

Radiance Calibrated Night Lights Products that Reveal Urban Cores and Gas Flares

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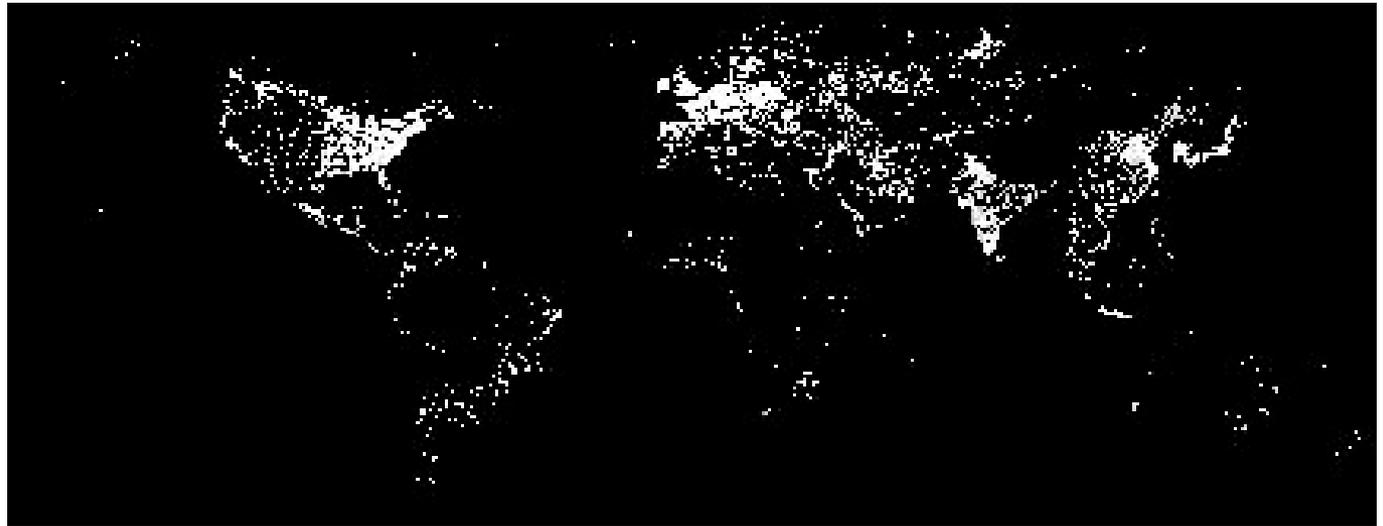
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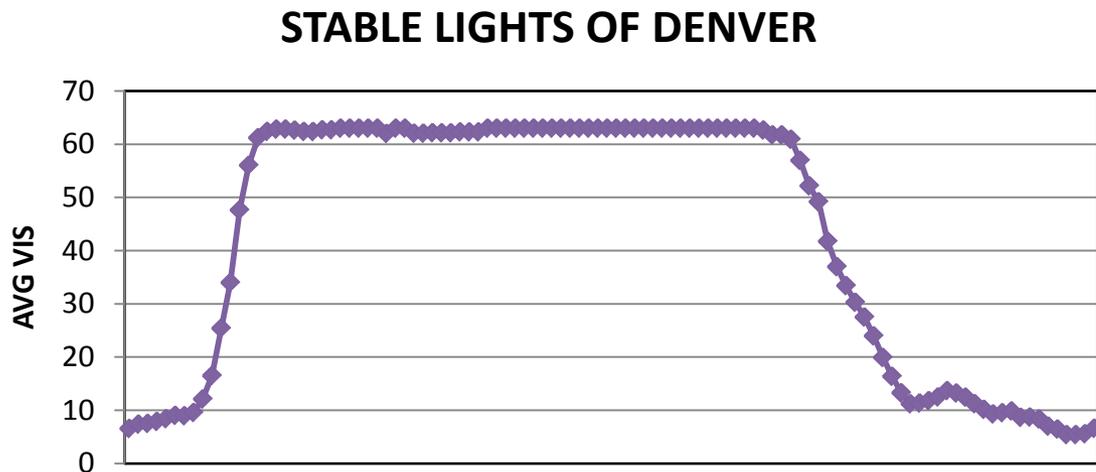
The Observations

