Use of Real Time PV Plant Output Data for Solar Forecasting

ESIG Forecasting Workshop 2018

21 June 2018

Dr. Nick Engerer

A solar forecasting R&D project with DNSPs

DNSP = Distribution Network Service Provider

Oversight by Australian Energy Regulator (AER)

Responsible for ensuring quality & quantity of supply (frequency and voltage) in LV

Required to publish public planning reports, apply for expenditure for upgrades, etc

Future role ?: Enable the DSO future (e.g. UK model?)

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R&D project creating valuable IP outputs

Innovative Commercialisation Model

- ANU Applied R&D team (postdocs, developers, students) creating IP
- Staged commercialisation of IP into Solcast over course of three-year project
- **Outcome:** Return on investment to University for future research projects
- **Outcome:** Continued availability of project tools to DNSP project partners beyond the project lifetime + real-time support for tools

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DNSPs are facing significant challenges

$4M Project, ARENA & Industry backed [2016-2019]

Australian Government
Australian Renewable Energy Agency

ARENA

Deploying solar data tools to participating networks

Overall Objective: Enable higher penetrations of solar in Australian distribution networks

Current Focus: Discover use cases for high-resolution solar data services for LV network operations

End Goal: Integration of solar data with operations

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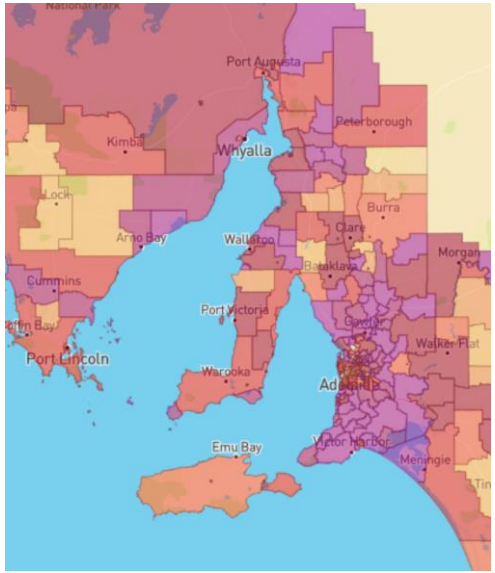
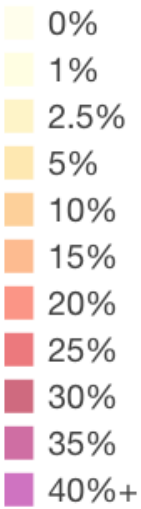
BtM Solar DER Penetrations

6GW in 2017 + extra 5-6GW by 2020 w/ +3GW Large in Solar in 2018

25% rooftop penetration levels headed for 35-45%





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OBJECTIVE: Solar PV Visibility

LV Network Mapping of Solar Actuals + Forecasts

Distributed PV metadata gathered & tagged by distribution network asset

We use satellite based estimates of PV power output to:

Partnered with 12 DNSPs

1) generate rapid-update forecasts of their power outputs

2) build database of historical PV estimated actuals

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Solar data services:

Forecasting – minutes, hours, days ahead

Estimated Actuals – historical data

Global & live coverage, 0-7 days, powered by 3rd generation weather satellites

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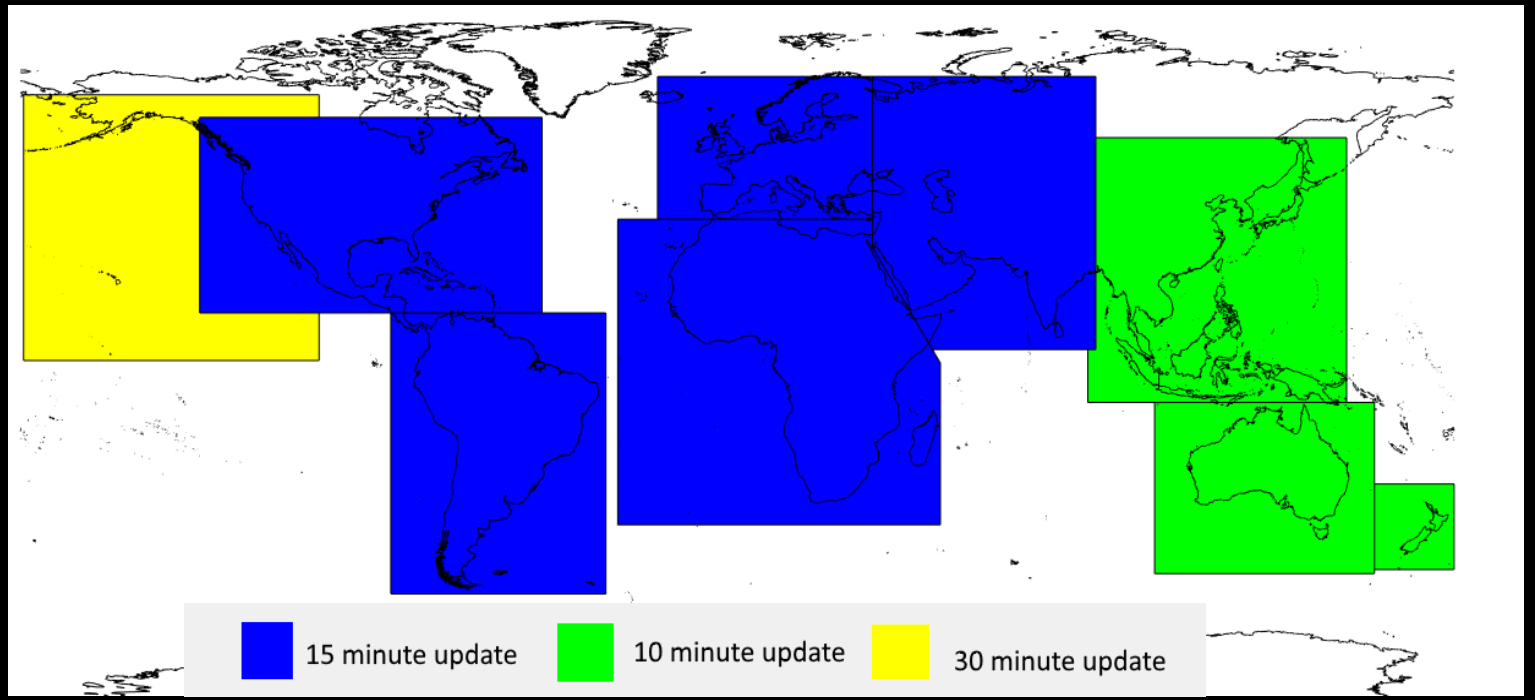

