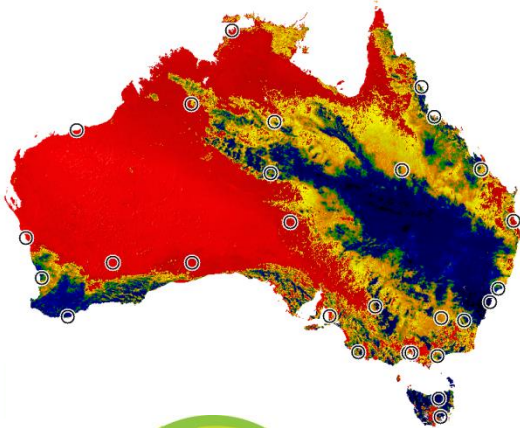# Real time solar and coincident weather data
for solar deployment and building optimisation and energy management

Trevor Lee
Director, Buildings

Grant Edwards PhD
Department of Environment and Geography, MQ

Real time solar and coincident weather data for solar deployment and building optimisation

The Australian Solar and Climate Resource

● **Australian Solar Radiation Data Handbook background and applications**

Beyond TMY: Typical Meteorological Year

Climate Data for Specific Applications

● **Australian Climate Data Bank and**

● **using Reference Meteorological Years (RMY)**

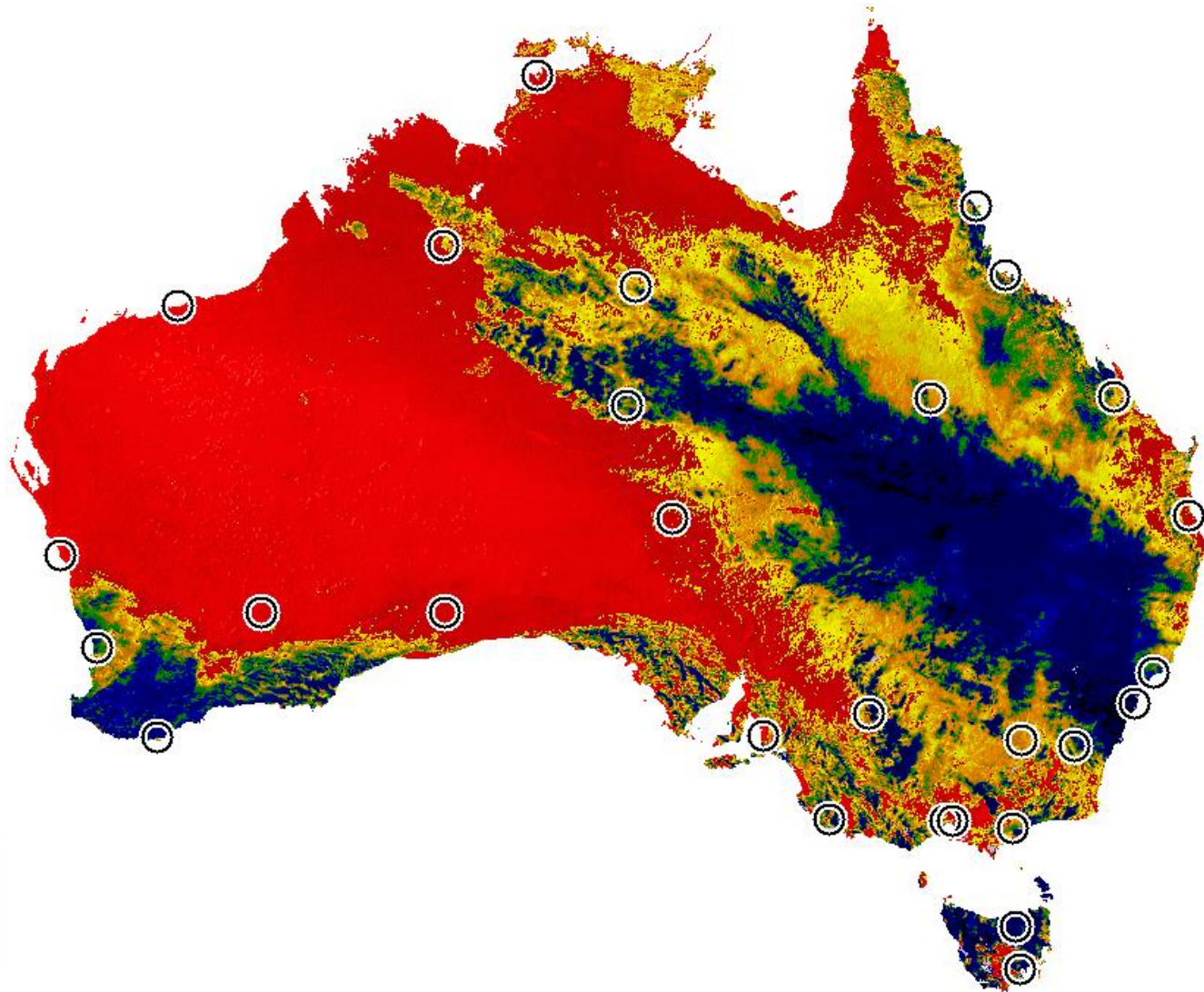## Creation of Ersatz Future Weather Data Files

● **Measuring energy performance of buildings under projected future weather conditions**

Team members: Zhong Ran "Talent" Deng and Chun Yin Wu
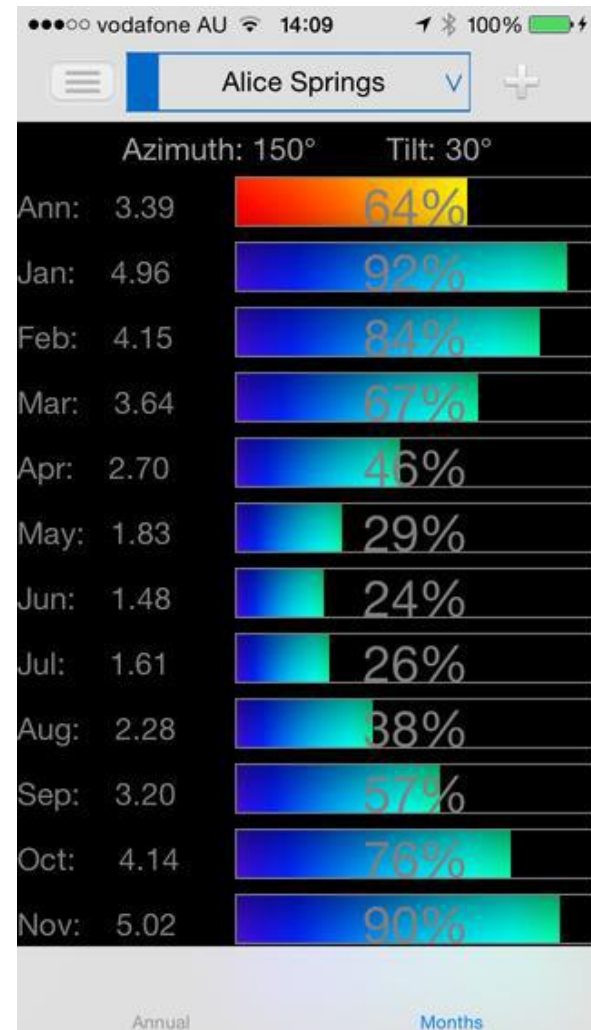Adelaide Applied Algebra, Global Sustainable Energy Solutions