- The Defense Meteorological Satellite Program (DMSP) has flown a long series of satellites.
- These satellites have an instrument called the Operational Linescan System (OLS), which was designed to detect moonlit clouds.
- Anthropogenic lighting is also detectable.
- Digital OLS data have been archived at the National Geophysical Data Center (NGDC) from 1992.



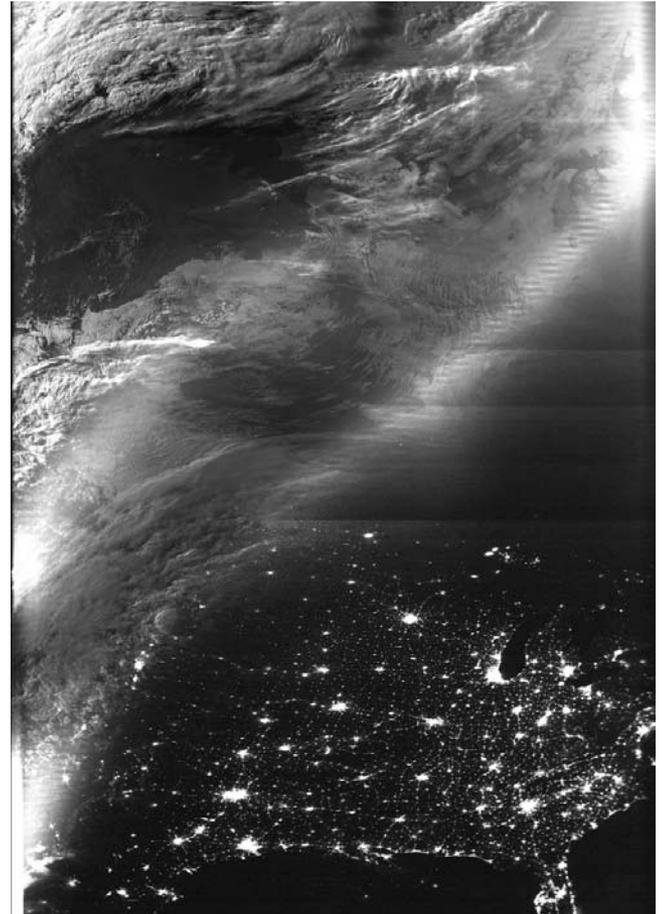
Saturation

- Observations of bright targets such as cities tend to saturate, so resolving spatial details and estimating the actual radiance of cities is impossible.



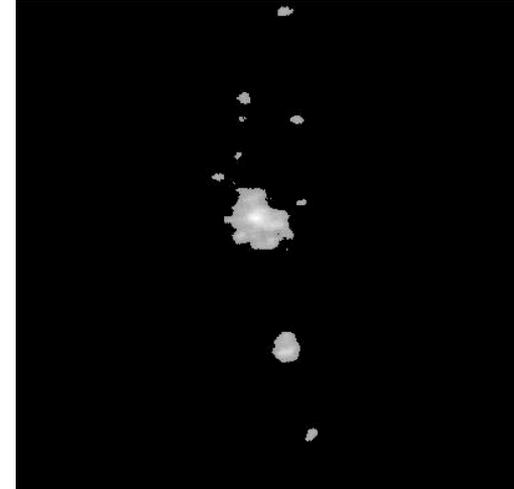
Variable Gain

- Gain is adjusted continuously both along the satellite track and along the scan line.
- The goal was to create a large area image of uniform brightness.
- Gains are not recorded in the data stream.

