



CSIRO ENERGY
www.csiro.au

CSIRO

COMPOSITIONAL CHARACTERISATION OF THE PINNACLES VICARIOUS CALIBRATION SITE

Ong, C.¹, Caccetta, M.¹, Lau, I.C.¹, Ong, L.² and Middleton, E.²

Cindy Ong
26 July 2017

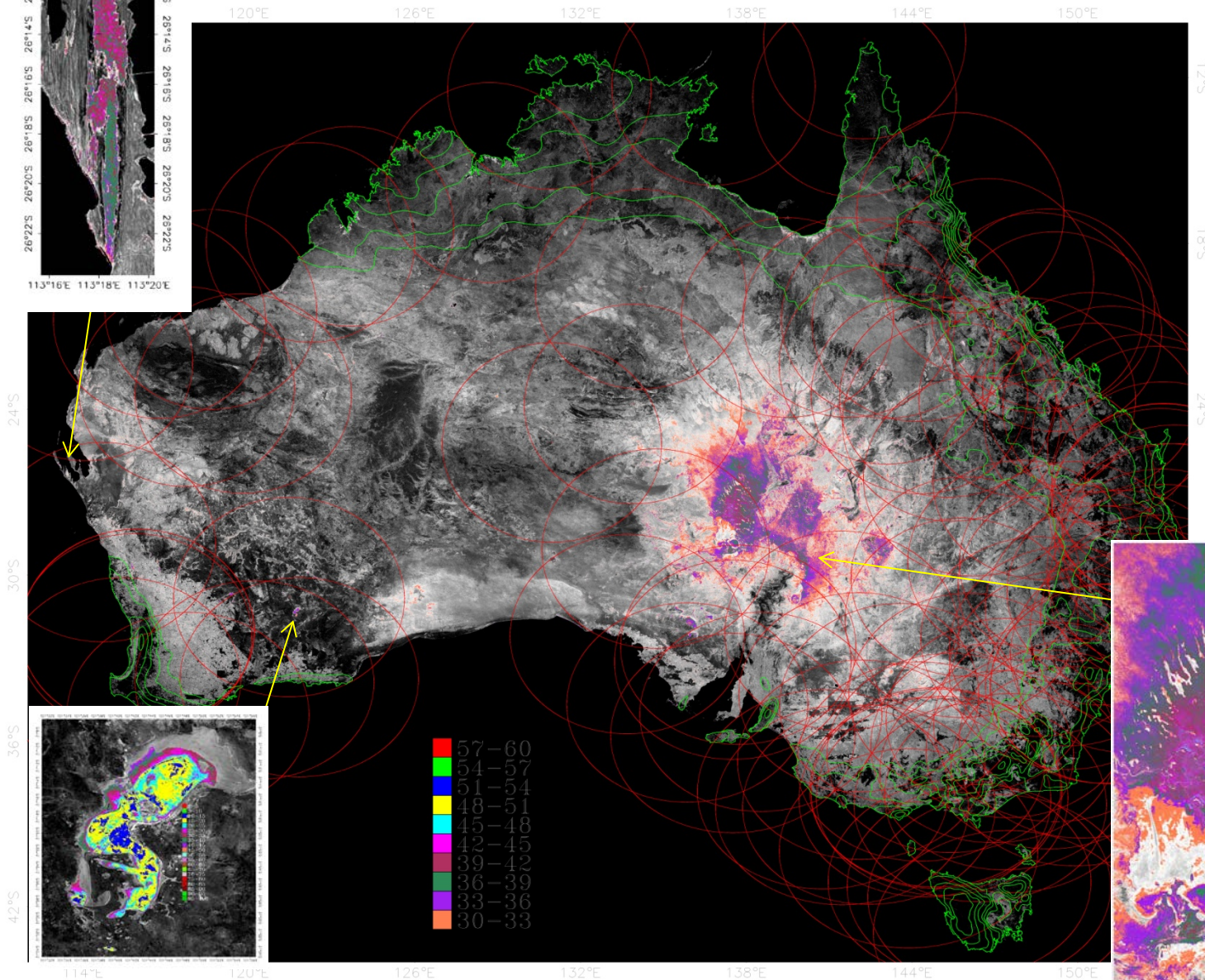
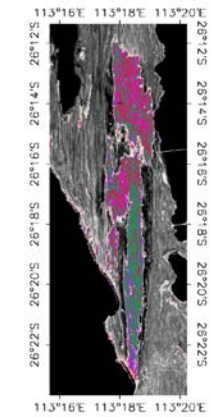
Aim

To build a vicarious calibration site specifically for imaging spectroscopy missions underpinned by instrumentations and laboratory calibration facilities at least meeting (and aiming for beyond) those of current CEOS endorsed vicarious calibration sites.

