

Protection of SAAO observing site against light and dust pollution

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science
& technology

Department:
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SAAO
South African
Astronomical Observatory

SALT and other Sutherland telescopes



- SAO is national facility for optical and IR astronomy;
 - Main functions: Research and provision of research facilities, postgraduate training, instrument development, and outreach and education.

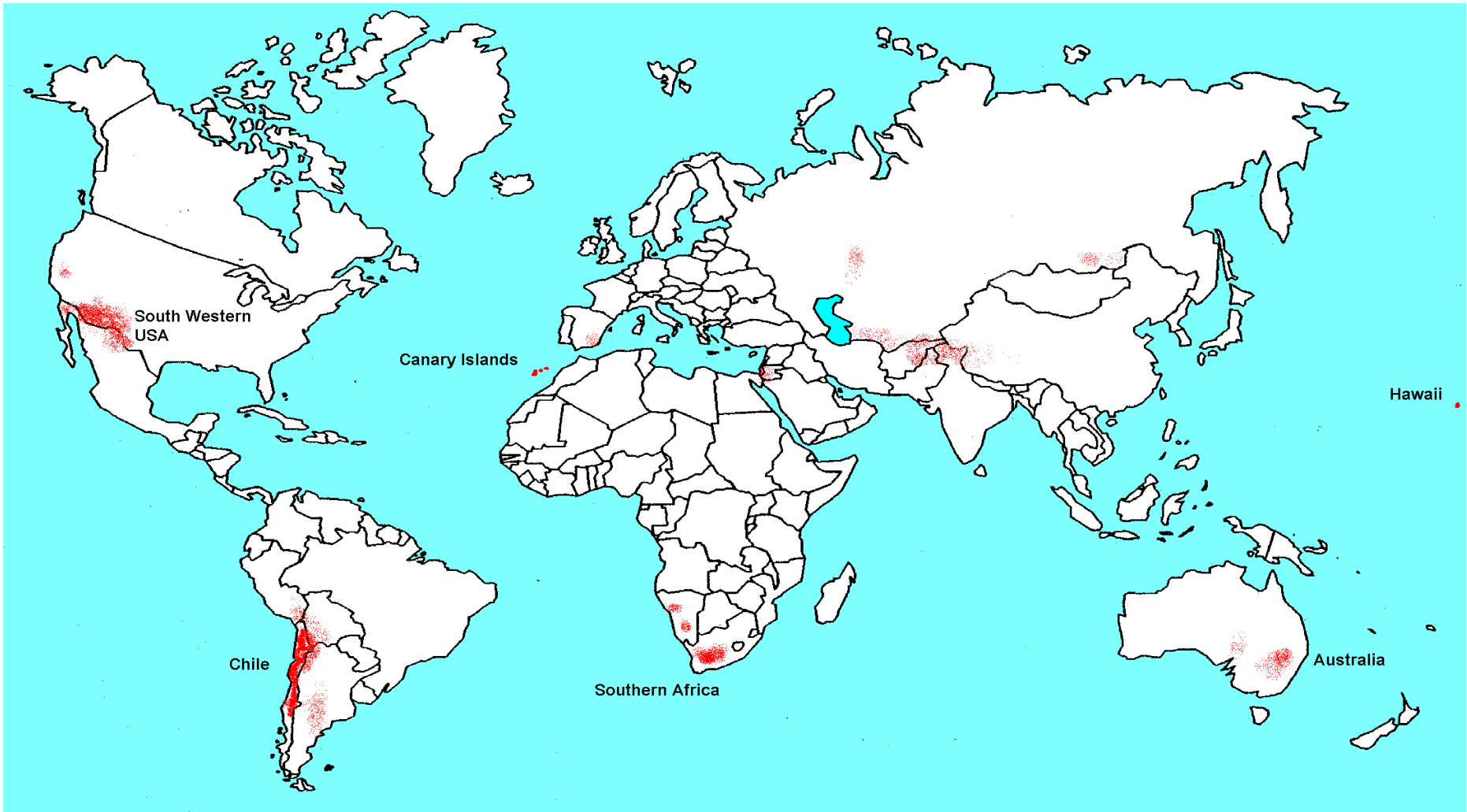
Sutherland telescopes



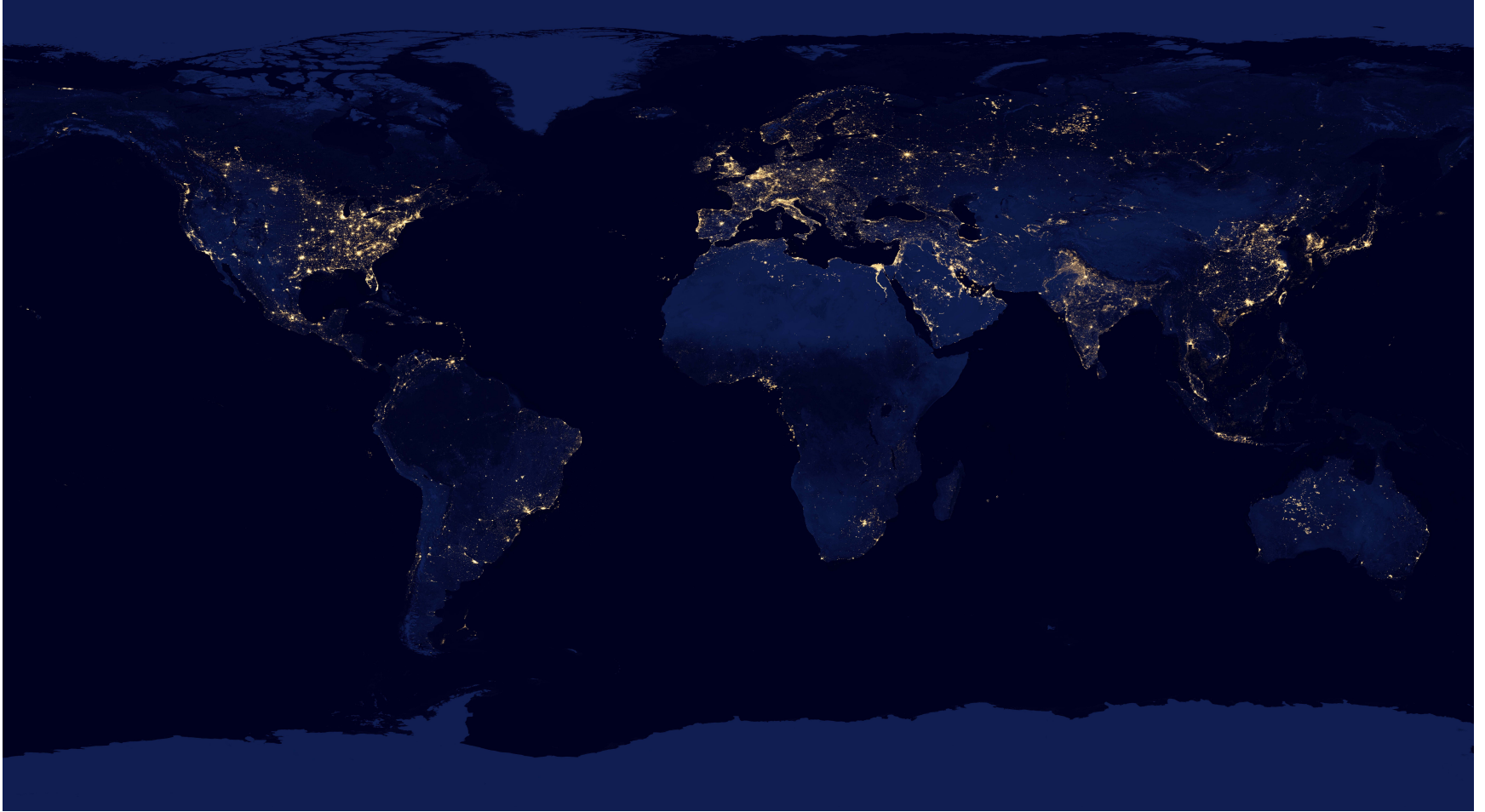
Sutherland International telescopes

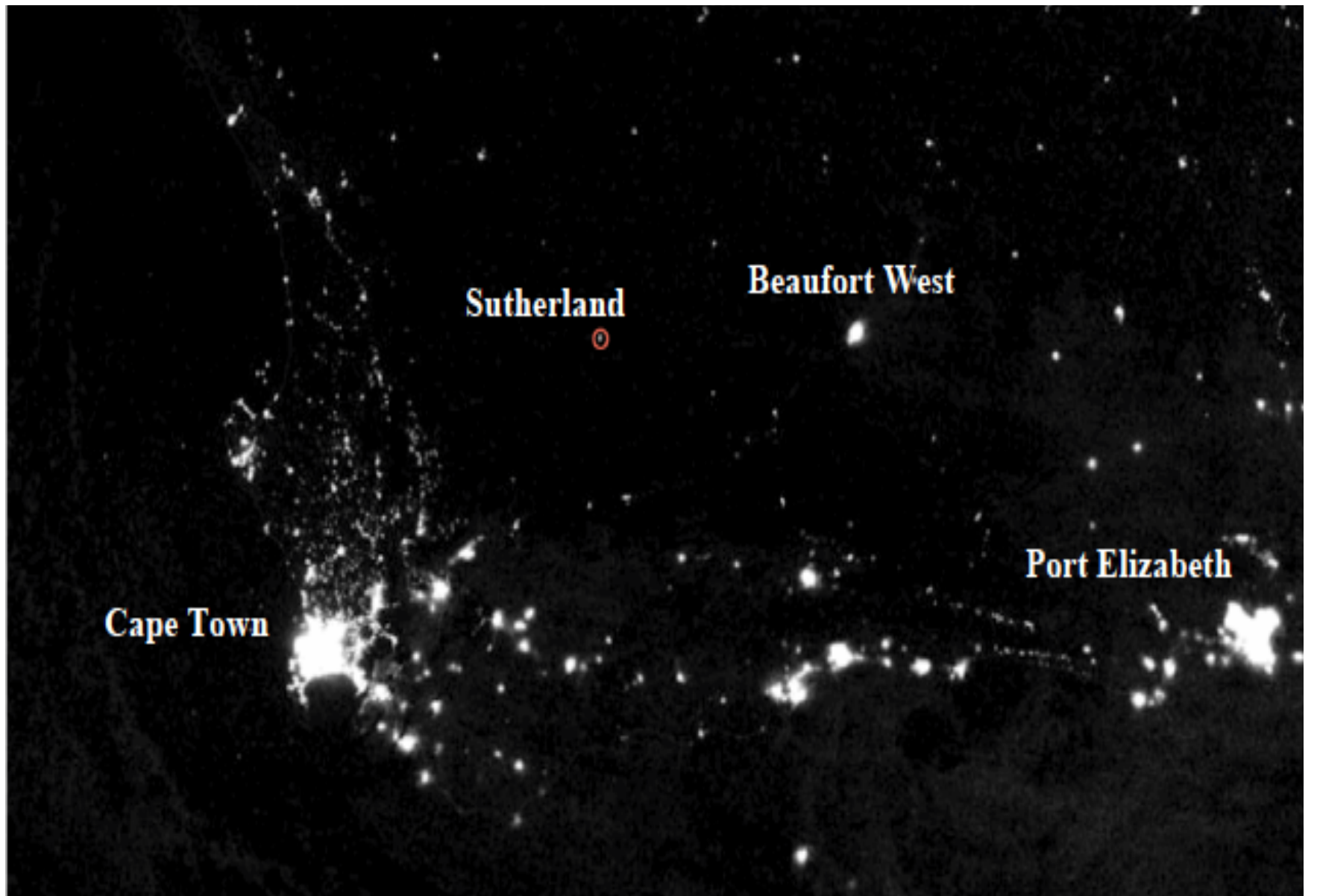
Telescope	Owners/Country	Size/Type	Science
SuperWASP	UK Universities	8 cameras/robotic	Extrasolar planets
KELT-South	Vanderbilt University, US	4.5cm/robotic	Transiting planets
LCOGT Network	Las Cumbres, California, USA	Three 1.0m telescopes/robotic	Time domain astronomy
Solaris	Poland	Two 0.5m telescopes/robotic	Eclip. Binaries/ Circumbinary planets
Monet	Germany	1.2m/remote	exoplanets
KMTNet	Korea	1.6m telescope / Observer operated	Extrasolar planets/ Survey
MASTER	Russia	Two 40 cm telescopes/ Robotic	Optical transients / alerts
IRSF	Japan/SA	1.4m/Observer	IR astronomy