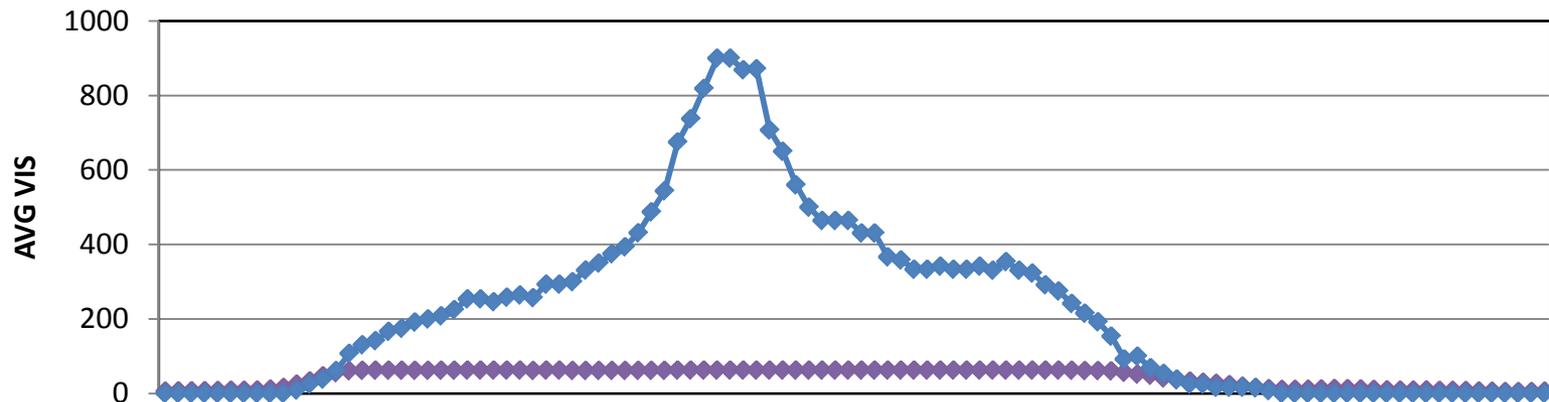


Fixed Gain Observations

- Upon request the USAF will allow us to specify the gain of the OLS instrument.
- A series of days with gains “fixed” at 15, 35, and 55 are acquired.
 - **Non-saturated**
 - **Low coverage (high noise and anomalous events get large statistical weight)**
 - **Low gain reduces sensitivity**