Beyond TMY: Climate Data for Specific Applications
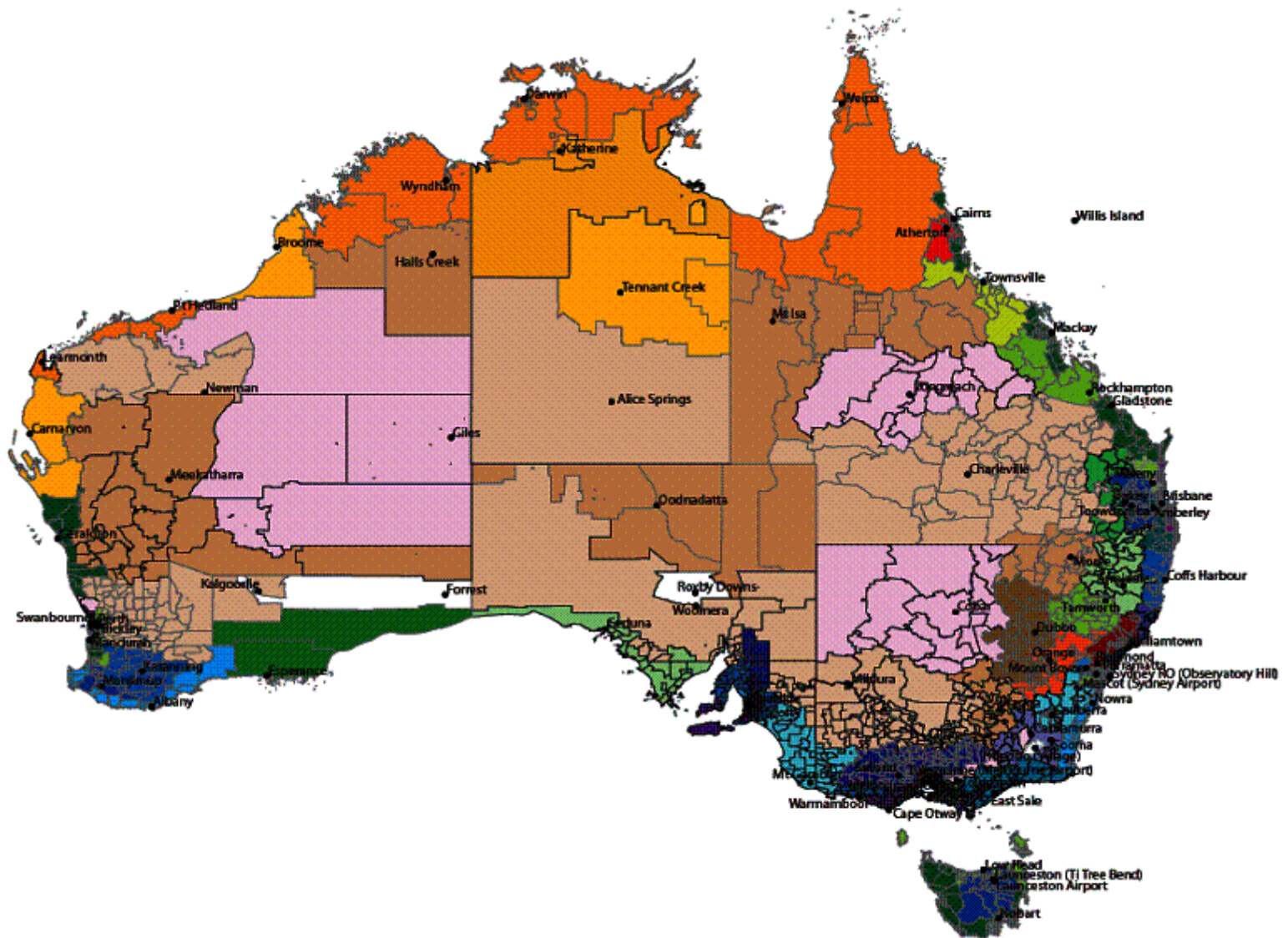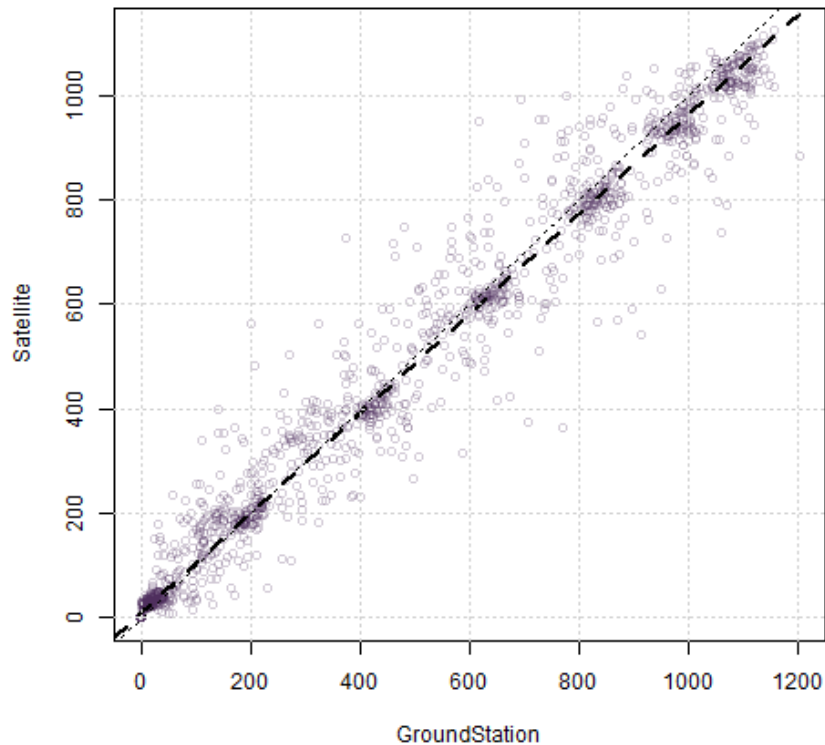
Weather Data - satellite measurement
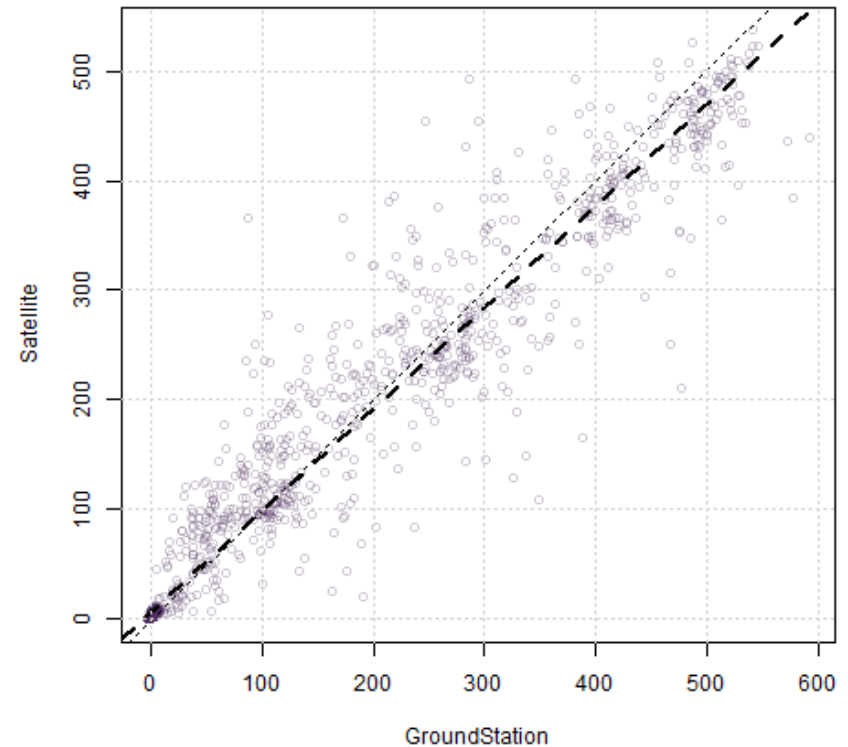
Weather Data - satellite measurement

