Validation of Hawaii Wind Integration Data Set

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PIX #14697

Is the Hawaiian model data set a valid tool for wind energy grid integration studies?

Scope and Data Set Characteristics

Validation of preliminary data set produced by AWS Truewind

Data Set Characteristics

- Numerical model output for years 2007-2008
- Speed and power production at heights of 60 m and 80 m
  - Horizontal resolution at 1 km
- Time series of wind speed and power production
  - 10-minute for wind speed
  - 10-minute, one minute, and two second for power production

Validation Analysis

- Annual wind speed
- Diurnal wind speed and power production
- Wind ramp characteristics
- One minute and two second power production data

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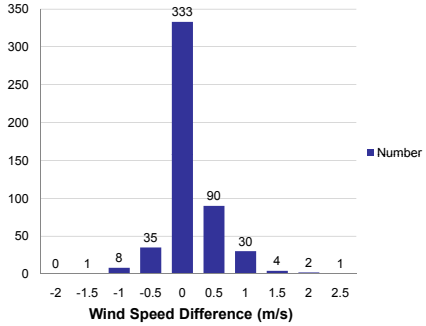
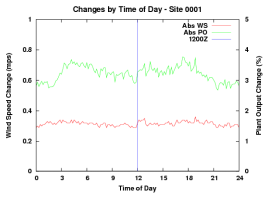
Annual Wind Speed Validation (80 m height)

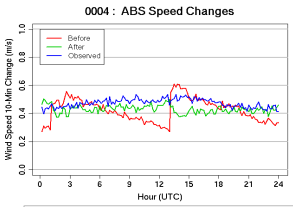
Histogram of Model Speed minus Validated Hawaii Wind Resource Map Wind Speed (grid points)

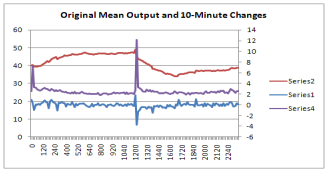


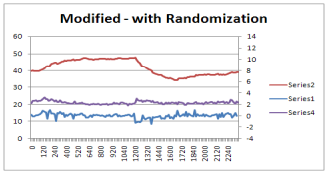
Diurnal Validation- Speed and Power Changes

Identified artificial speed and power production change patterns in original data set. AWS Truewind modified time series data to eliminate discontinuities.

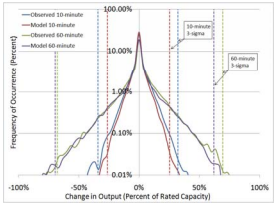


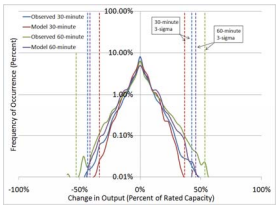


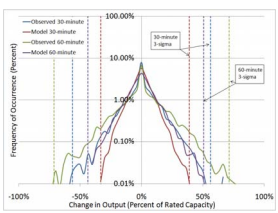




Wind Ramp Analysis



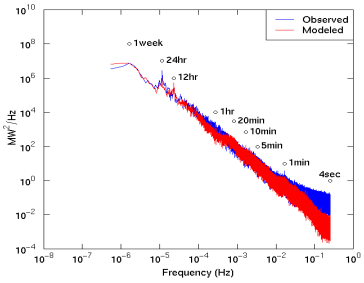




Model data agreed fairly well with observed variability at two Hawaii wind plants. Third wind plant had more variability than model data.

Power Spectral Density Analysis

- Validated high frequency data

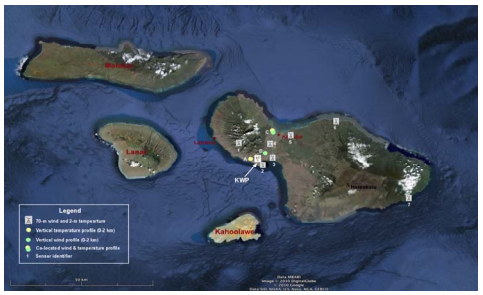


Hawaii Forecasting Activity

AWS Truewind analyzed wind ramp events in Maui and Hawaii (Big Island) wind farms

- Ensemble Sensitivity Analysis (ESA)
  - identified measurements needed to improve 0-6 hour ramp forecasts
- Analysis of meteorological factors associated with wind ramps
  - low-level jets
  - mixing of winds from aloft
  - passage of rain showers
  - terrain induced small-scale flows

Monitoring Stations on Maui



AWS Truewind has proposed these monitoring station types and locations based on meteorological analysis and ESA results.

Conclusions

Hawaii model data is a valid tool for integration studies

AWS Truewind data accurately depicts basic wind resource characteristics

- Seasonal patterns and geographic distribution

Data set was used for the Oahu Wind Integration and Transmission Study

Plans to place public version of data set available in the future

Wind speed data set at individual grid points will be made publicly available on web

PIX # 14703

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