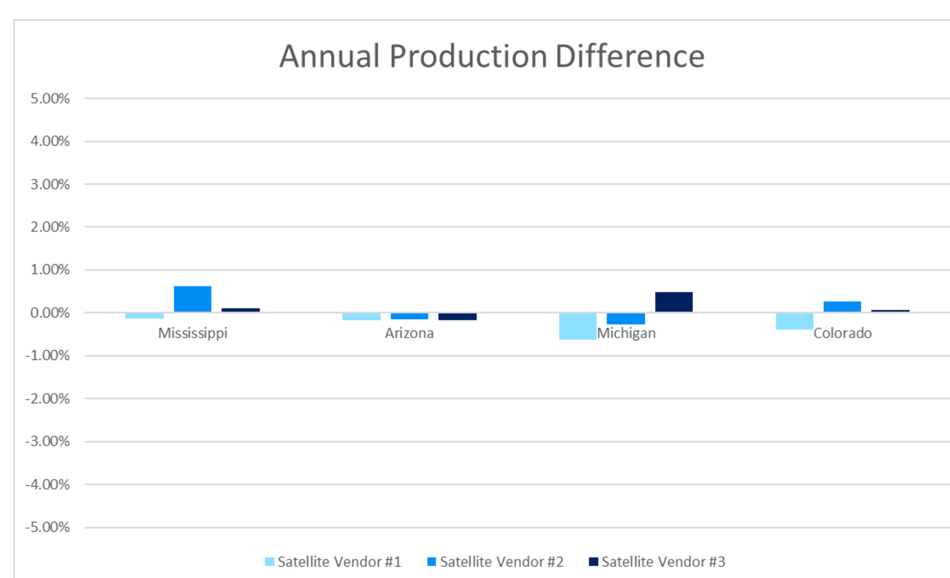
- 130 MWdc, 100 MWac, GCR 35%
- Module: CdTe, Inverter: Central, Single-axis tracker

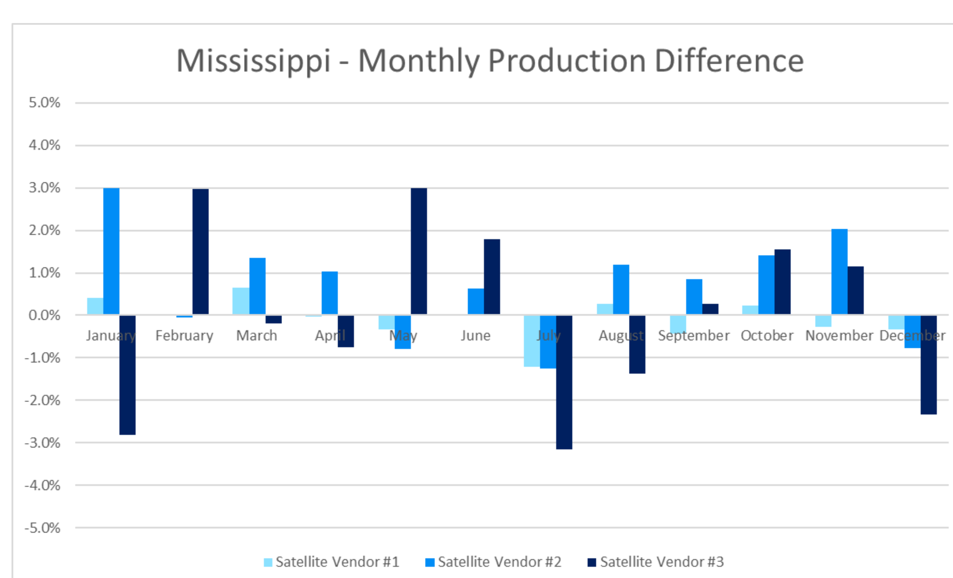
We are looking at annual and monthly comparisons for four distinct geographic and climate locations:

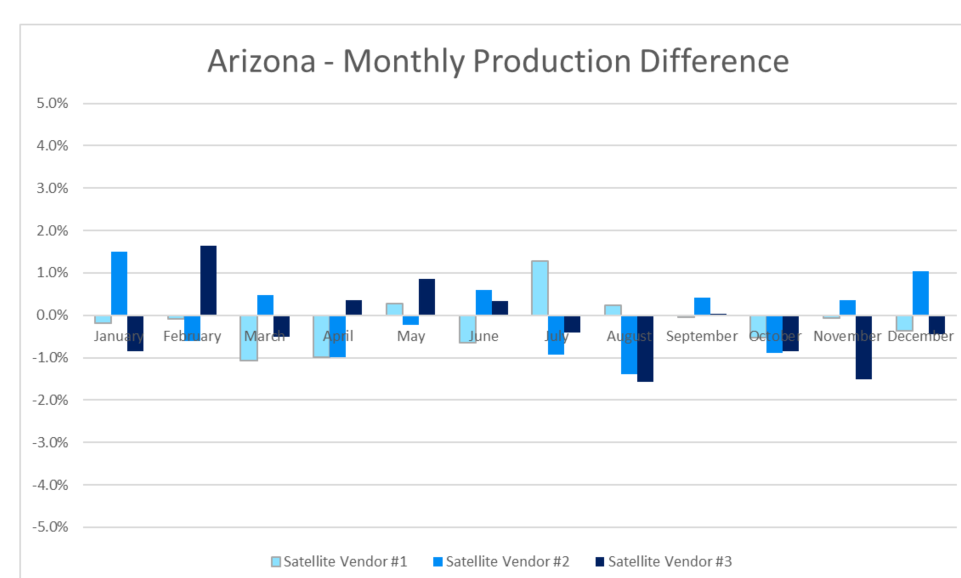
- Warm & Moist (Mississippi)
- Warm & Dry (Arizona)
- Cold & Moist (Michigan)
- Cold & Dry (Colorado)