Best sites for optical astronomy



The Earth at night





Cape Town

Sutherland



Beaufort West

Port Elizabeth

SAAO Sutherland at night



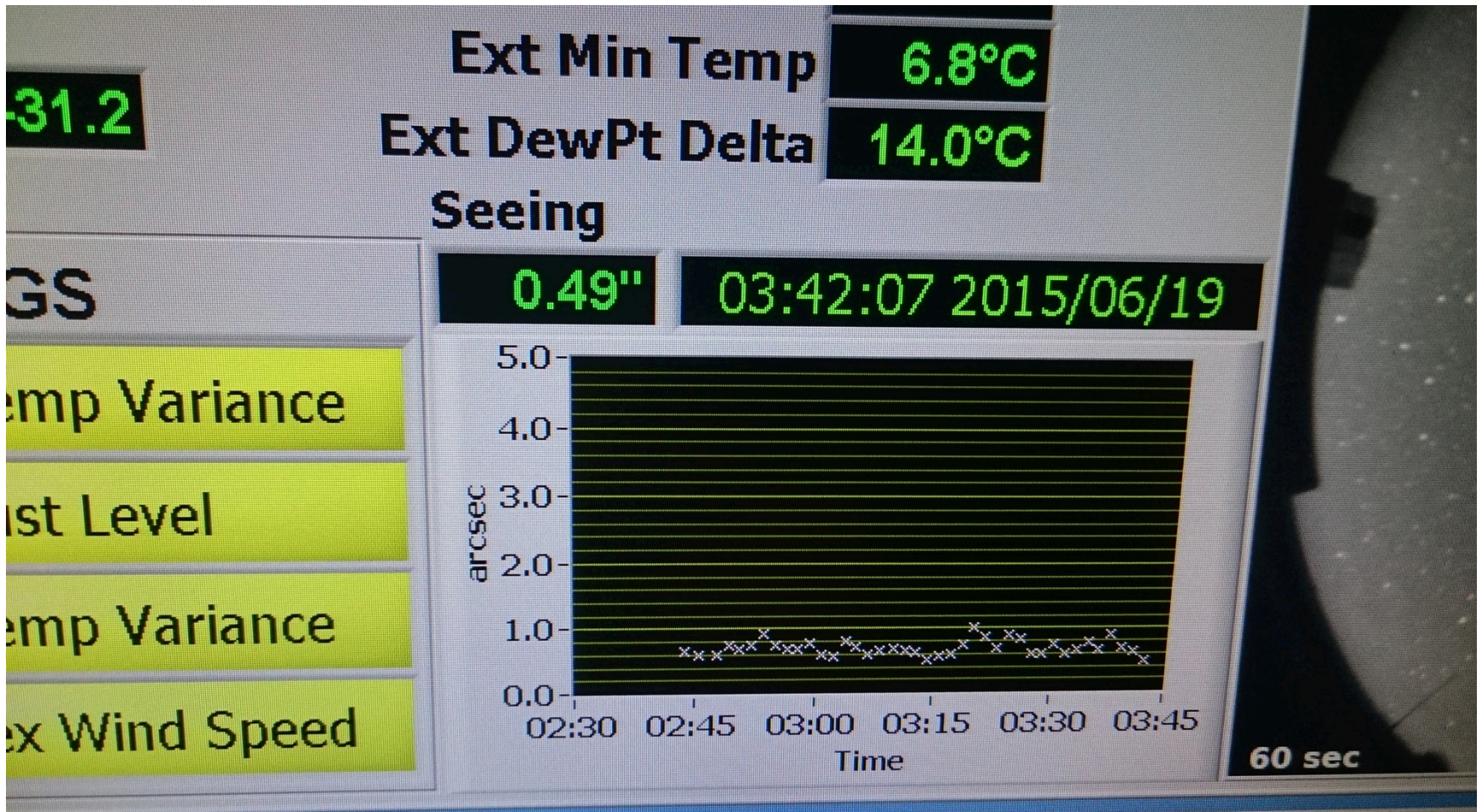
The SAAO observing site near Sutherland. The arrow is pointing in the direction of Sutherland, the nearest town (15 km away).

The visible light glow to the left of the arrow is next biggest town Worcester, 170 km away)

Night sky view from Mauna Kea Observatory, looking northwest of the observatory (Wainscoat, 2007).