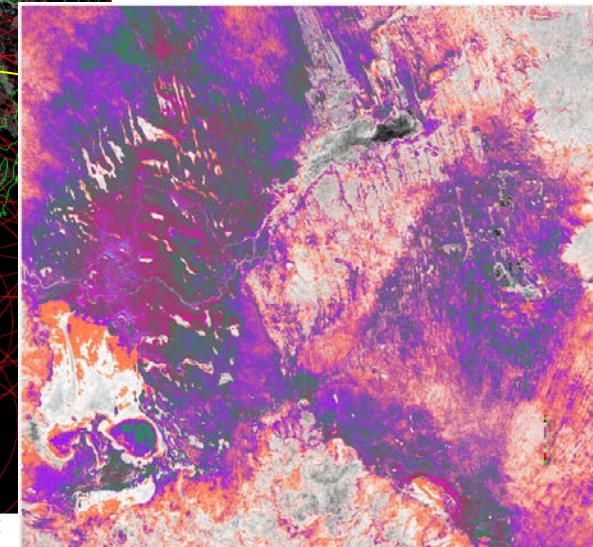
Recommendations For Site Characteristics

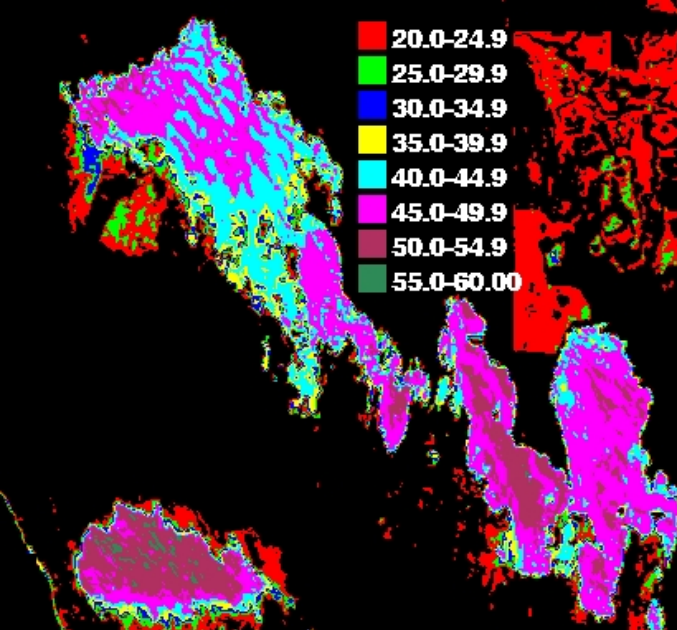
1. A high-reflectance results in higher signal-to-noise ratio (SNR) which, in return, increases overall accuracy.
2. The higher the spatial uniformity of the area, the lesser the effects of generalizing the reflectance data to the size of the full test site.
3. Spectral uniformity of the site eases the calibration procedure.
4. Temporal uniformity of the site eases the calibration procedure.
5. The site should have little or no vegetation that can deteriorate spectral and temporal uniformity.
6. Higher elevation reduces the error due to aerosols.
7. A Lambertian site surface is preferable since it decreases errors caused by different solar and view geometry.
8. High probability of cloud free days provides more time for calibration studies.
9. A longer distance to densely populated areas and/or industrial facilities decreases the effect of anthropogenic aerosols.
10. A location far from the seas or other large water bodies minimizes the influence of atmospheric water vapour.
11. Having a site in an arid region minimizes probability of precipitation and this in turn may change the surface BRDF. Also, in arid regions, the probability of a cloudy weather is minimum.
12. Having a large site minimizes the unwanted effects of scattering of light from areas outside the target area.
13. Easy access to the site is an advantage.
14. Instrumented test sites are preferable.