Globally Accessible Solar Data Services via API

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Tuned PV Power – individualized forecasts for PV systems of any size

Aggregations –regional or network based rooftop solar totals

Solar Farms – including very high-resolution, minutes ahead

Weather Data – radiation & cloud cover

Infrastructure and **24/7 Support**

python C#.net Microsoft

Server Libraries

ServiceStack Redis OrmLite

Databases and NoSQL Datastores

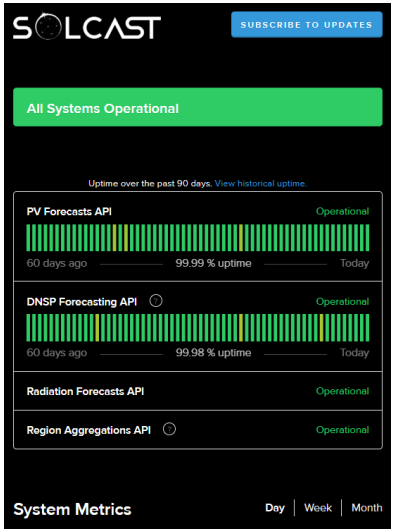
redis Amazon RDS PostgreSQL

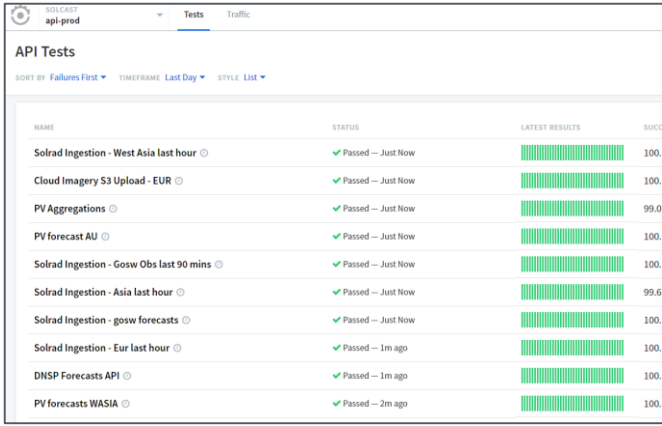
Server Software

docker

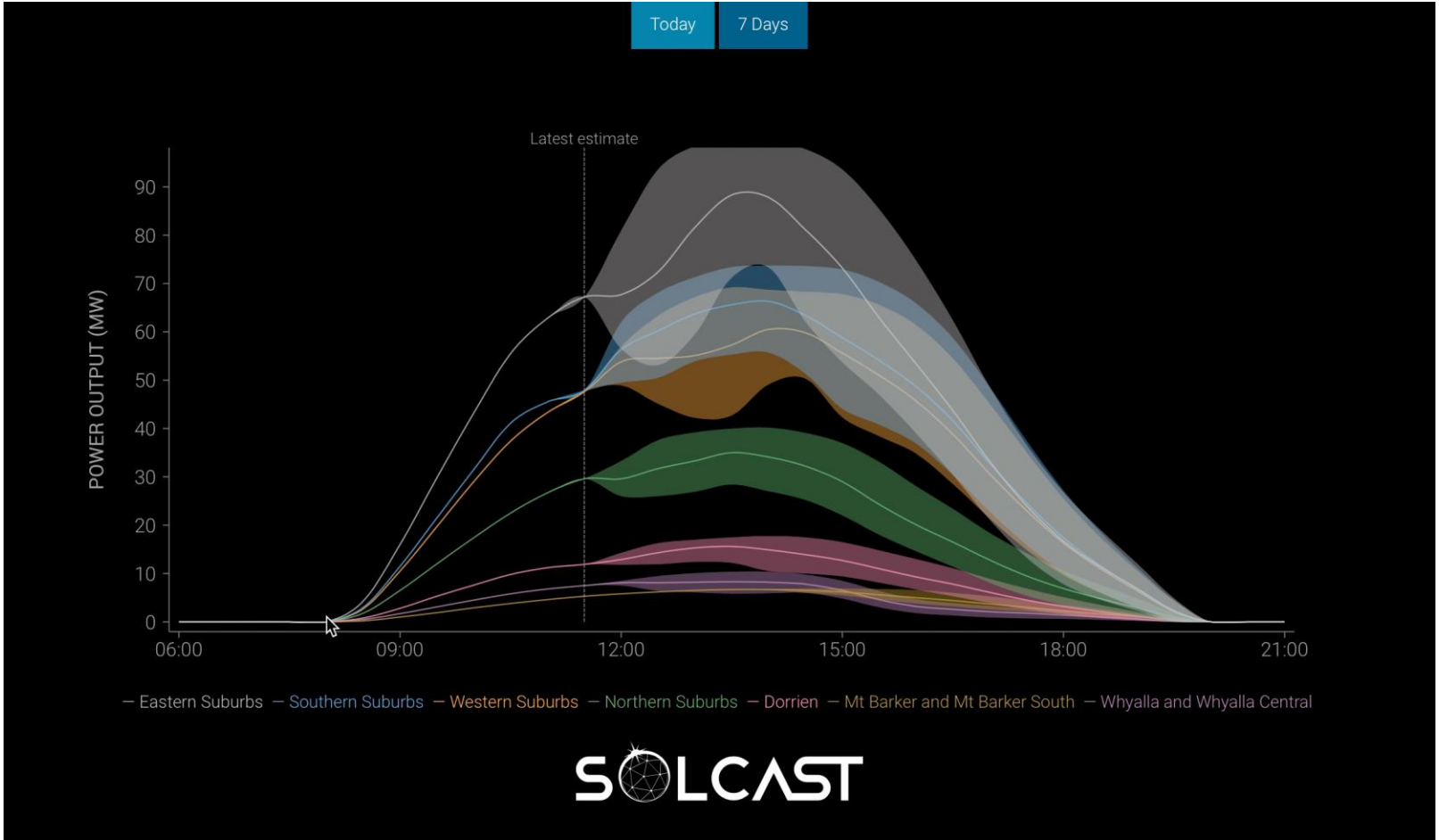
Cloud/Hardware Infastructure

powered by amazon web services™ amazon cloudfront amazon web services ROUTE 53 amazon web services™ S3