Weather Data - satellite measurement

BlackMontain Satellite(bias corrected) VS Ground Station GHI
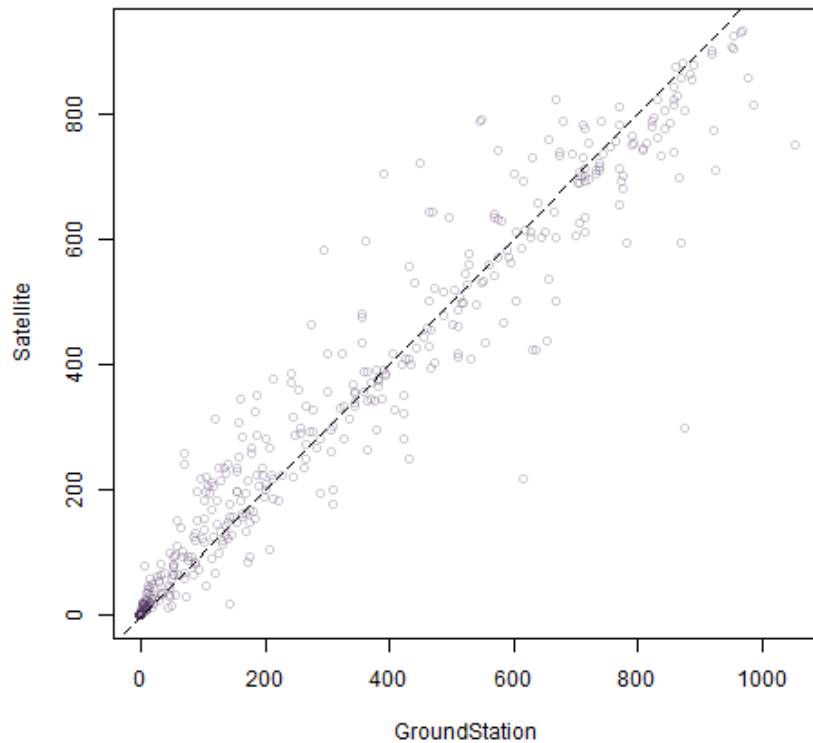All-December

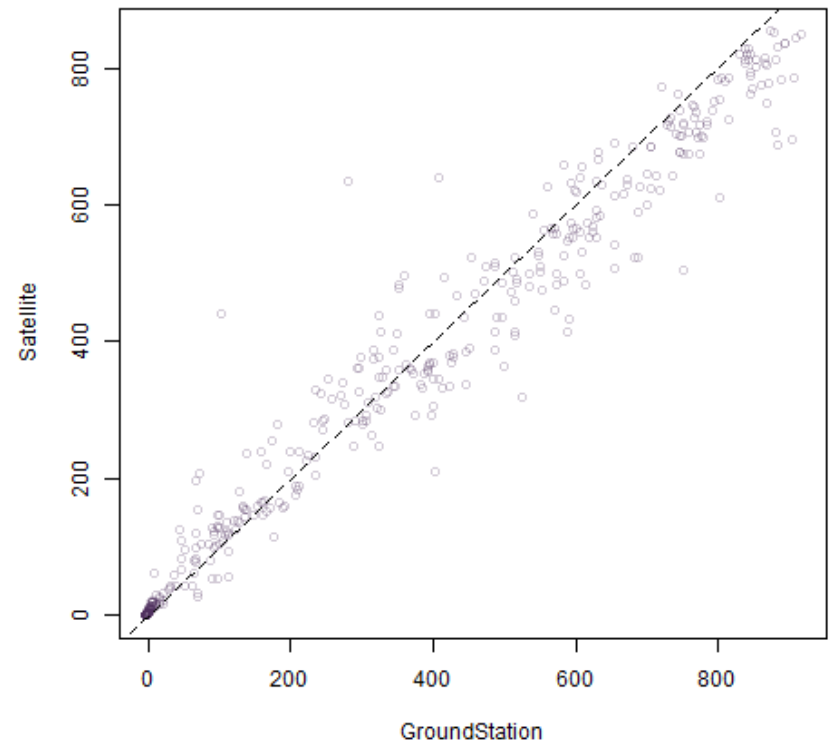BlackMontain Satellite(bias corrected) VS Ground Station GHI
All Junes

Weather Data - satellite measurement

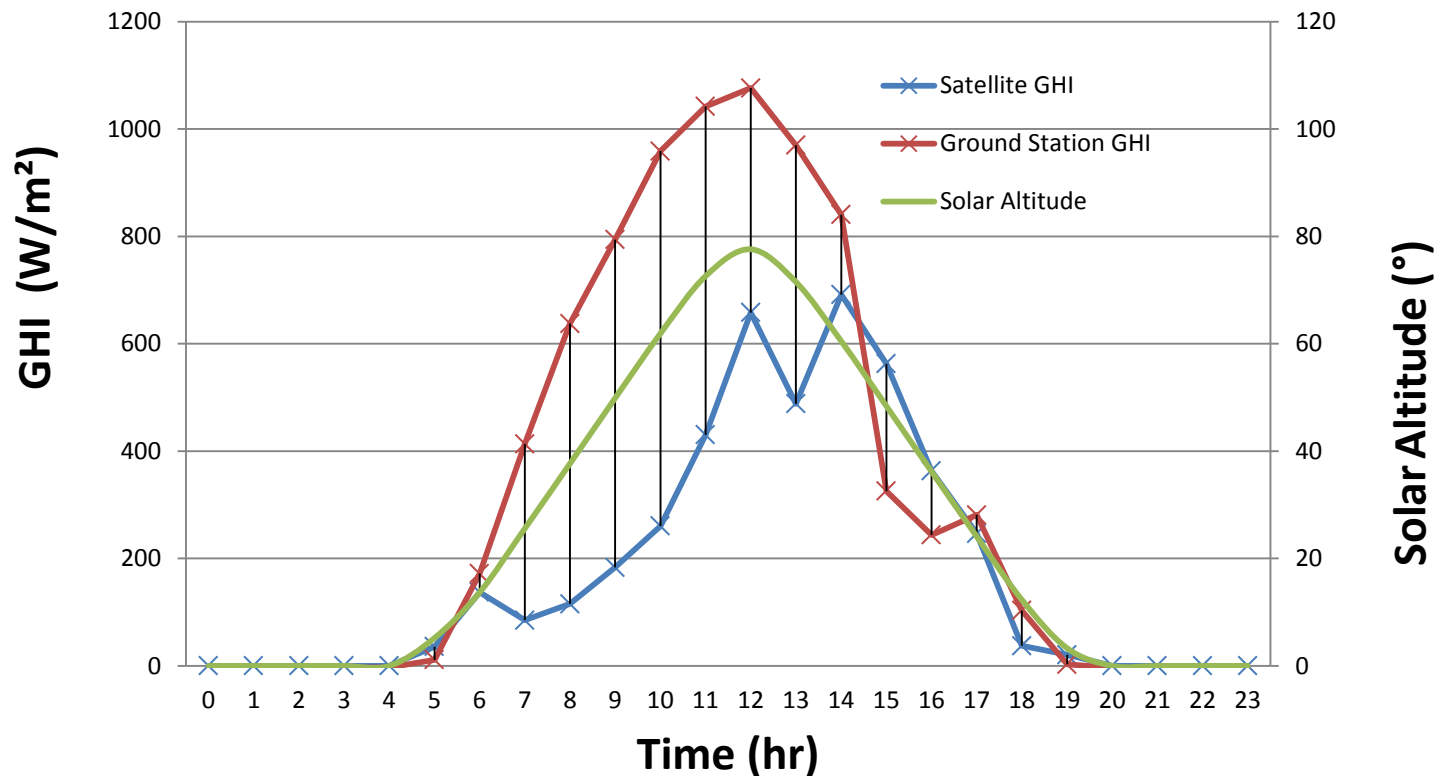Black Mountain Satellite(bias corrected) VS Ground Station GHI 2014-03