Systematic Search For Vicarious Calibration Site Using Landsat TM Archive

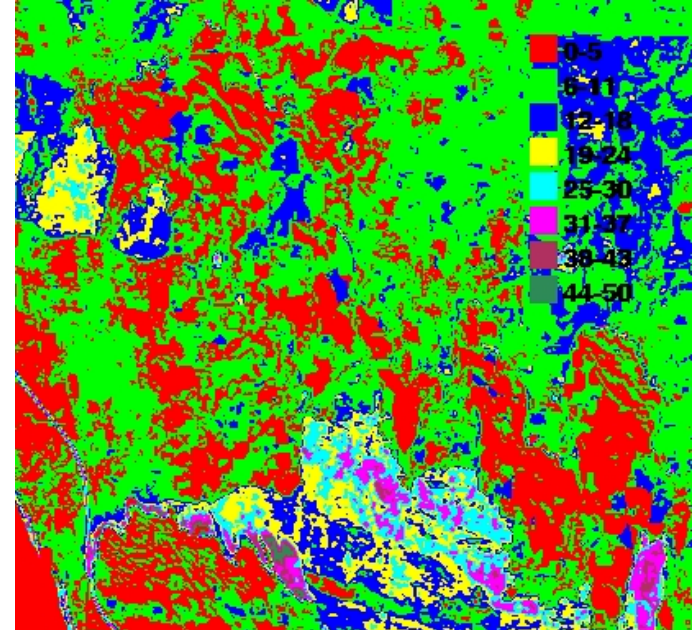


- Green vectors show high rainfall zone >600 mm pa
- Red circles show radius of 400 km (half day's drive) from major airport
- Image is VNIR-SWIR temporal means



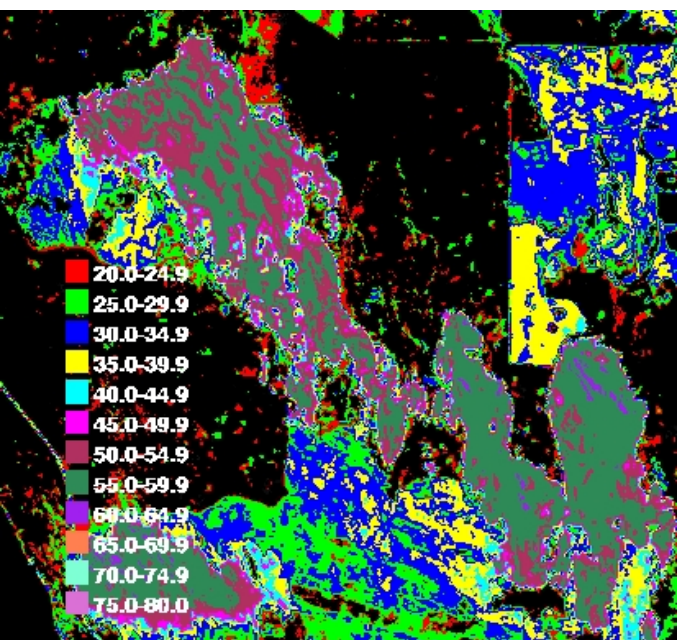


10 year Temporal Means VNIR-SWIR

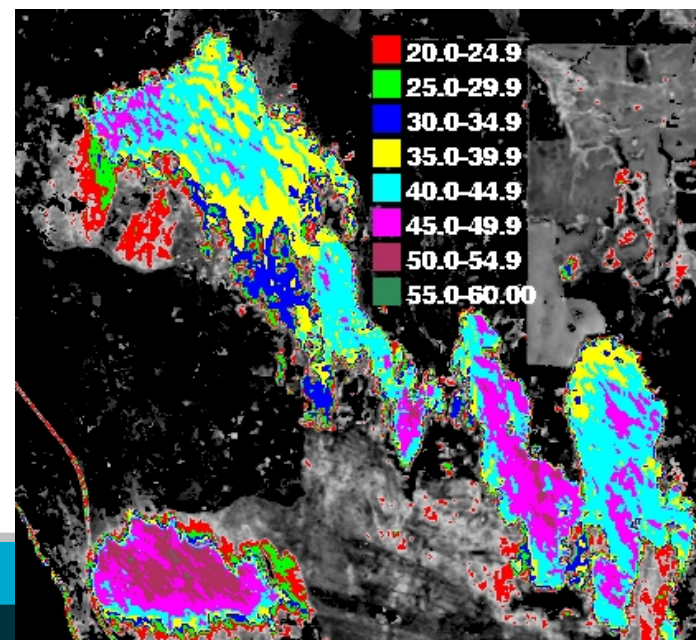


Coefficient Of Variation VNIR-SWIR

Spatial, Temporal Variation (C1,2,4)