Solar PV at SA Connection Points



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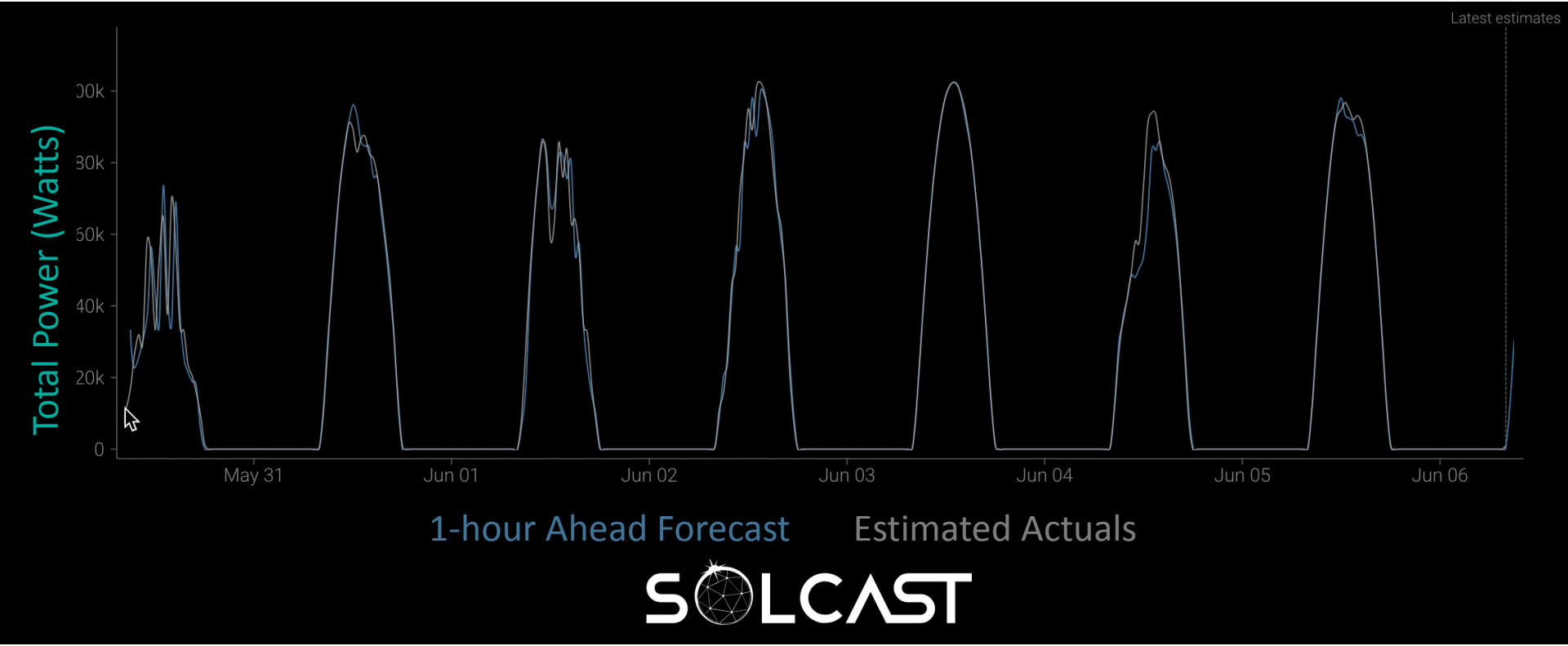
Eastern Suburbs (Accuracy)



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Zone Substation API for DNSPs

Snapshot of GetZoneSubstationForecast generated by ServiceStack
on 06/05/2018 22:34:23

view json datasource **from original url:**
https://api.solcast.com.au/distributors/sa_power_networks/zonesubstations/mount_barker_distribution/forecasts? **in other formats:** json xml csv jsv

Forecasts

Pv_estimate	Pv_estimate90	Pv_estimate10	Period_end	Period
902623.137985001	915631.003988286	854486.357740224	2018-06-05T23:00:00.0000000Z	PT30M
1571395.69776837	1572765.7184825	1499193.90305518	2018-06-05T23:30:00.0000000Z	PT30M
2201021.86958839	2206271.3950373	2098086.56980924	2018-06-06T00:00:00.0000000Z	PT30M
2730148.95613698	2753495.35190024	2582755.76286785	2018-06-06T00:30:00.0000000Z	PT30M
3125739.58626622	3208844.65630242	2917868.13057253	2018-06-06T01:00:00.0000000Z	PT30M
3417480.03306914	3563844.93793523	3064577.23499572	2018-06-06T01:30:00.0000000Z	PT30M
3580087.16622322	3817708.08163973	3114208.29852078	2018-06-06T02:00:00.0000000Z	PT30M

probabilistic forecast fields (W)

All DNSP zone substations have a forecast & estimated actuals

Total installed PV behind each substation is modelled based on Solcast cloud/radiation data

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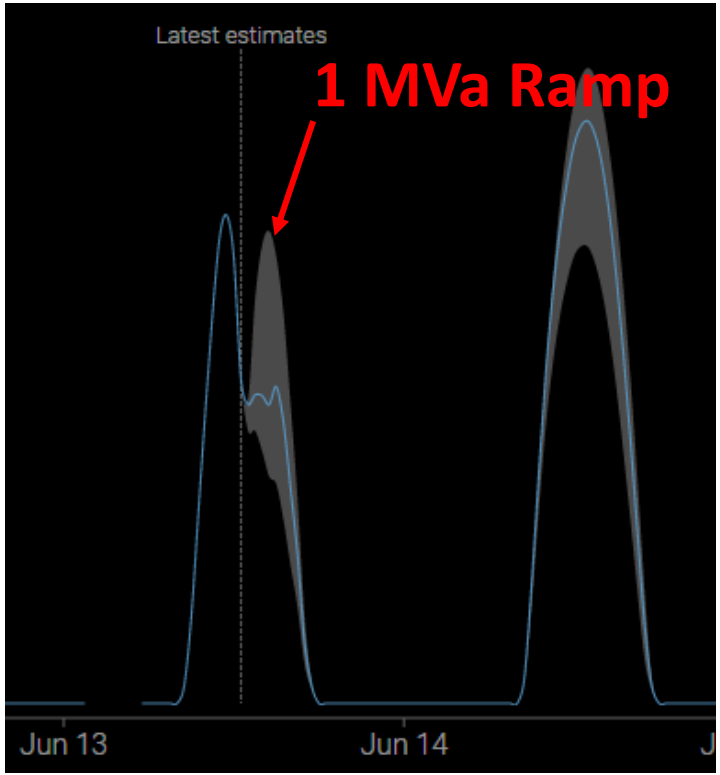
Mt Barker – Ramp Event (example)