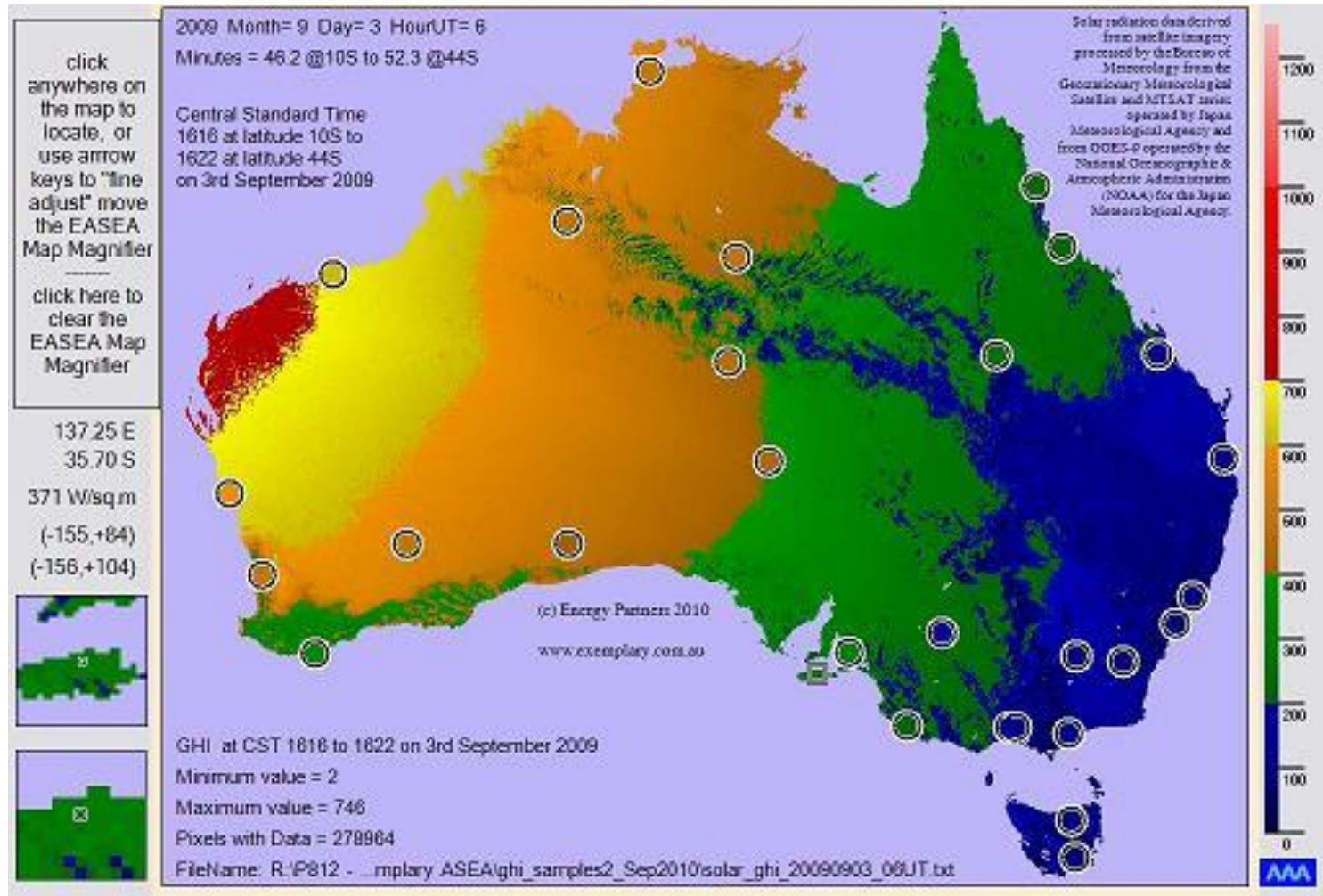Black Mountain Satellite(bias corrected) VS Ground Station GHI 2014-09

Weather Data - satellite measurement

Hourly GHI in Black Mountain Canberra 2014/12/11

Weather Data - satellite measurement

Exemplary Australian Solar Energy Atlas

Representative Extremes

eXtreme Meteorological Year (XMY) data sets still require full definition

### Examples include

- Performance during a hot, dry (El Niño) year

- Performance during a windy, wet (La Niña) year

- Amalgamation of 'hottest summer' with 'coldest winter' months

- Warmest months ever (changed warmer climate)

- Historical year with worst/best energy outcome

Real-time Data – Weather not Climate

- **Simulation Model Calibration**

- **Building or system monitoring**

- **Renewable energy system monitoring**

- **Measuring actual output or consumption in previous year or month relative to Reference Meteorological Year (RMY)**

    Real-time year-to-date data (RTY)

Macquarie University
Automatic Weather Station
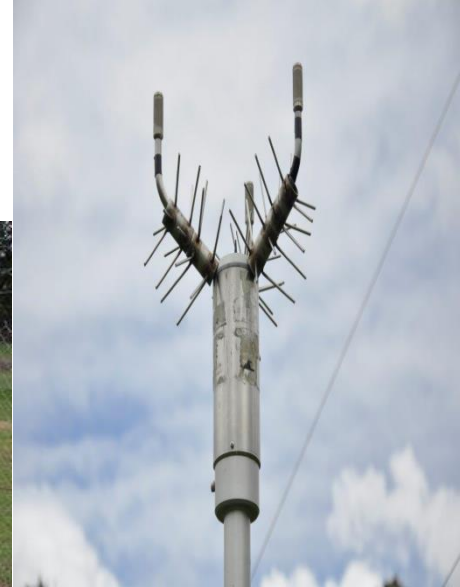
Exemplary Weather and Energy Index - Canberra

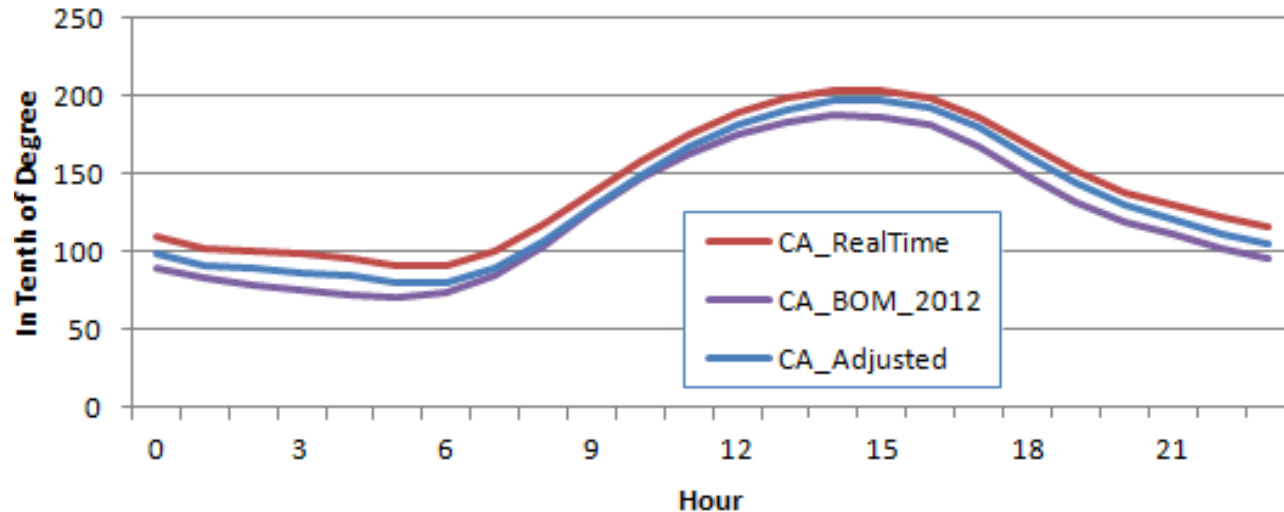CSIRO Black Mountain
Automatic Weather Station