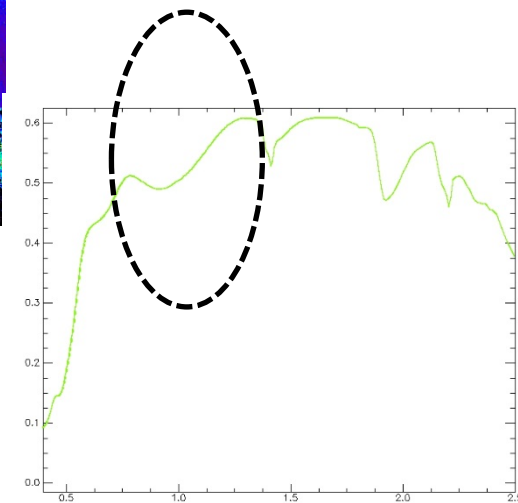
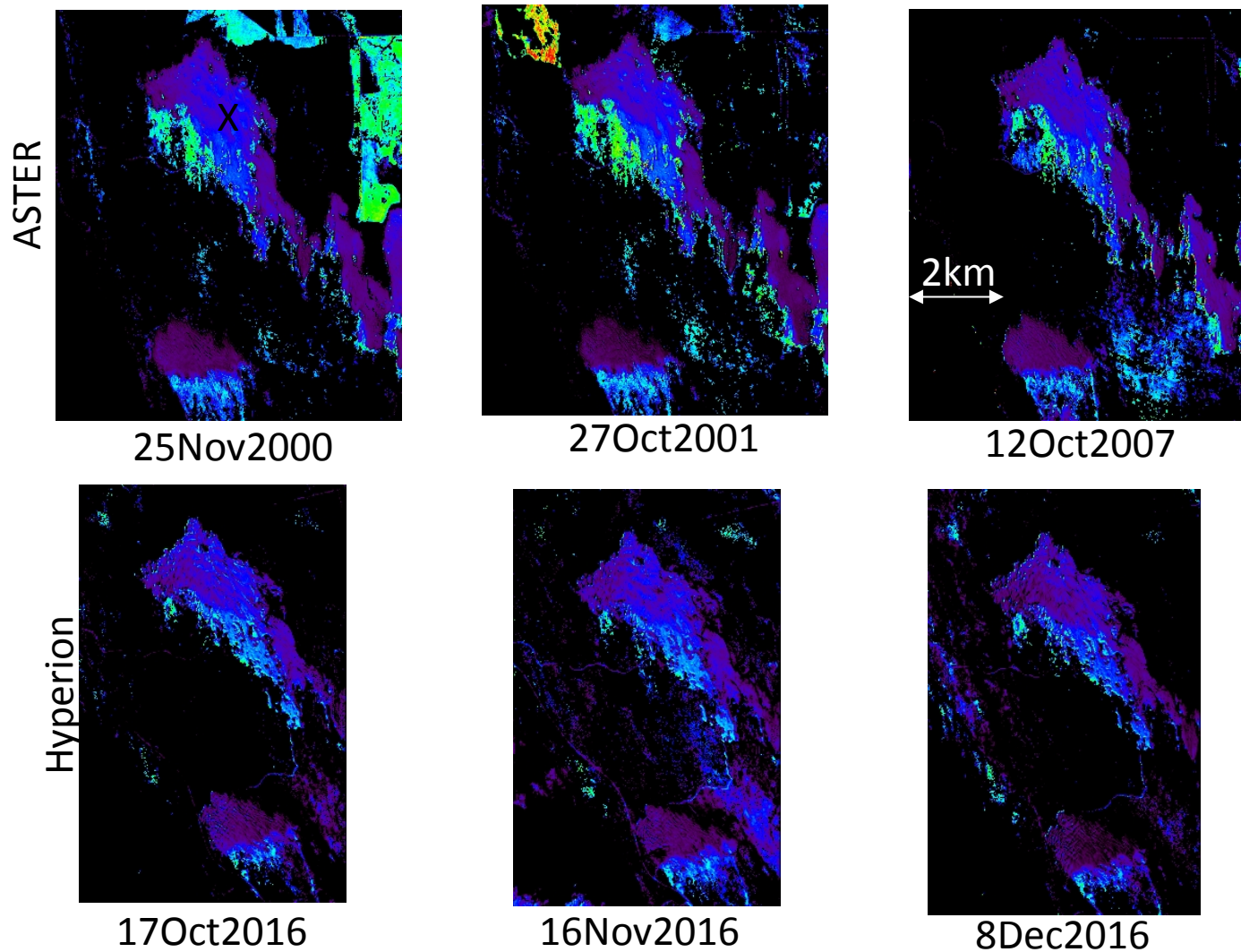