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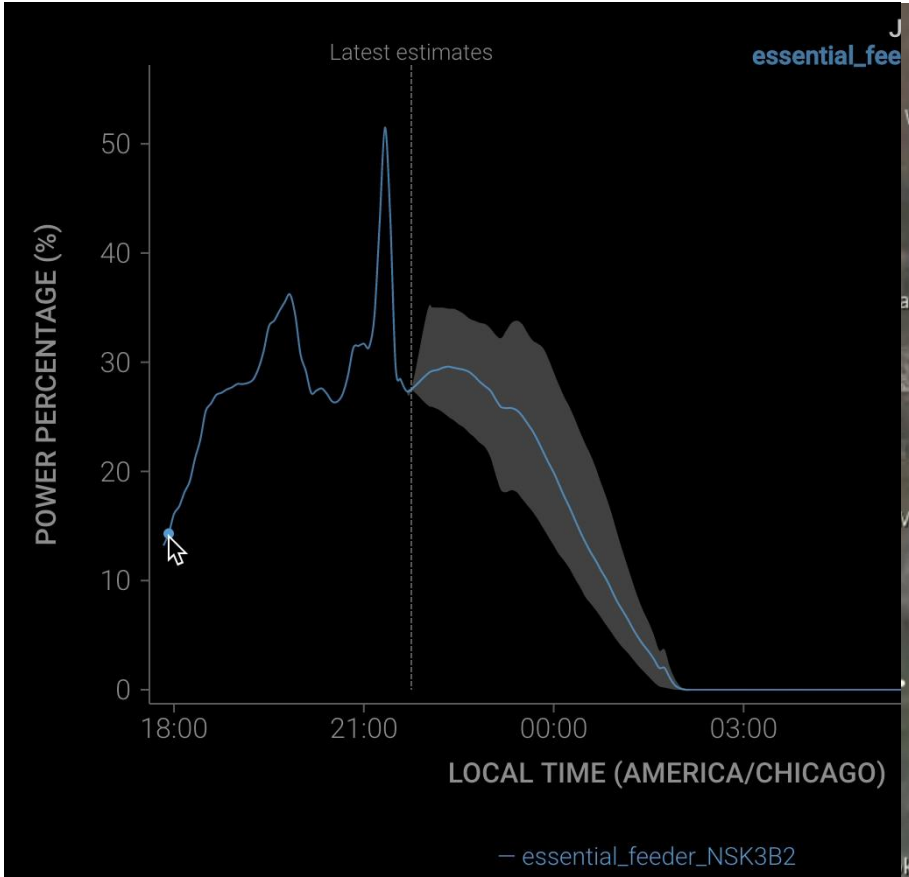
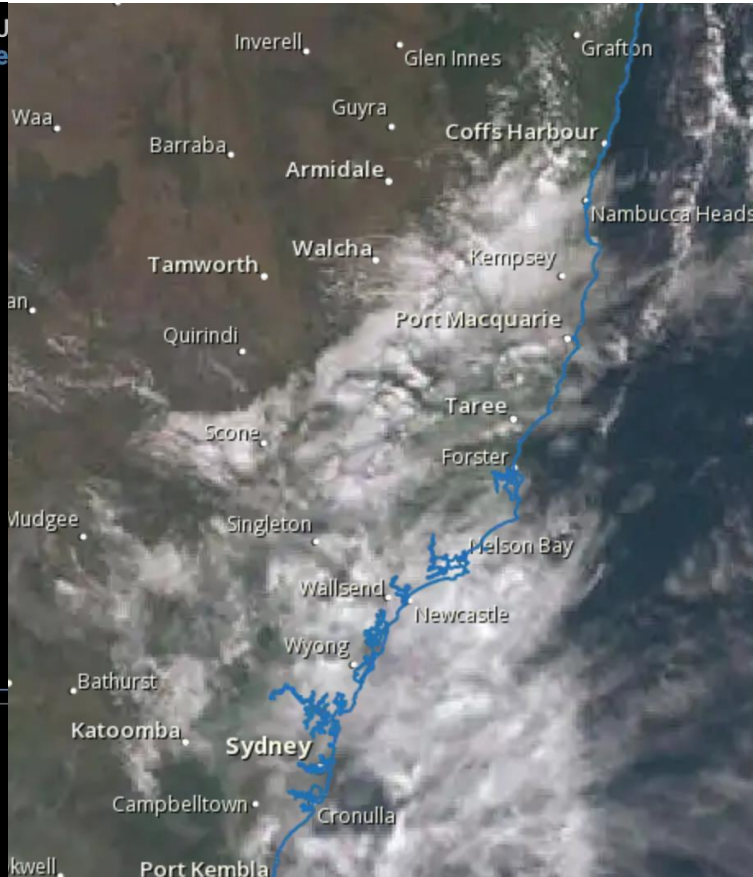
Feeders – 5-minute resolution data