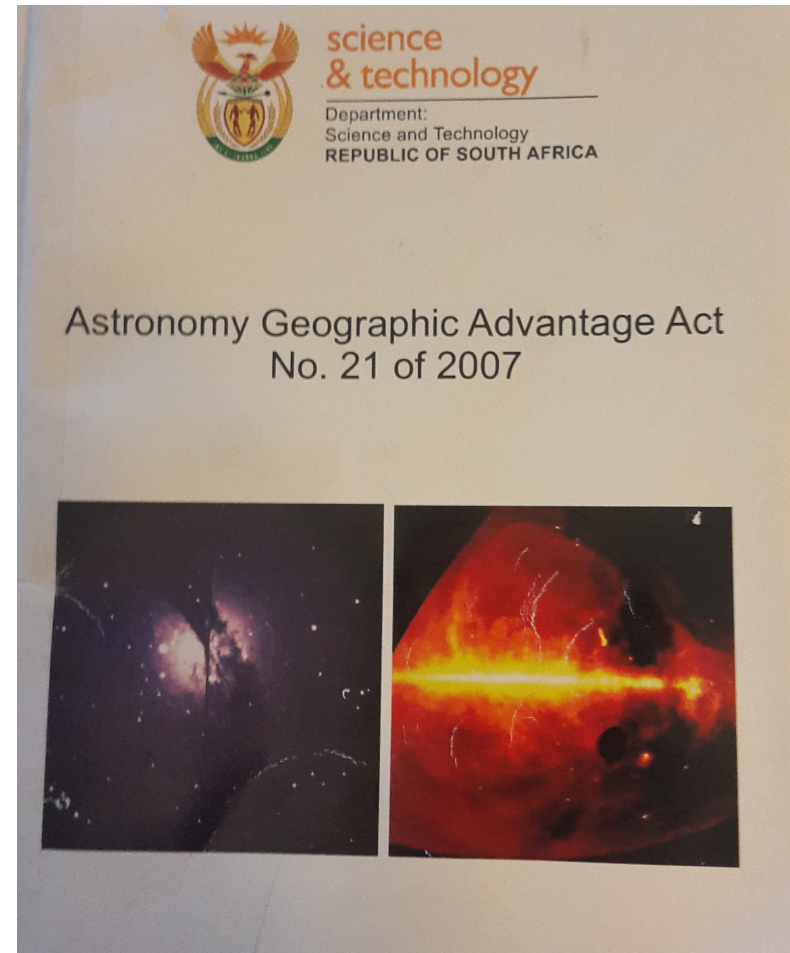


Seeing conditions



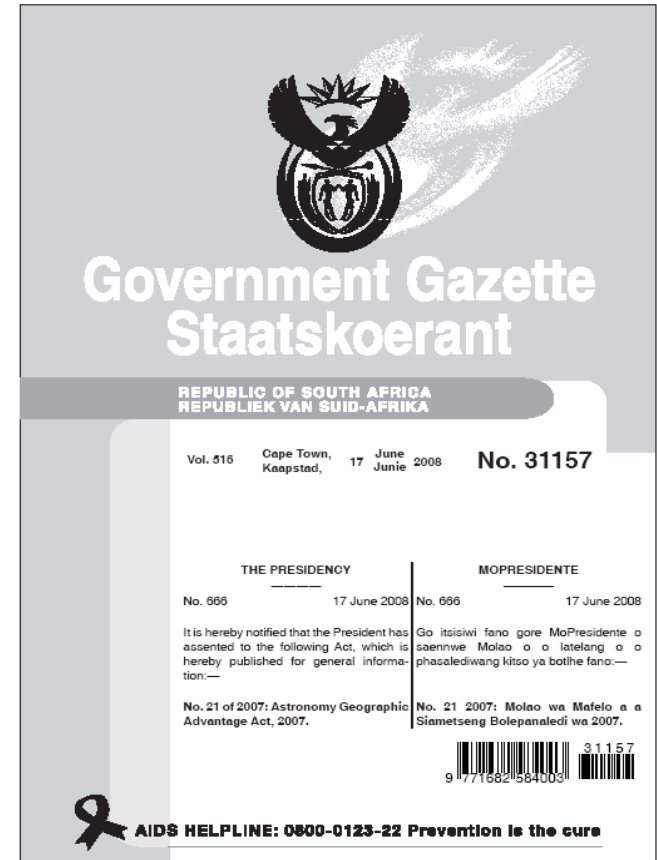
Astronomy Geographical Advantage (AGA) Act

- Empowers the Minister for S&T to declare protected areas around strategic astronomy sites
- Protected areas apply to existing and new activities
- The Act covers both radio and optical astronomy
- Three tiers of protected areas:
 - **Core area** – the physical area of the observatory / instrument
 - **Central area** – Minister prohibits certain activities / categories of activities in this area (around the Core)
 - **Coordinated area** – Minister sets standards which activities must comply with