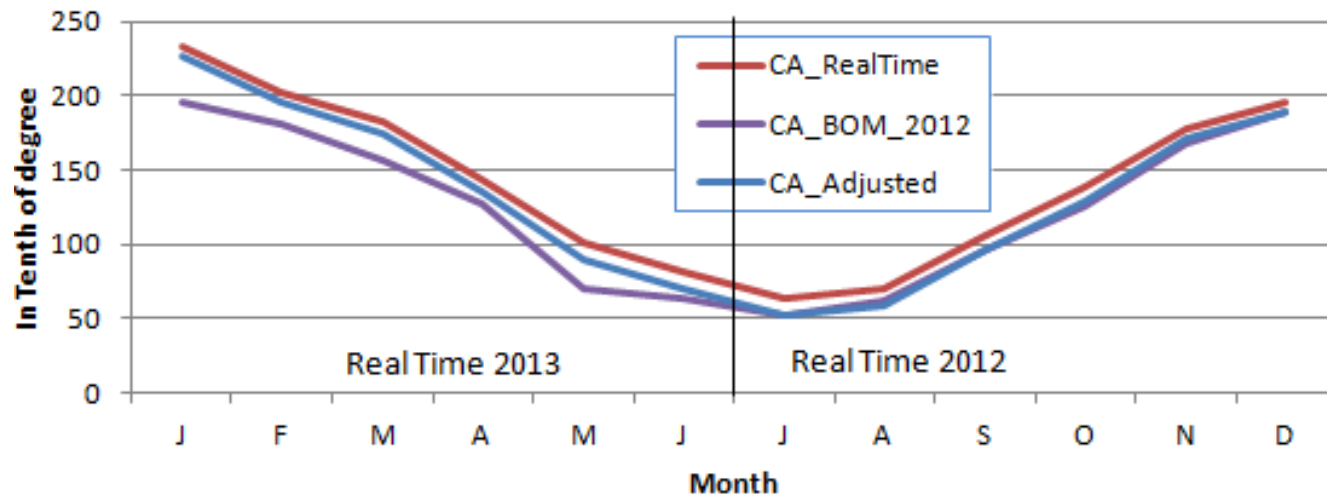# Exemplary Weather and Energy Index - Canberra

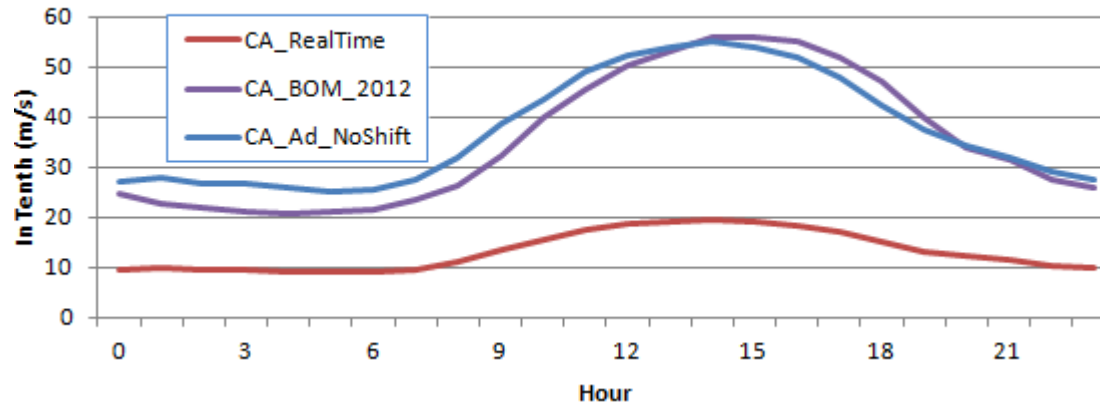# CSIRO Black Mountain AWS – Normalisation to CBR

Temperature (Hourly)

Temperature (Monthly)

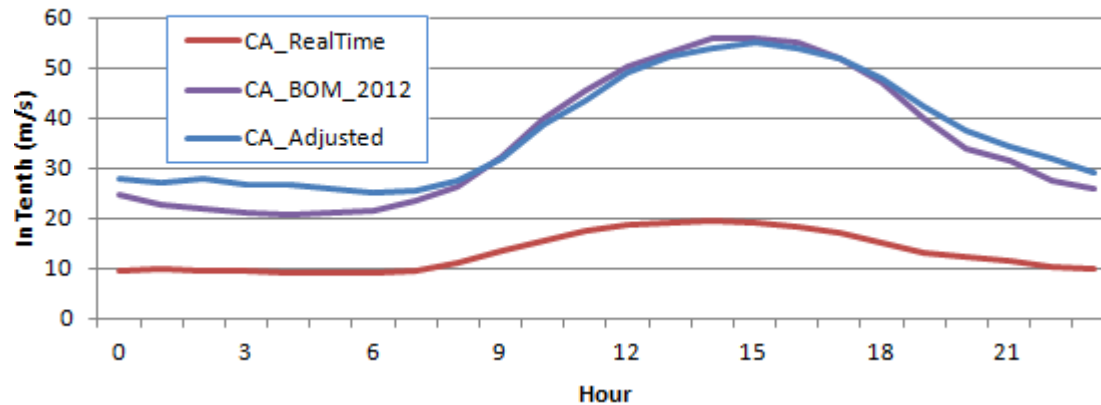# CSIRO Black Mountain AWS – Normalisation to CBR

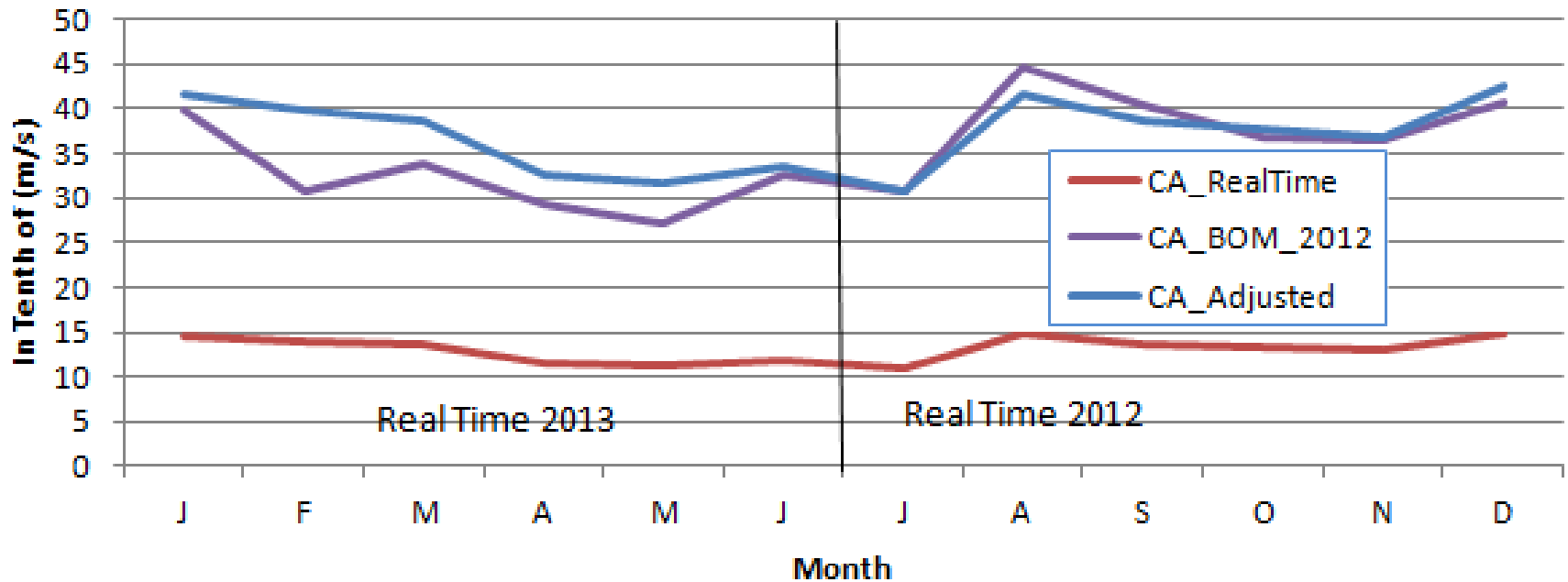# CSIRO Black Mountain AWS – Normalisation to CBR