10 year Temporal Means SWIR



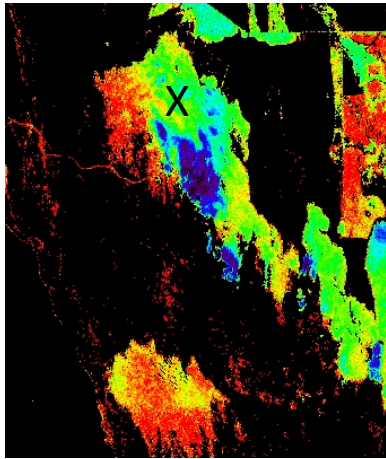
10 year Temporal Means VNIR

Temporal Compositional Variation (FeOx)

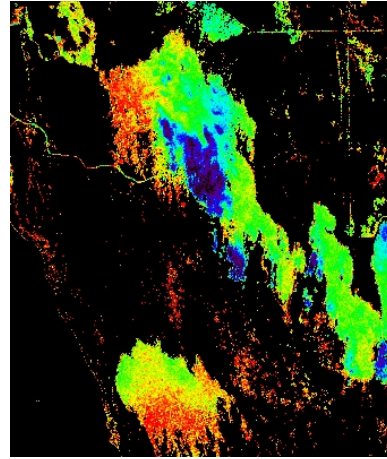


Temporal Compositional Variation (MgOH)