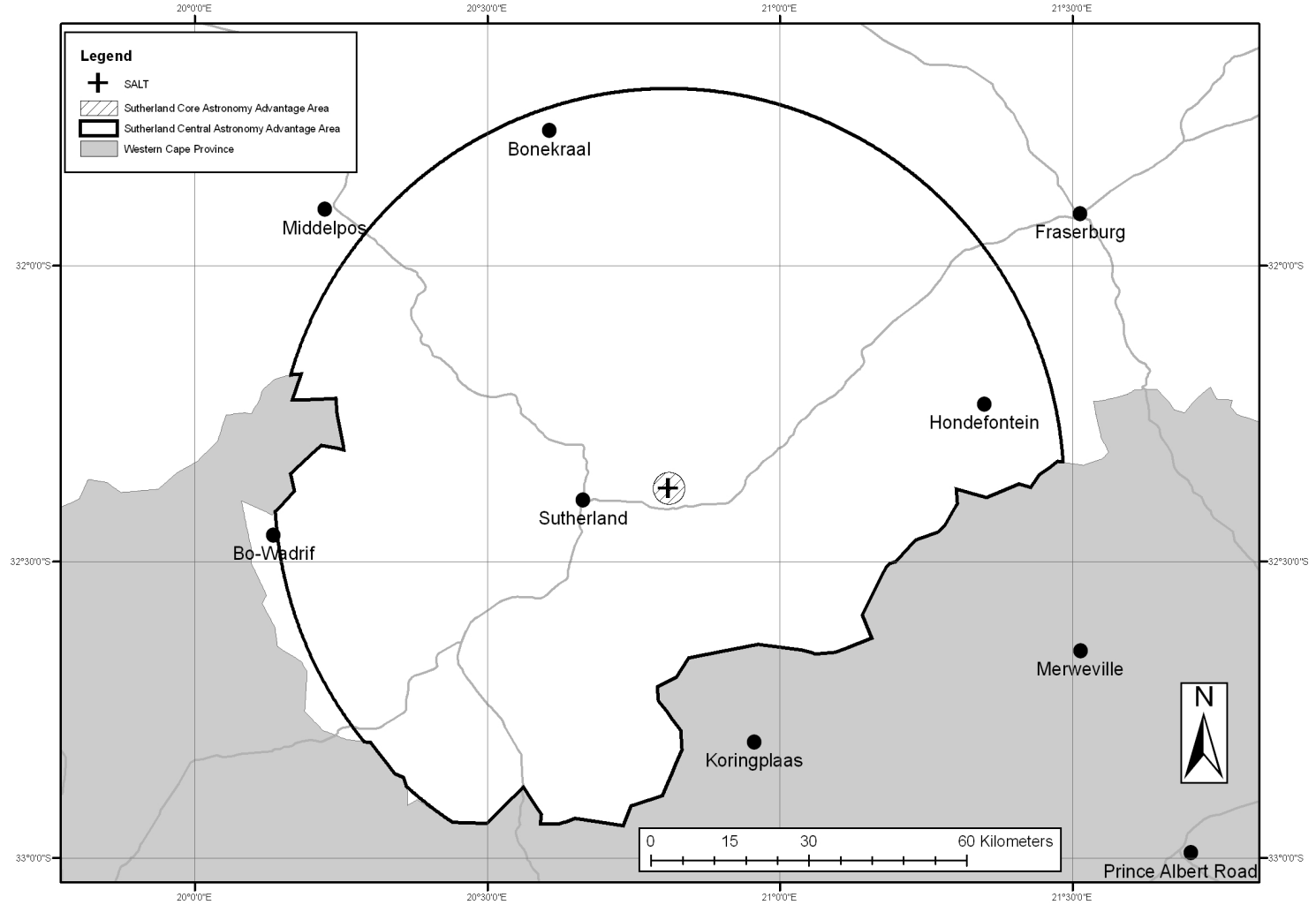


Astronomy Advantage Areas (AAAs)

- The Minister is empowered to prohibit or regulate certain “declared activities” in the AAAs (after notice in the Gazette and public consultation), which include:
 - Mining or prospecting
 - Outdoor lighting
 - Power generation
 - “Harmful industrial activities”
- Declared:
 - Core AAAs (Karoo and Sutherland);
 - Restrictions of certain activities in the core AAAs
 - Central AAAs (Karoo and Sutherland)
- In the process of making regulations to restrict or control certain activities in the Central AAAs