Real-time Data – Weather vs Climate

Exemplary Weather and Energy Index

http://www.exemplary.com.au/EWE%20indices.php

- **Monthly Graphs** (last updated 14 May 2015)
  - Archetypical 10 storey office building
  - Archetypical 3 storey office building
  - Archetypical 1 storey supermarket building
  - Typical 3 kW domestic solar PV system
- **Canberra** (using CSIRO data)
- **Perth** (using Murdoch Uni data)
- **Sydney** (using Macquarie Uni data)

Exemplary Weather and Energy Index Canberra – 12 months actual v RMY

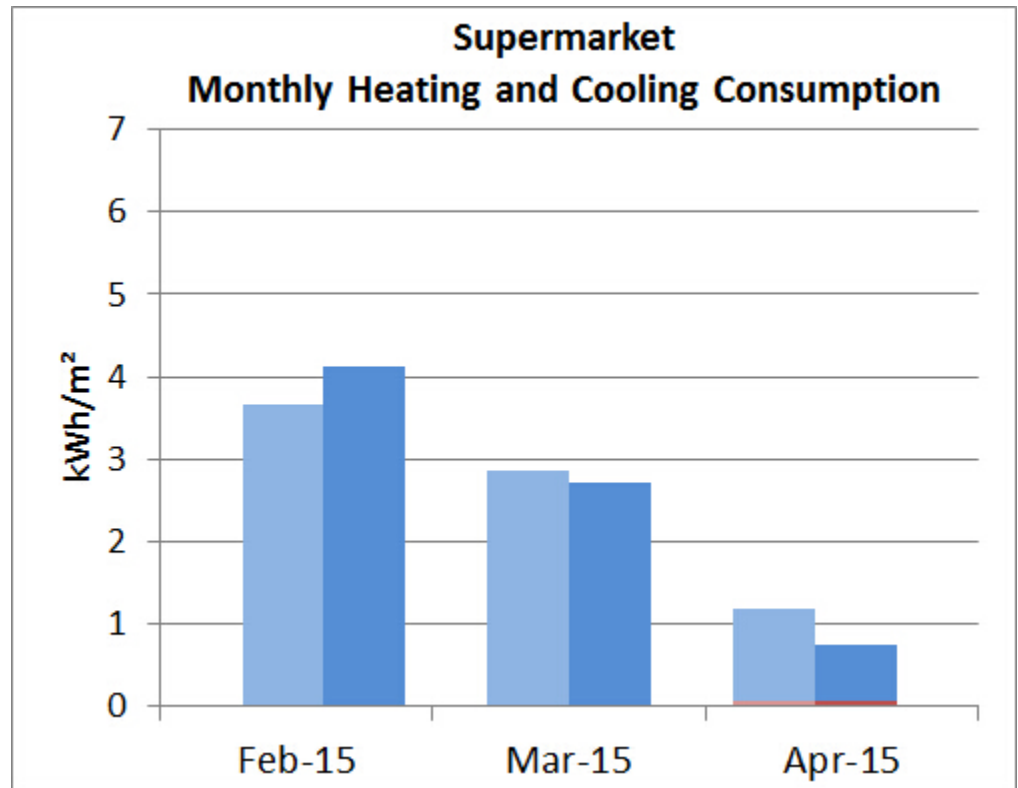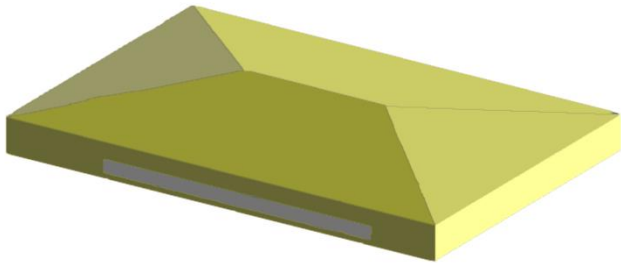| Weather Energy Index						
	10-storey Office		3-storey Office		Supermarket	
	Cooling	Heating	Cooling	Heating	Cooling	Heating
May-14	-5%	31%	-6%	31%	9%	19%
Jun-14	-16%	3%	-14%	6%	86%	-1%
Jul-14	14%	18%	13%	24%	N.A.	2%
Aug-14	-1%	33%	-5%	32%	1%	58%
Sep-14	2%	28%	0%	-100%	1%	-11%
Oct-14	10%	-22%	15%	-20%	90%	93%
Nov-14	15%	N.A.	20%	N.A.	49%	-73%
Dec-14	2%	N.A.	2%	N.A.	18%	-100%
Jan-15	-1%	N.A.	0%	N.A.	-7%	N.A.
Feb-15	6%	N.A.	6%	N.A.	12%	-100%
Mar-15	-4%	N.A.	-4%	N.A.	-6%	92%
Apr-15	-25%	33%	-25%	30%	-39%	6%