DENVER STABLE LIGHTS AND FIXED GAIN 15

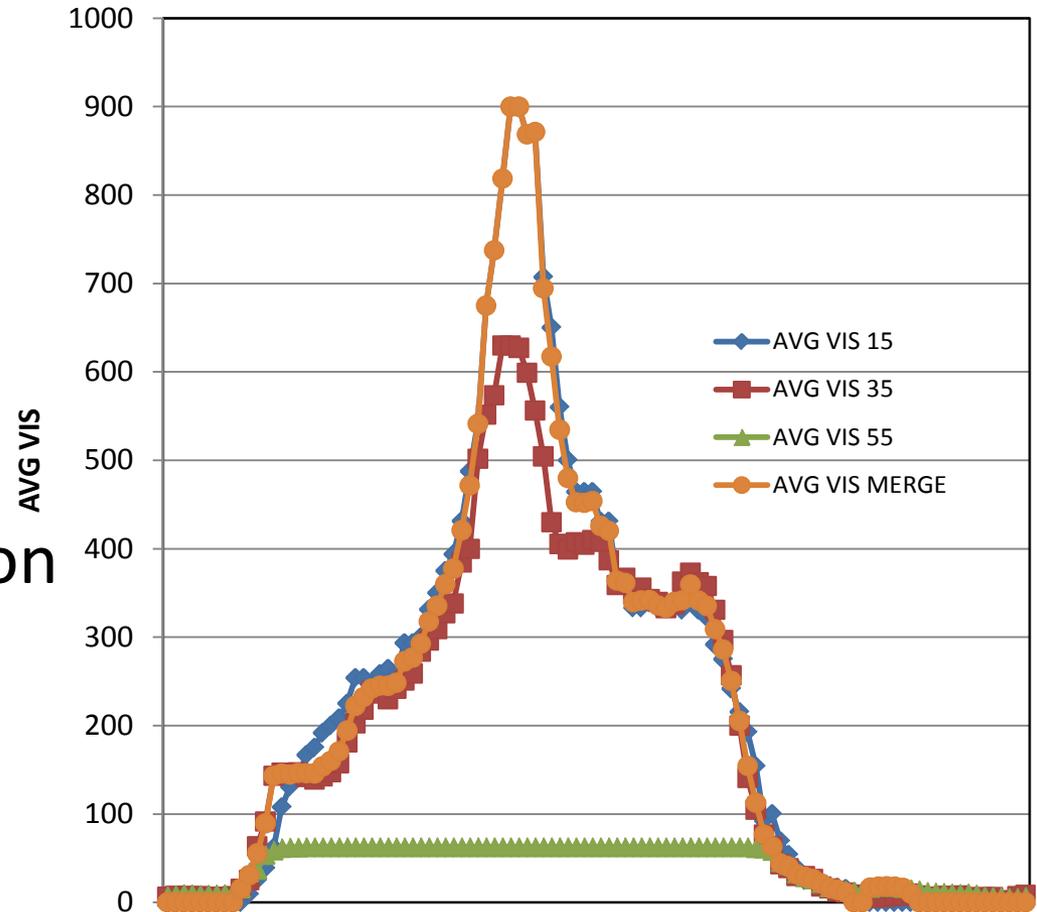


Merging Fixed Gain Data

FIXED GAIN	MULTIPLIER
15	100
35	10
55	1

- Weighted Mean
 - Number of observations
 - Proximity to saturation
- Smooth data may include saturated pixels

DENVER FIXED GAIN MERGED



Blending with Operational Data

Rio de Janeiro, Brazil F16 2006

- Fixed Gain products tend to have three flaws:
 - Insufficient coverage in some places
 - Anomalous events, such as fires, are included
 - Noise
- Blending with Operational data improves each of these issues.