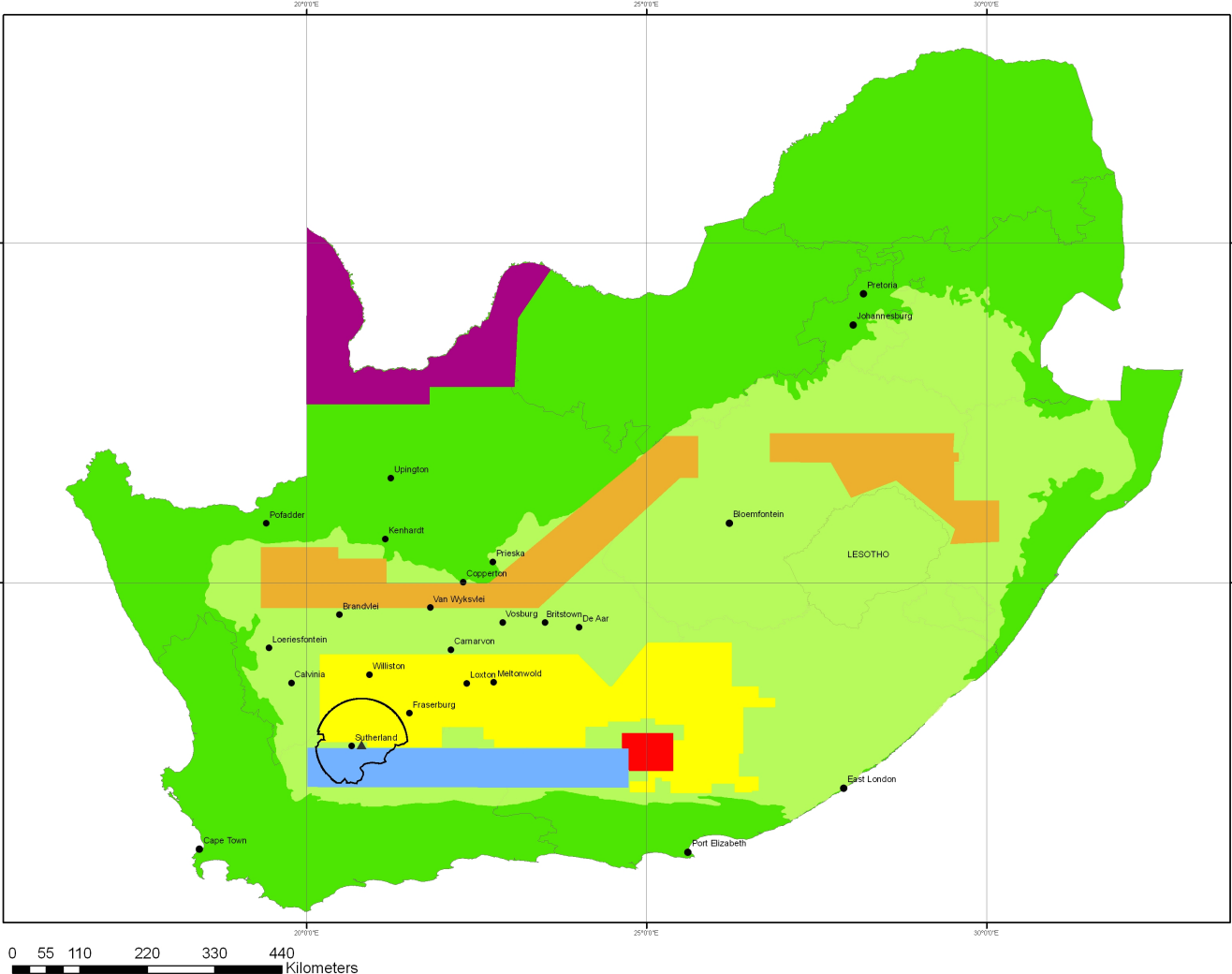
Sutherland Central AAA



Challenges

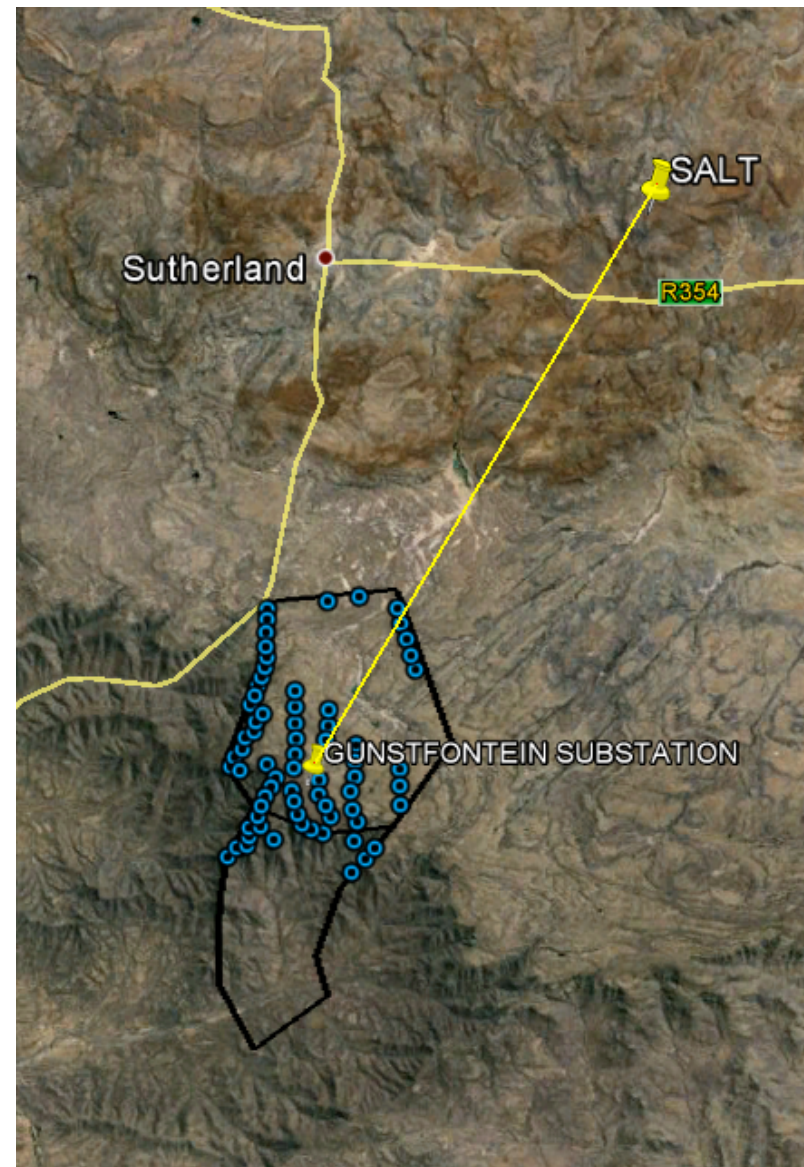
Planned developments around Sutherland, including :