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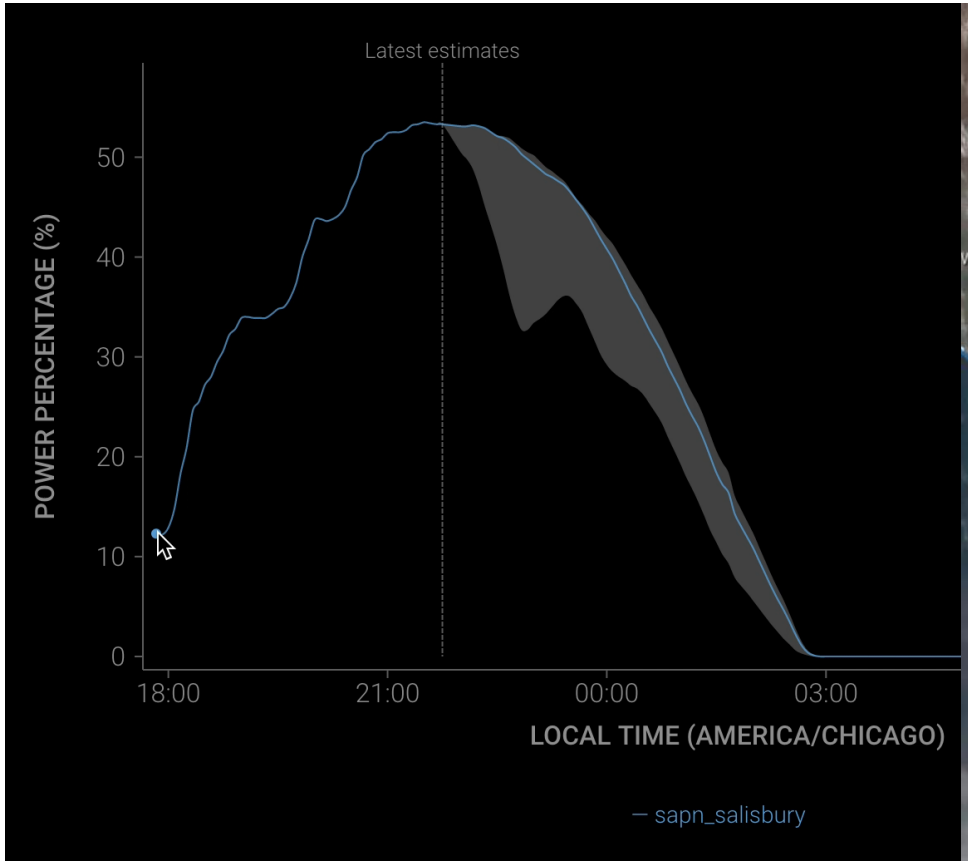
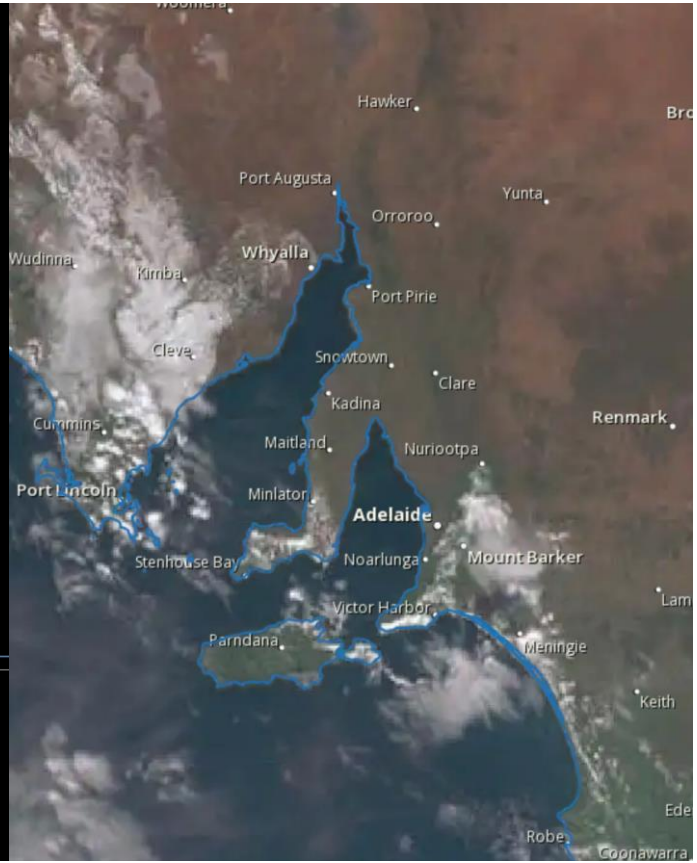
South Australia VPP – 5-minute resolution data





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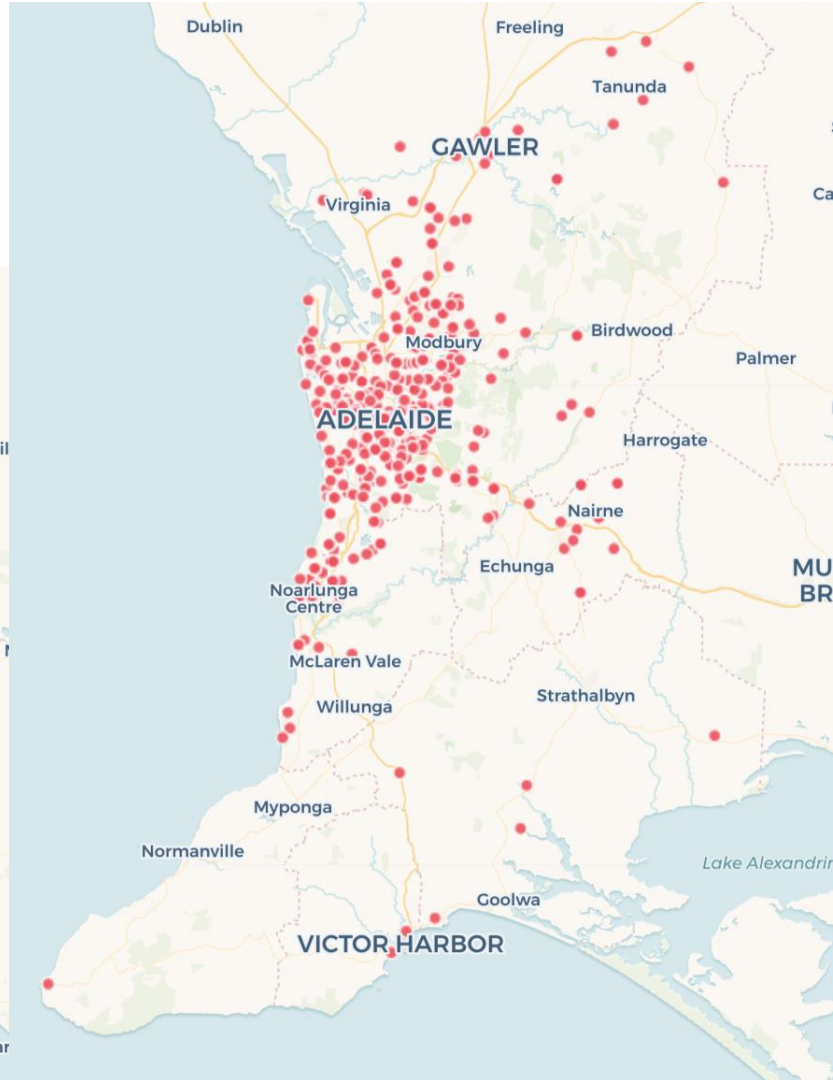
SA Solar PV Actuals