Exemplary Weather and Energy Index - Canberra
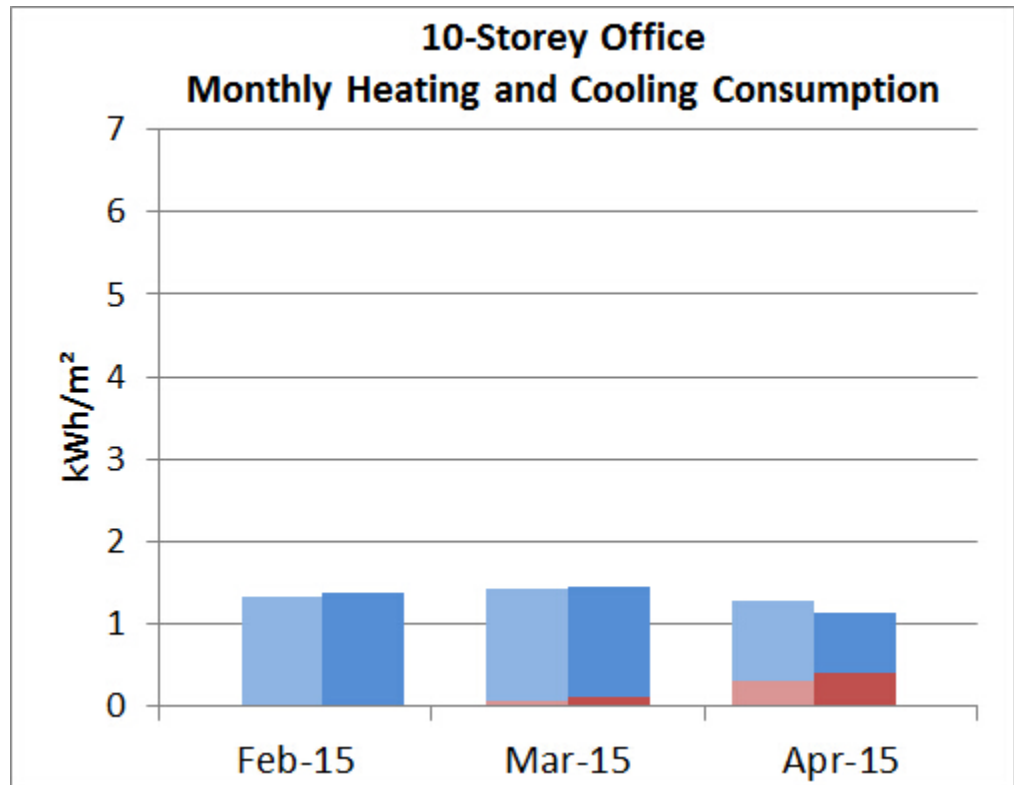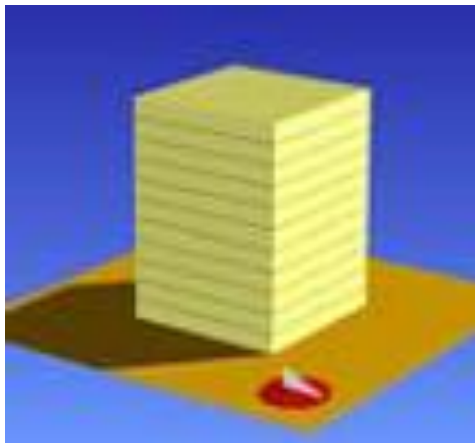
Exemplary Weather and Energy Index - Canberra
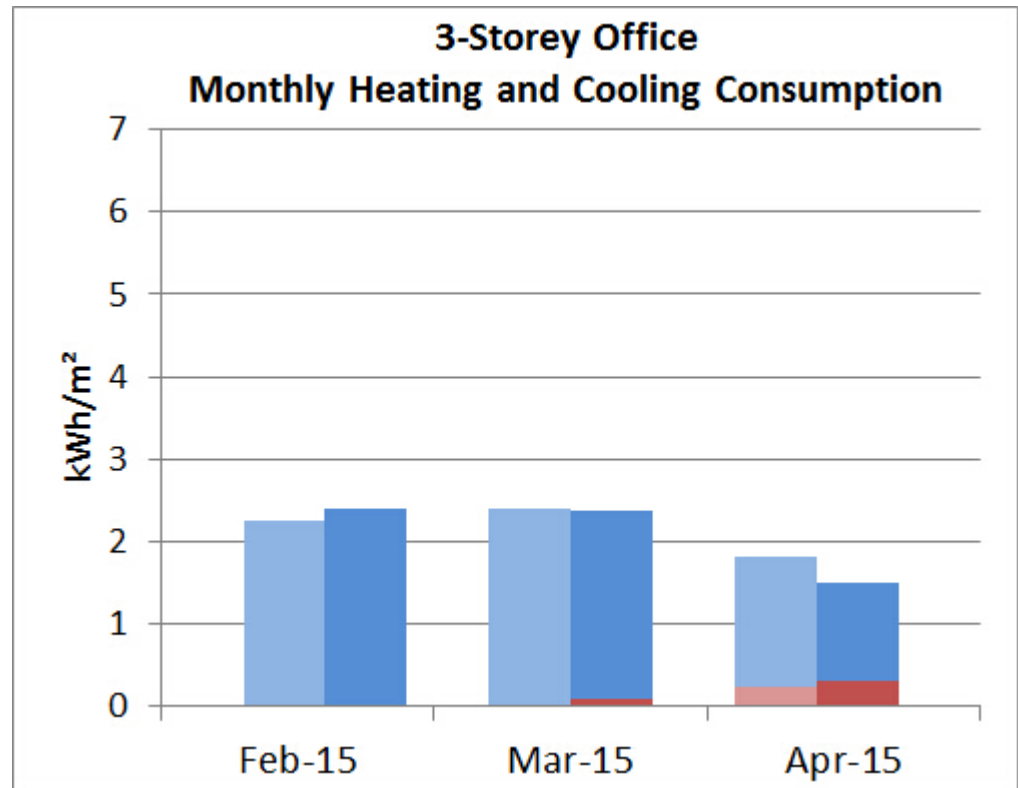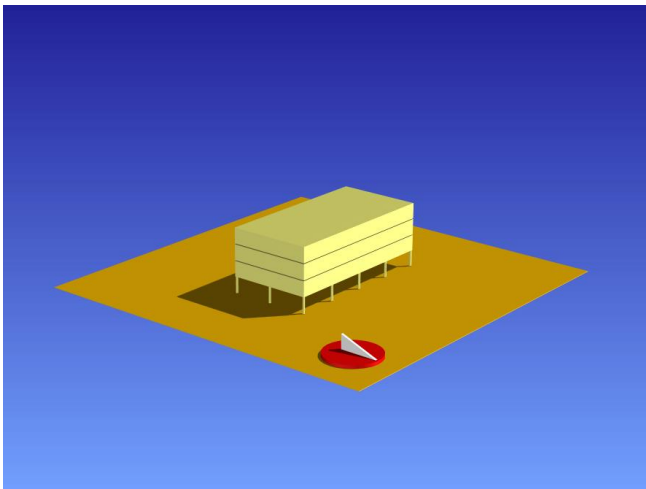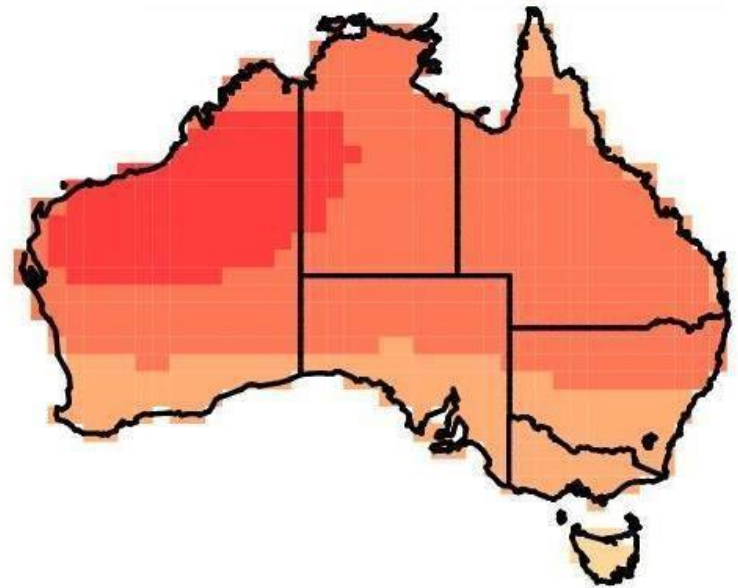
Exemplary Weather and Energy Index - Canberra

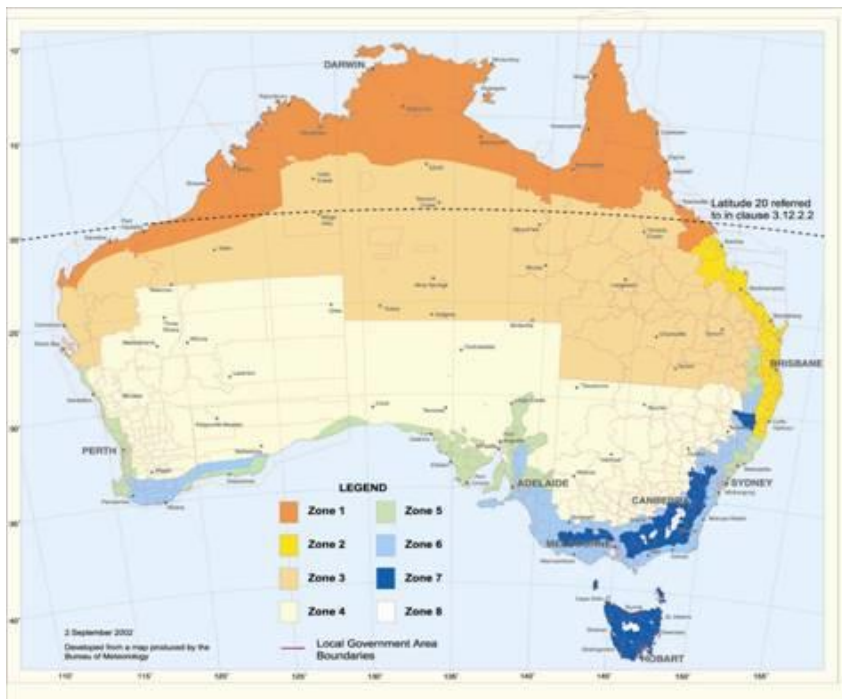# Exemplary Weather and Energy Index – Canberra PV