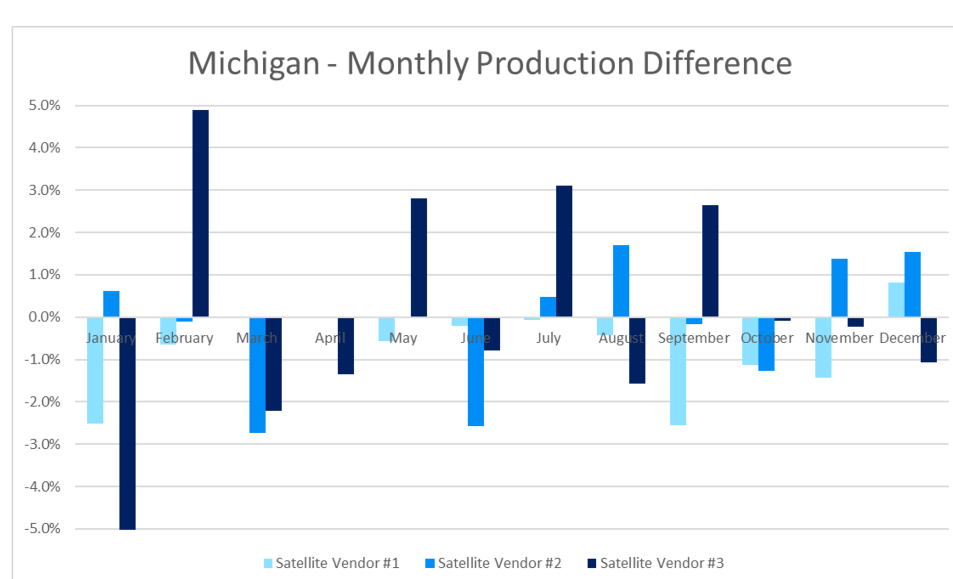
RESULTS

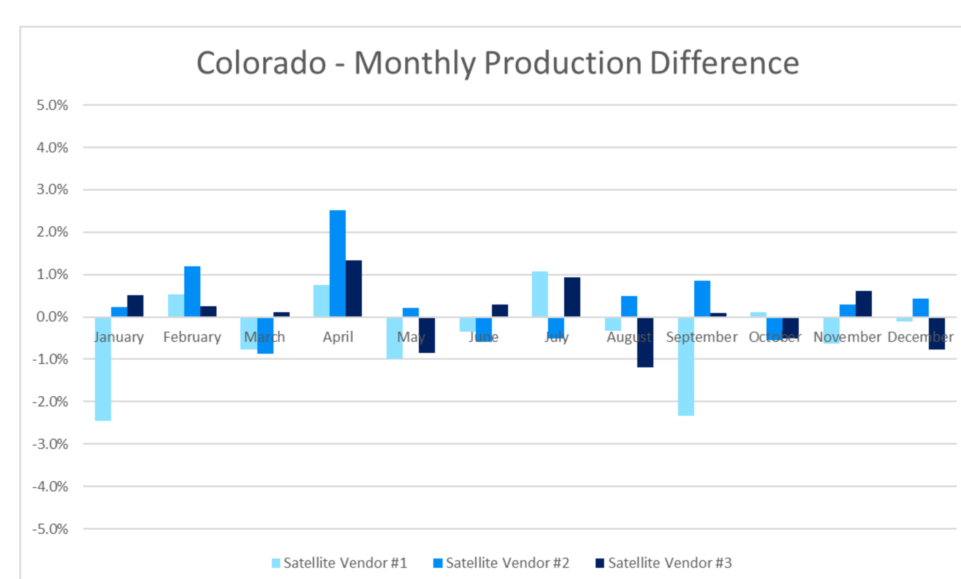
- Results use the TMY data set for each satellite data provider as the reference (i.e. negative values represent underestimation from the TMY)
- Annual production:
  - Difference across climate regions and satellite vendors was relatively small (±0.6%)
  - Michigan (Cold & Moist) location resulted in the highest variance across satellite data sets
  - Arizona (Warm & Dry) location resulted in the lowest variance across satellite data sets
  - TMY for Satellite Vendor #1 provided a consistent underestimation of production compared to the time series
  - TMY for Satellite Vendor #2 and Satellite Vendor #3 did not have a trend as compared to the time series
- Monthly production:
  - The monthly variability across climate regions and satellite vendors was much higher compared to annual production
  - Regions with greater climate variability had larger monthly differences in production
  - Both Mississippi and Michigan (moist regions) resulted in greater monthly spikes compared to the other locations - up to ± 5.0% difference
  - TMY production for Satellite Vendor #2 and Satellite Vendor #3 had greater monthly variance compared to Satellite Vendor #1











CONCLUSIONS

- Annual production difference between TMY and time series data was small for all climate regions and satellite vendors
- Greater variability between TMY and time series data occurred when considering the higher temporal resolution of monthly production
- Time series data for regions with low sub-annual climate variability had monthly production closer to the TMY compared to more variable climates
- No pattern arose from the three satellite vendors that points to a consistent over or underestimation using TMY data in the monthly production
- Using to a time series irradiance data set should be dependent on the needs of the developer due to its computationally intensive nature

FUTURE WORK

- Incorporate a higher resolution production output – hourly 12x24
- Investigate impact of different module technology
- Determine revenue impact of using TMY vs time series on an annual, monthly, and hourly level

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CONTACT INFORMATION

Clayton Matheny – clmat@orsted.com
Shawn Malone – shmal@orsted.com
Rounak Kharait – rounk@orsted.com