Fronius (+ others soon)

Fronius inverter data: 100 sites

300+ sites PVOutput.org

Scale to 3,000+



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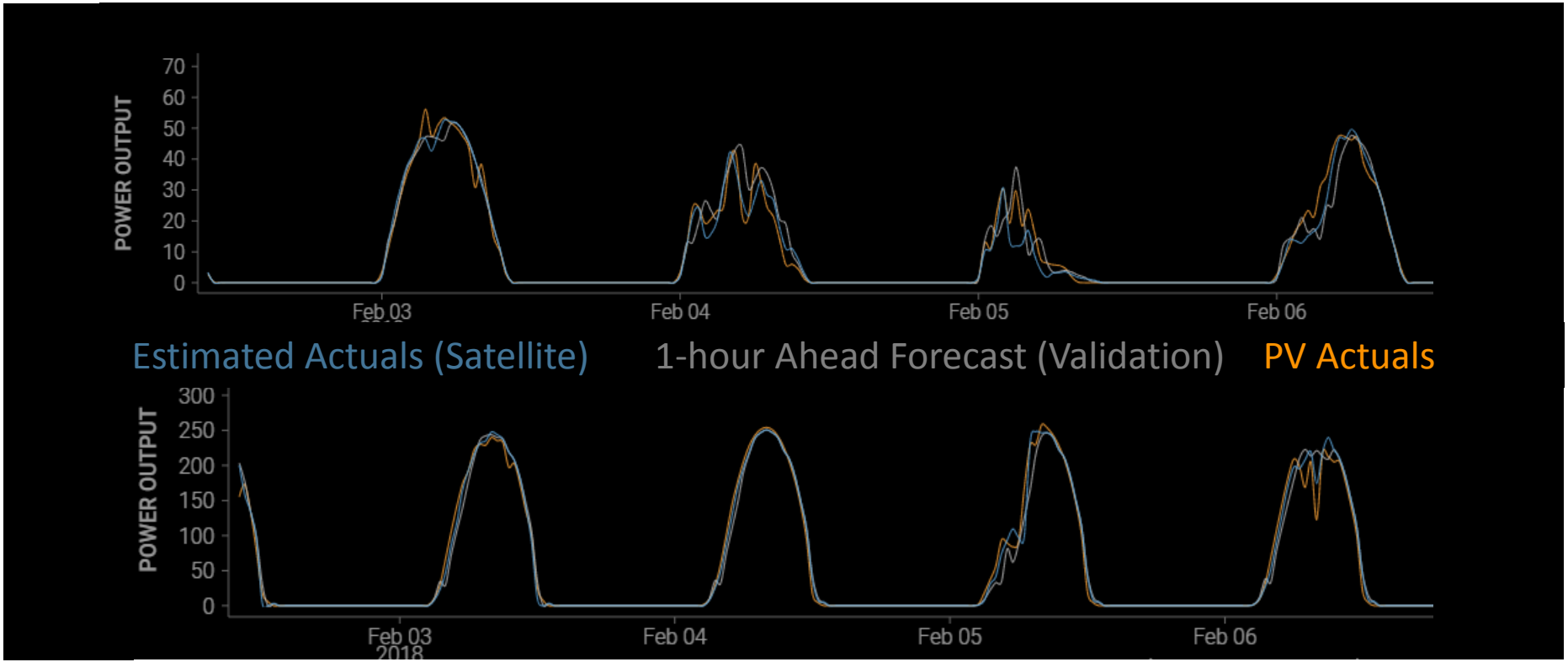
PV Actuals = visibility & validation