RED – FG MERGED

GREEN – OPERATIONAL

BLUE - BLENDED



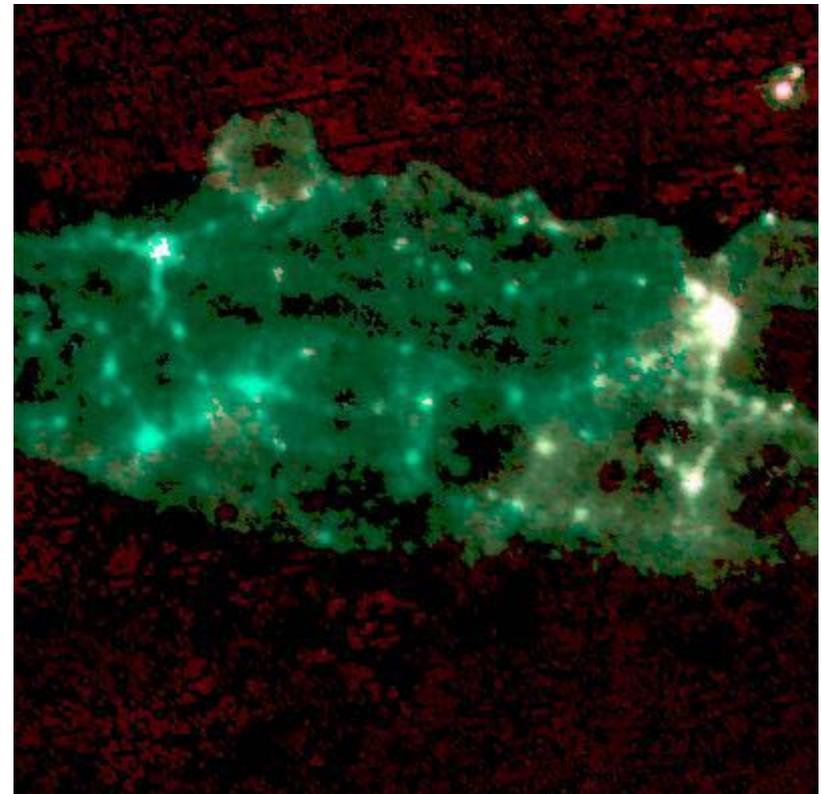
Match to the Nile Delta



Benefits of Blending

- Red water? Noise, boats, low coverage...
- Blue-Green land – low coverage due to clouds. Ops data fills in.
- Fires present

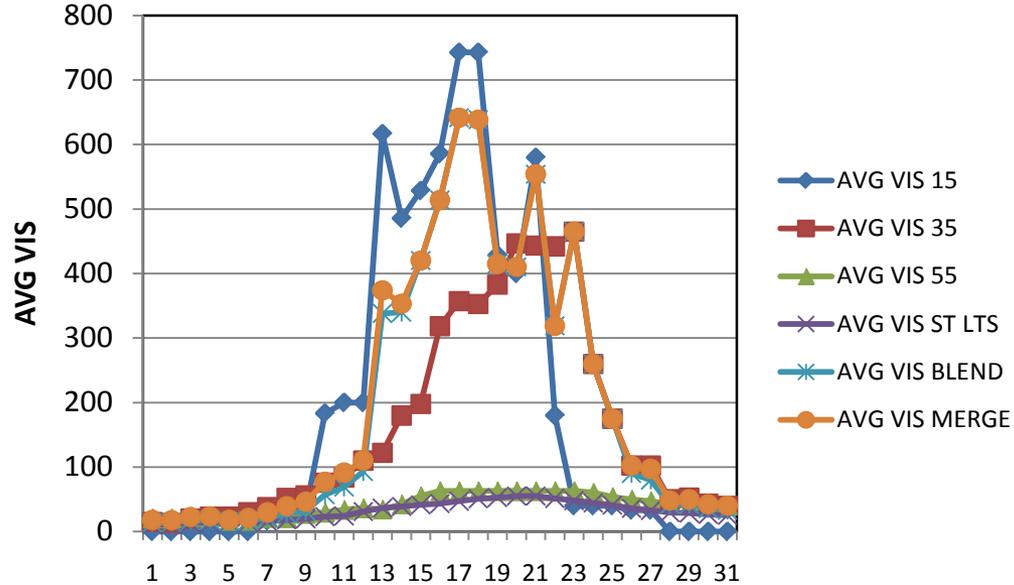
Java F12 1997



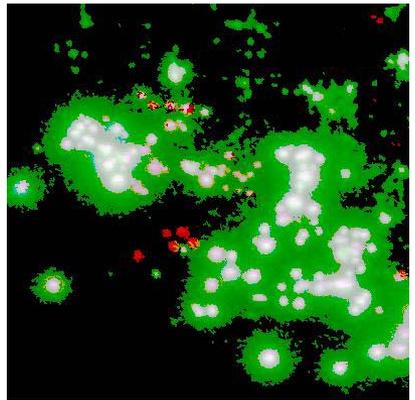
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Gas Flares



RED – FG MERGED
 GREEN – OPERATIONAL
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Products

SATELLITE	YEAR	STATUS
F12	1997	BETA
F12	1999	BETA
F12	2000	ALPHA
F14	2002	ALPHA
F14	2004	ALPHA
F16	2006	BETA

Next Steps

- Complete all years for which we have observations
- Intercalibrate to make a uniform time series
- Request more fixed gain data from satellite F16 (superseded by F18)
- Perform research utilizing the new information from unsaturated urban cores and gas flares.