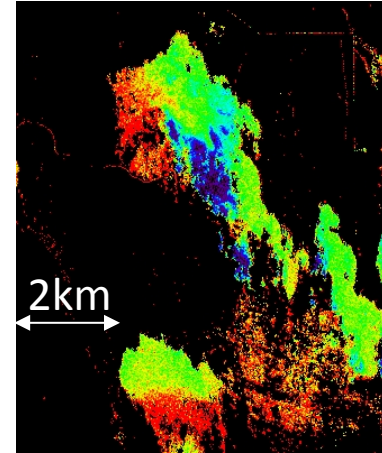
ASTER



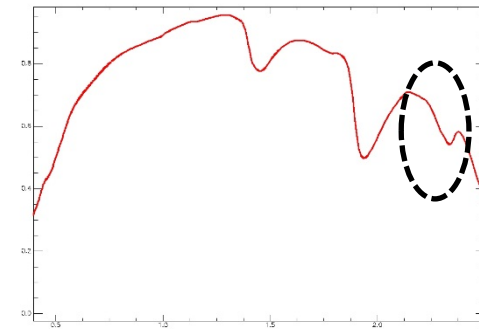
25Nov2000



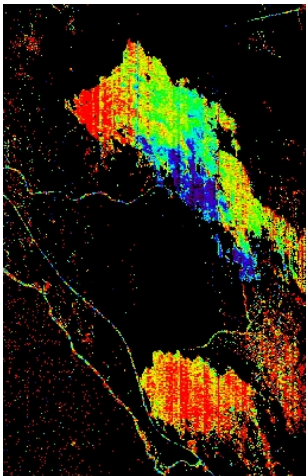
27Oct2001



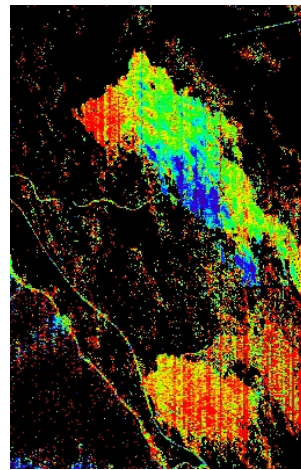
12Oct2007



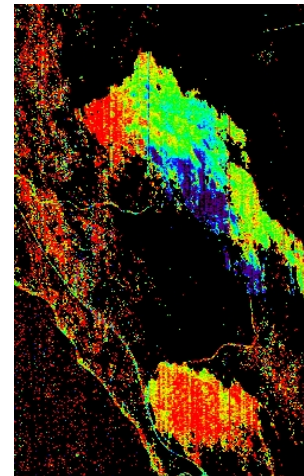
Hyperion



17Oct2016



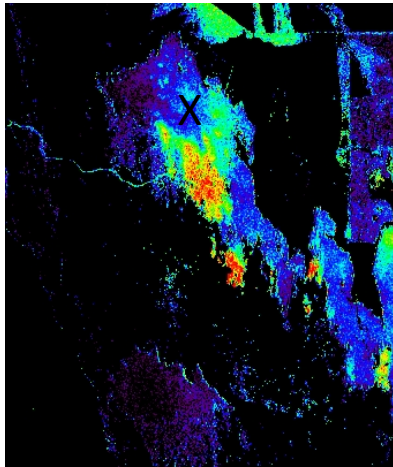
16Nov2016



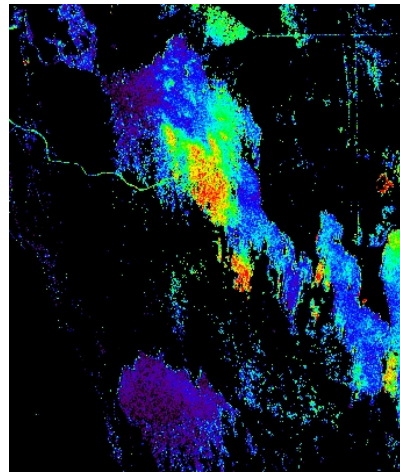
8Dec2016

Temporal Compositional Variation (AlOH)