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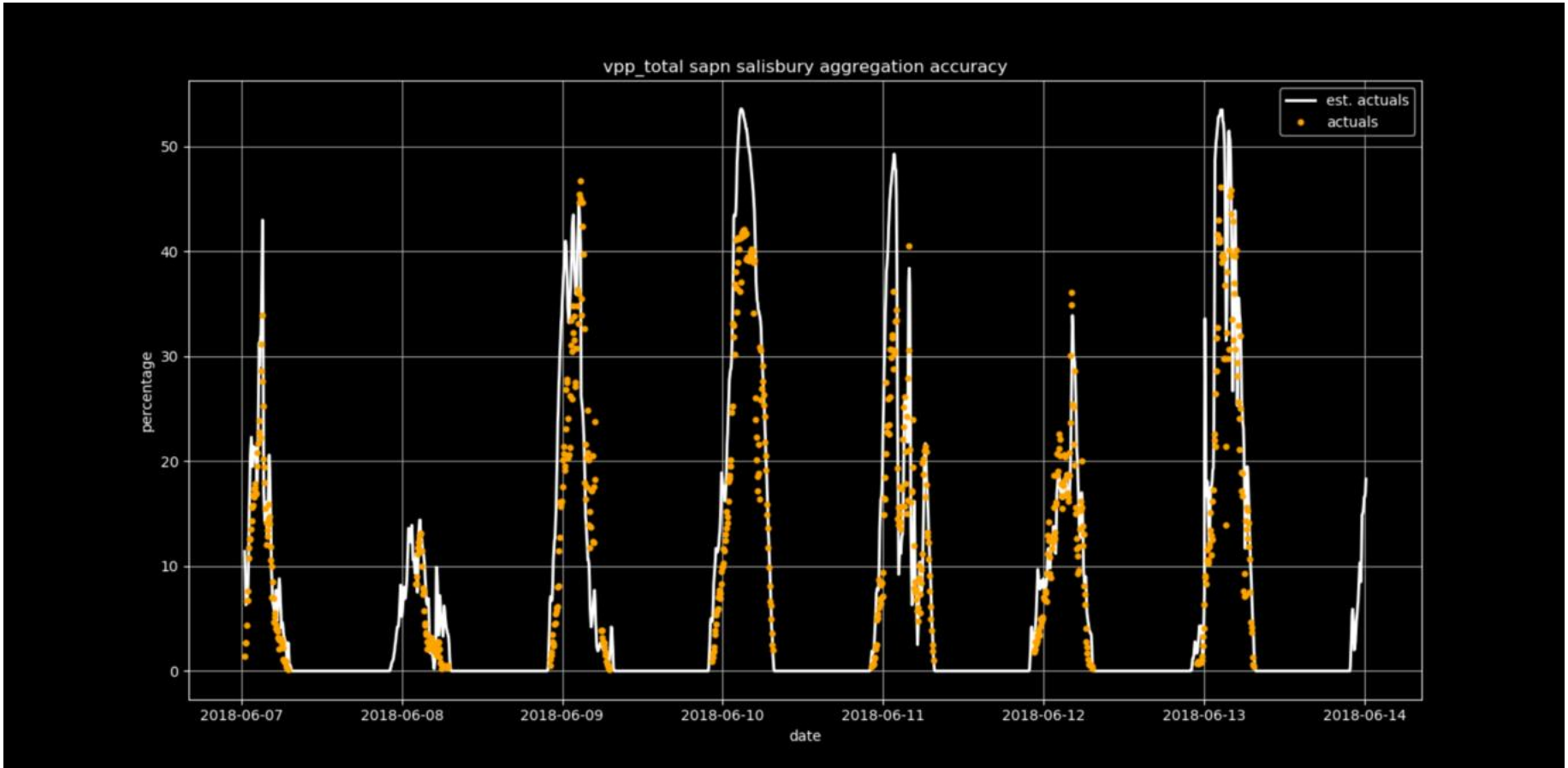
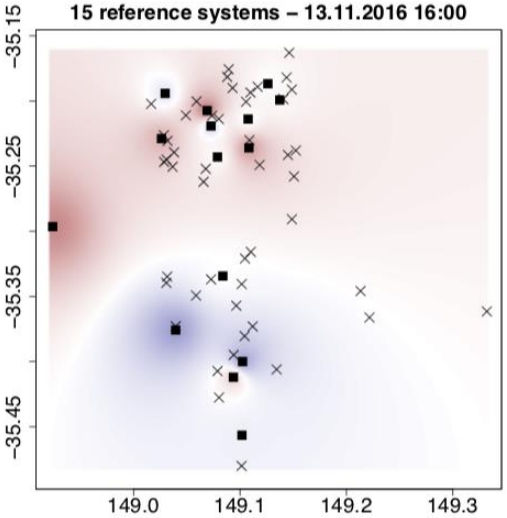
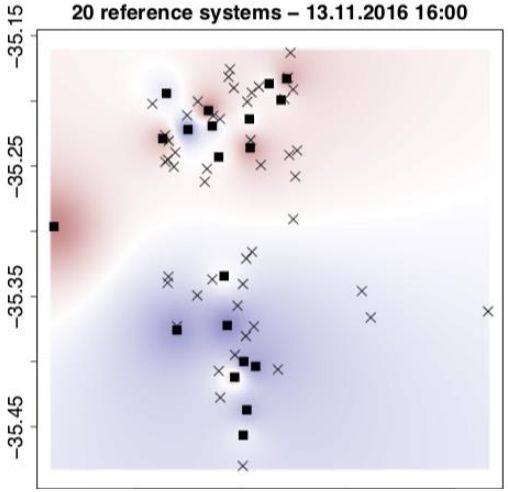
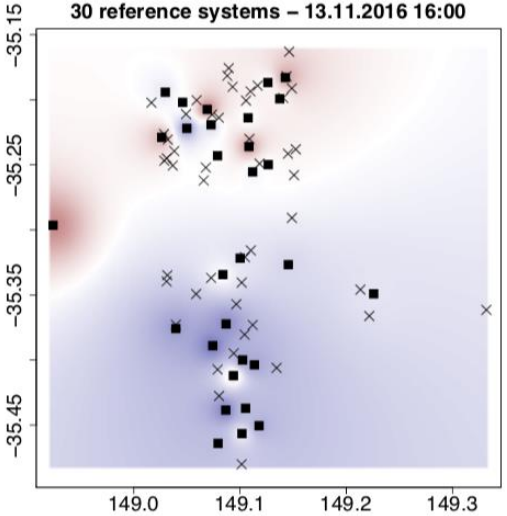
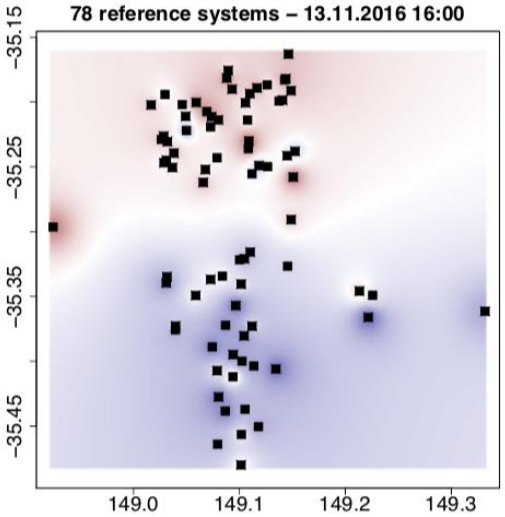
PV Actuals VPP Validation

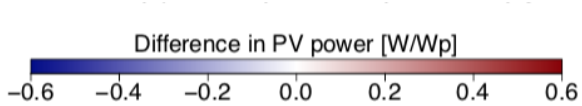












■ = Reference site

X = Validation site

Increasing # of PV Actuals “Reference Systems” + Satellite data = improved resolution in nowcasts