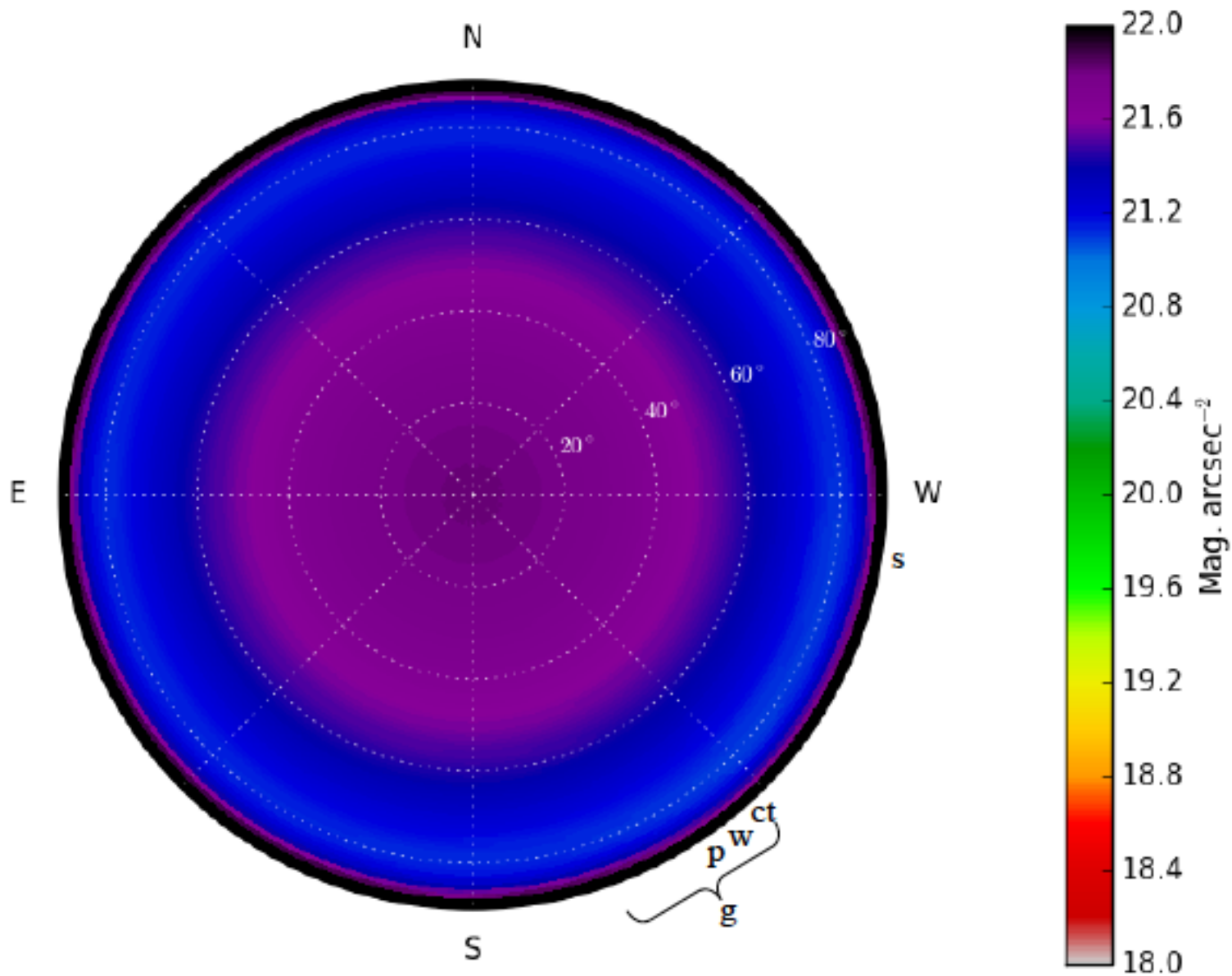
- Oil and gas explorations / exploitation (including fracking)
- Mining, and
- Wind farms



Challenges (Wind energy developments)

- Several wind farms are planned around Sutherland, within the Central AAA
- Example of planned wind farm, GWEF, 20 to 25 km from the observatory
- About 50 wind turbines planned
- Almost all lit ones will be directly visible at the SALT / Sutherland observatory.
- Possible light pollution as result of civil aviation requirements for tall structures
- DSP helped model the impact of GWEF





Results of the DSP modeling

Zenith Angle	Brightness Ratio		
	AZ 213° (with GWEF/without GWEF)	AZ 223° (current/natural)	AZ 262° (current/natural)
0°	1.000	1.005	1.002
45°	1.001	1.009	1.005
60°	1.002	1.013	1.008
70°	1.003	1.019	1.014
80°	1.006	1.047	1.034
85°	1.015	1.115	1.087

- AZ 213: Gunsfontein WEF (22 km)
- AZ 223: Worcester (173 km, and Cape Town, 281 km)
- AZ 262: Sutherland (14 km)

Results: **No significant impact from the GWEF for observations down to 70 degrees from the zenith.**

Current status: light pollution

- Continue to engage with different energy developers and local communities around the Sutherland Central AAA to find ways of protecting the observatory, but at same time be able to have renewable energy developments going on
 - **Astronomy at SAAO should not be perceived as hindrance to rural developments and provision of 'renewable' energy in SA.**
- Have also been engaging with the Civil Aviation Authority (CAA) to relax some of their lighting related regulations around the Observatory;
 - **E.g. SA CAA's plan to have wind farms around Sutherland install pilot activated lighting (PAL) or pilot controlled lighting (PCL) to reduce the impact of light pollution at the observatory;**

Compliance and mutual cooperation

Voluntary compliance through understanding and education continues to be our main strategy when it comes to protection of the observatory against light and dust pollution.

- **Building good relationships with the public and the local community is an essential component of protecting our astronomical sites.**