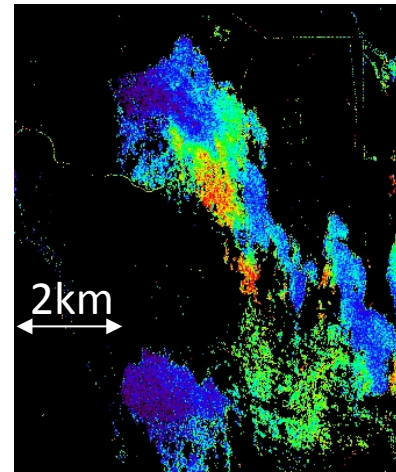
ASTER



25Nov2000

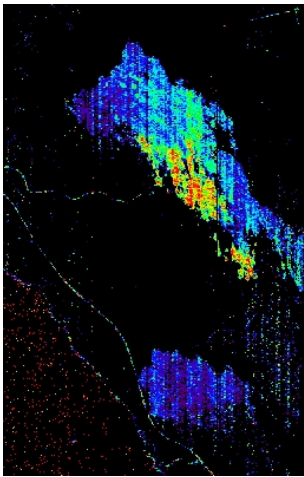


27Oct2001

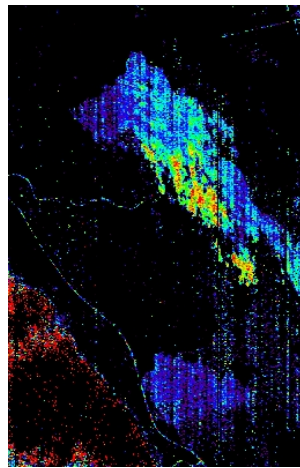


12Oct2007

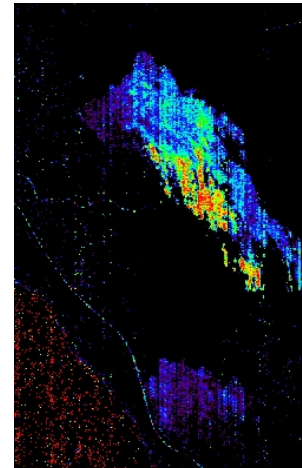
Hyperion



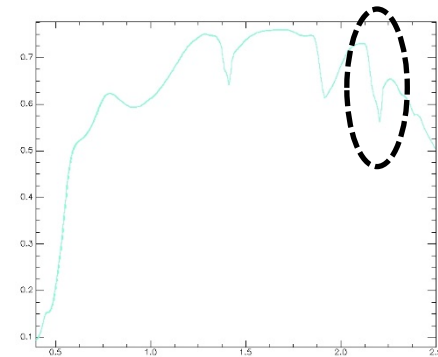
17Oct2016



16Nov2016

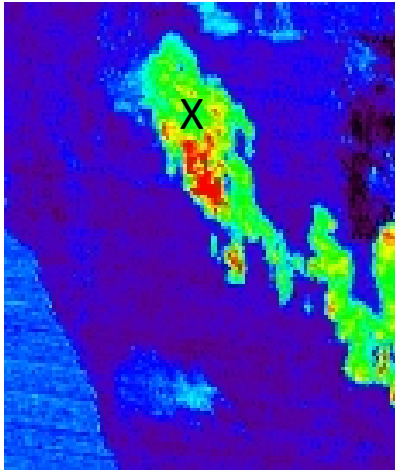


8Dec2016

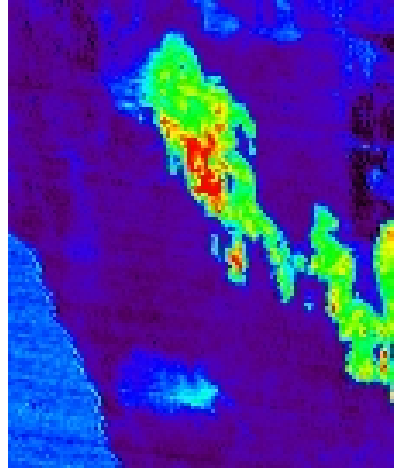


Temporal Compositional Variation (Silica)

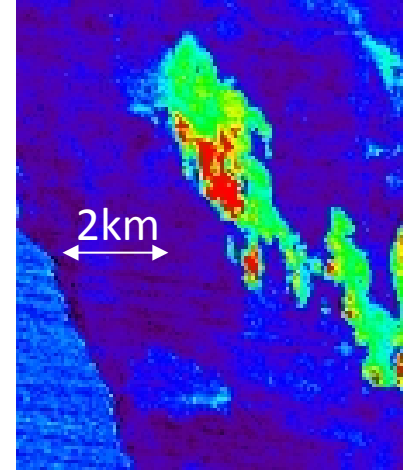
ASTER



25Nov2000

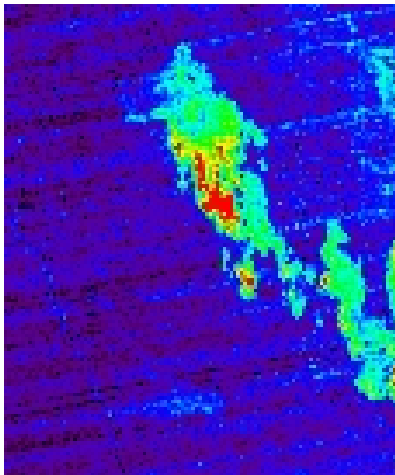


27Oct2001

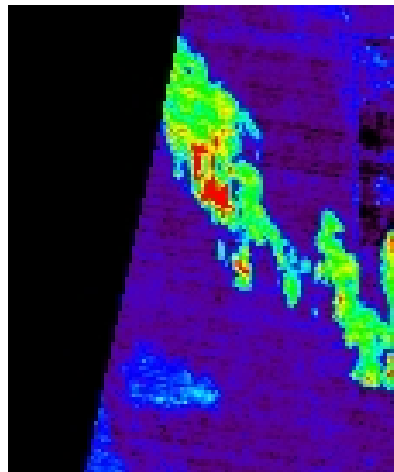


12Oct2007

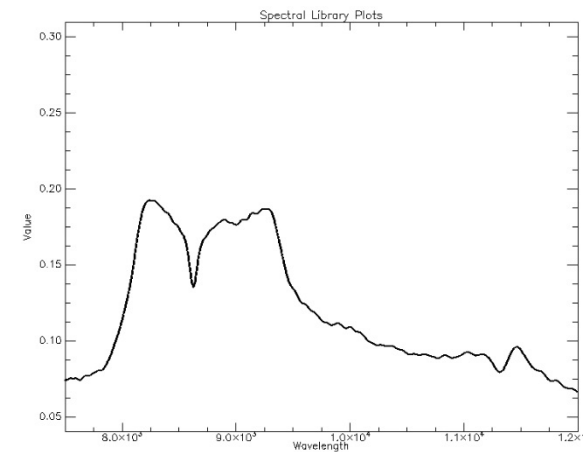
ASTER



01Dec2016



16Dec2016



Pinnacles Desert Logistics

Communications

- 3 / 4 G
- Satellite
- Landline

Permissions

- Department of Parks and Wildlife
- Aboriginal Heritage
- Need to minimise disturbance especially if on dunes
- Bitumised, locked up areas around the Discovery Centre