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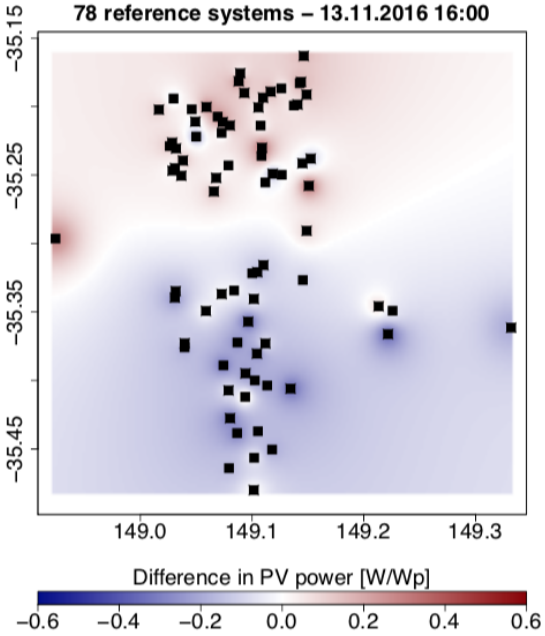
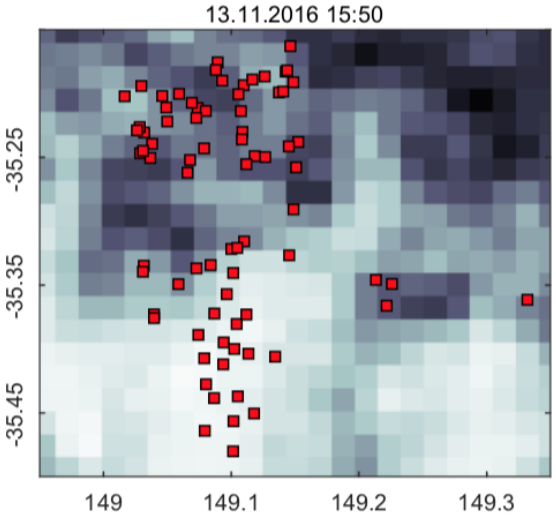
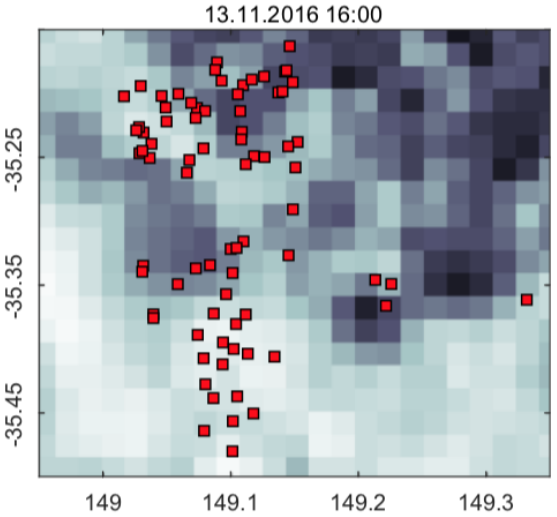
Fronius (+ others soon)

Utilising PV Actuals in Forecasts







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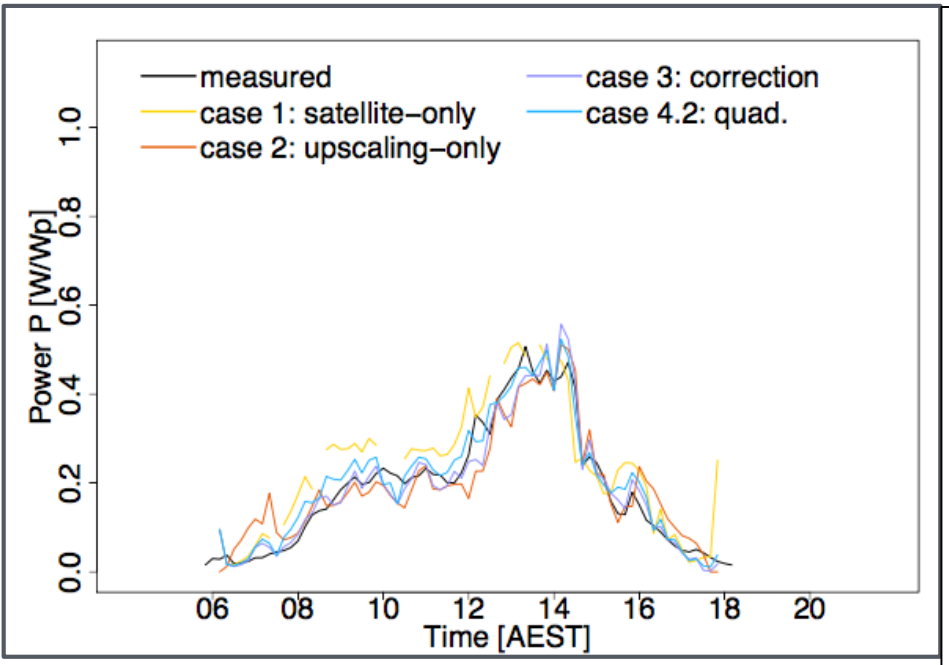
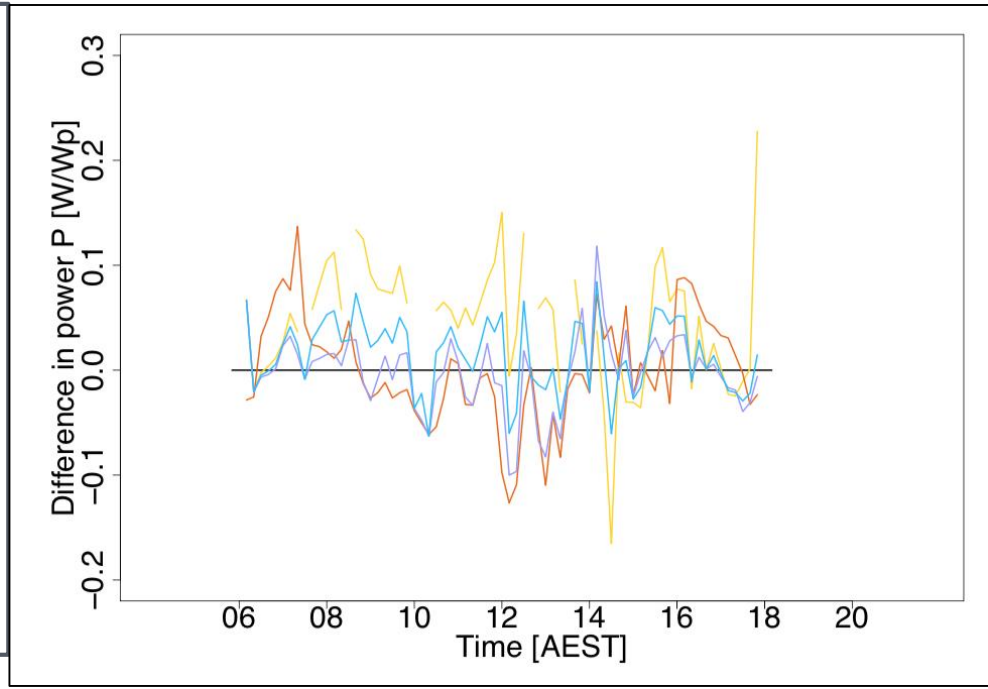
Satellites Nowcasting + PV Actuals = Improve





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Thanks for your attention!

- I want you to see **“Intermittency as Opportunity”** for energy storage + VPPs, demand management, smart inverters

- Our team is making our API & data + tools available to collaborators (**teaming up for the solar-powered future**) so sign up -> http://solcast.com.au/api

- Let’s connect! ->

Dr. Nick Engerer
@nickengerer