Creation of Ersatz
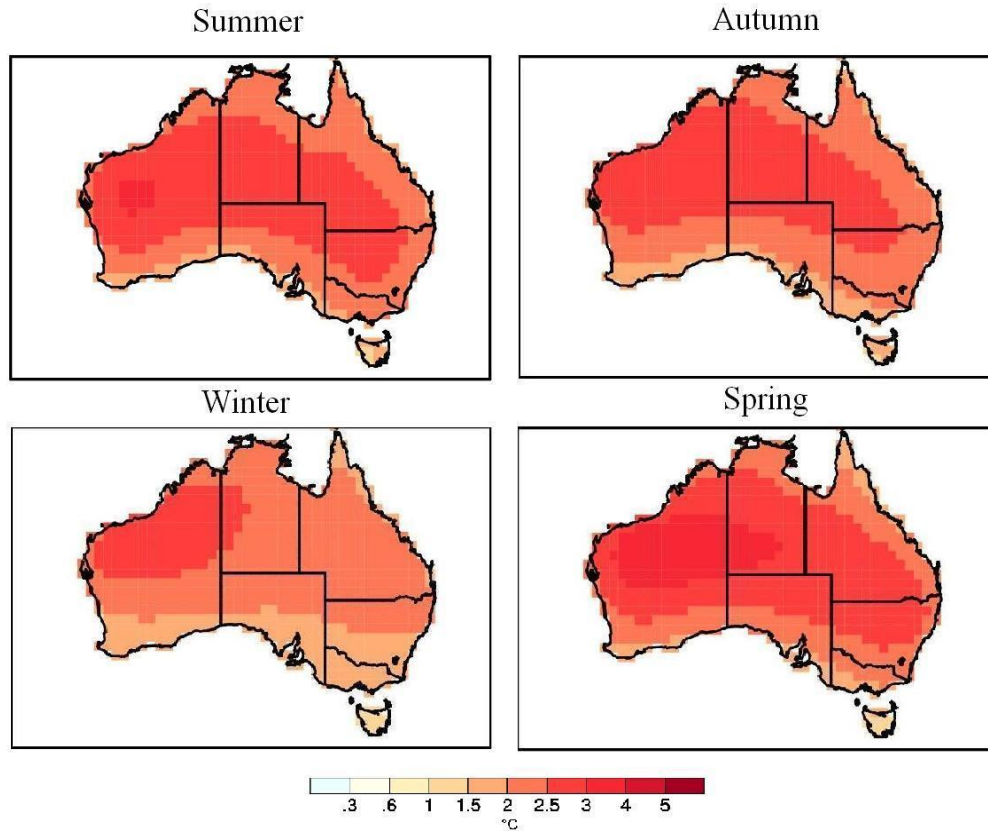# Future Weather Data Files

Climate "Forecast" (Seasonal)

- 50th percentile change in Dry-Bulb Temperature

Climate "Forecast" (Seasonal)


Summer   Autumn   Winter   Spring
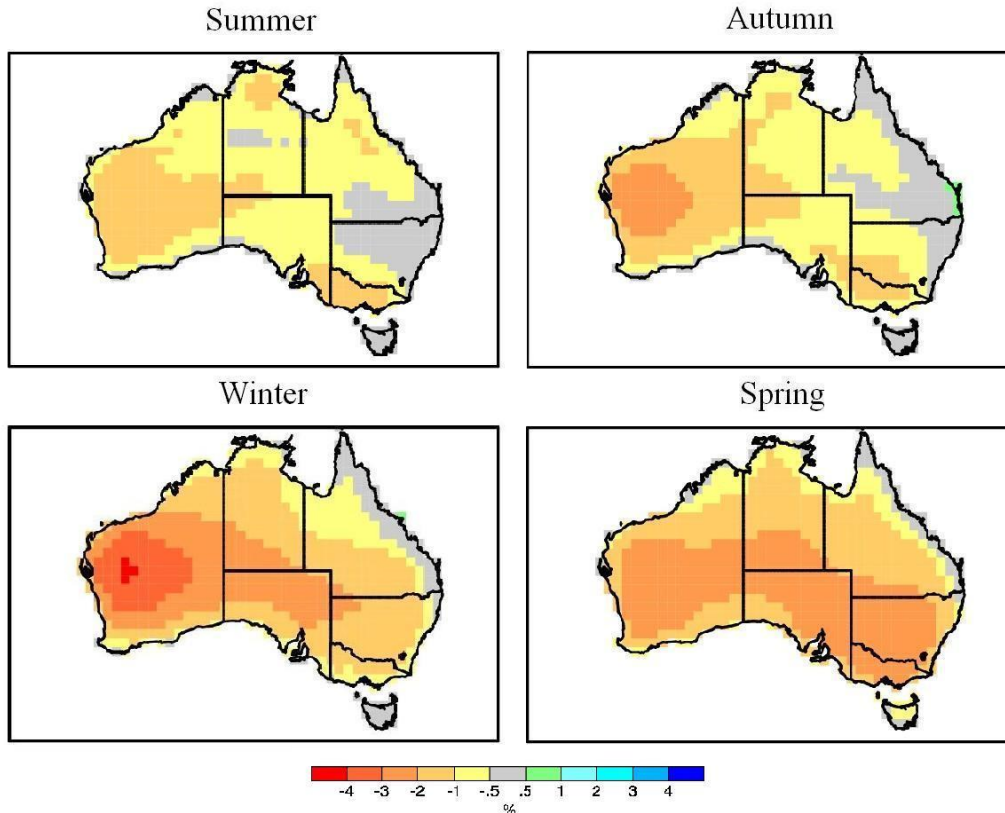
- 50th percentile change in Relative Humidity

Conclusions

- Climate and weather data may be tailored to suit a wide range of renewable energy and energy conservation applications.

- XMYs and RTYs can be created for system design and operational optimisation.

- Ersatz Future Weather Data based on "forecast" scenarios for climate change can predict energy performance in the future.

- Weather data collected by institutions like CSIRO and Macquarie University can be applied with building and renewable energy system simulation techniques to maintain systems in optimal working order commensurate with designs

- That same data can be applied to publish a Weather and Energy Index based on archetypical systems as an indicator of variation in weather (compared with long term climate)

Real time solar and coincident weather data
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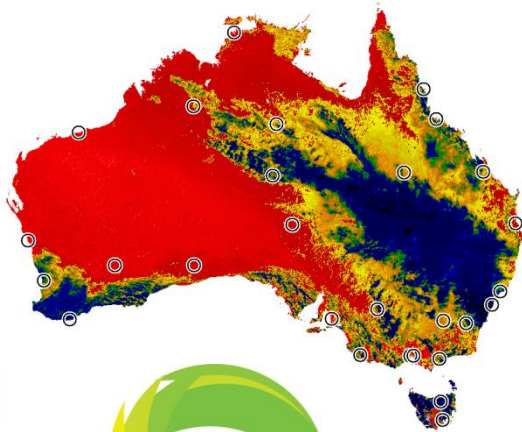
Questions?

Trevor Lee ARAIA
trevor.lee@exemplary.com.au

Grant Edwards PhD
grant.edwards@mq.edu.au

https://wiki.csiro.au/display/SRAF/Solar+Resource+Assessment+and+Forecasting+Home.
A separate page has been set up for each event (pages are listed on left hand side).