Security

- Dunes are in Nambung National Park
- Dunes are at least 1 km from tourist traffic area, no tracks except for animals (Emu and Kangaroos) in 7 visits
- Park is manned by rangers



Pinnacles Desert Climate Data From Nearest Weather Station

Statistics		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	Plot	Map
Temperature																	
Mean maximum temperature (°C)		30.0	30.9	29.5	26.4	23.2	20.7	19.5	20.0	21.3	23.4	25.9	28.2	24.9	46	1969 2015	
Mean minimum temperature (°C)		17.2	18.0	16.6	14.0	11.8	10.3	9.3	9.4	10.0	11.3	13.5	15.6	13.1	46	1969 2015	
Rainfall																	
Mean rainfall (mm)		6.5	14.3	14.0	29.1	78.4	104.5	112.3	80.7	44.5	25.7	18.2	7.1	532.9	46	1968 2015	
Decile 5 (median) rainfall (mm)		1.0	3.0	6.8	19.7	71.9	102.8	110.6	82.0	41.8	23.5	13.4	3.3	563.4	46	1968 2015	
Mean number of days of rain ≥ 1 mm		0.9	1.3	1.8	4.4	9.0	11.6	13.4	11.3	8.2	4.8	3.4	1.3	71.4	47	1968 2015	
Other daily elements																	
Mean daily sunshine (hours)																	
Mean number of clear days		16.0	13.4	13.3	9.9	8.4	7.3	7.4	7.9	8.7	10.5	11.3	14.6	128.7	41	1969 2010	
Mean number of cloudy days		5.2	5.1	6.8	9.1	11.9	12.9	13.3	12.0	9.7	8.6	7.4	5.4	107.4	41	1969 2010	
9 am conditions																	
Mean 9am temperature (°C)		25.2	25.2	23.7	20.6	17.4	14.9	13.9	14.6	16.7	19.1	21.8	23.9	19.8	41	1969 2010	
Mean 9am relative humidity (%)		56	57	59	64	70	75	77	73	68	61	58	56	64	38	1969 2010	
Mean 9am wind speed (km/h)		19.4	18.7	16.9	15.4	15.1	16.2	16.5	17.0	16.6	17.6	18.3	19.2	17.2	40	1969 2010	
9am wind speed vs direction plot																	
3 pm conditions																	
Mean 3pm temperature (°C)		26.4	27.2	26.5	24.3	21.7	19.4	18.3	18.6	19.7	21.1	23.0	24.8	22.6	41	1969 2010	
Mean 3pm relative humidity (%)		59	58	58	59	61	63	65	62	62	60	59	59	61	38	1969 2010	
Mean 3pm wind speed (km/h)		29.3	26.7	24.2	20.0	17.5	18.1	18.7	19.4	20.6	24.1	26.4	28.8	22.8	40	1969 2010	
3pm wind speed vs direction plot																	

Optical Vicarious Calibration Site at Pinnacles Desert

To be upgraded in the future
to DFOV VNIR-SWIR
spectrometer

CIMEL Sun photometer

3G antenna

9m mast

80w Solar panel

Control box and modem

12v/24v battery

Platform for mast (grated mesh)

screw piles

Sand dune

Steel guy ropes (if needed)

Concept sketch of mast, foundations and instrumentation installed on the sand dune



Near 30°35'16.45"S 115°9'21.81"E
looking north towards the proposed
instrument installation site



Near 30°35'9.47"S 115°9'22.3"E
looking west





Thank you

CSIRO Energy

Cindy Ong

Principal Research Scientist

t +61 8 6436 8677

e cindy.ong@csiro.au

w www.csiro.au

CSIRO ENERGY

www.csiro.au

CSIRO