Detection of Power Outages and Recovery Following Disaster Events: The Chilean Earthquake of 1 April 2014

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The Event

- 8.2 magnitude earthquake located 98 km NW of Iquique, Chile resulted in 2 meter waves
- Media reported power and phone outages along coastal areas
- The cities of Arica and Iquique reported widespread outages of electricity and phone service
- Nearly one million residents evacuated near the coast
- Estimated $100 million USD in damages
- At least 7 confirmed direct/indirect fatalities

VIIRS Day-Night Band (DNB)

- VIIRS DNB:
  - Band onboard the Suomi NPP satellite
  - Visible/Reflective band
  - Spectral resolution: 0.5 – 0.9 µm
  - Spatial resolution: 750 m
- Can detect light emitted from surface features (i.e., cities, boats, fires, etc.)
- Can also detect reflected moonlight from cloud tops and surface features
- When a disaster occurs, emitted light is often reduced due to loss of electrical power
- Differencing of pre- and post-event imagery can help identify changes in light emission within damaged regions
- As recovery occurs, light is restored, and pre-storm distribution of light returns

Case Studies: Arica & Iquique

- Estimating Affected Population
  - Oak Ridge National Laboratory produces a 30 arc-second (approx. 1 km²) global population grid known as the Landscale 2012 Global Population Data Set
  - By overlaying this grid with the difference product, SPoRT can estimate population affected and monitor recovery

DNB Difference Product

- SPoRT has developed a ‘percentage of normal emissions’ anomaly product
- Post event emissions are divided by pre-event levels to estimate percent of normal emissions following an event
- Color-coding allows for a stoplight chart which identifies change and monitors recovery
- This product allows for immediate identification of outage areas in cloud-free conditions

Conclusions/Future Work

- The NASA SPoRT Disasters Team has developed a technique to use the VIIRS DNB for identifying disaster impacts on human settlements
- A quantitative differencing product provides a regional view of light emission changes
- Subsequent additional satellite passes can monitor the rate of recovery as light emissions return to normal
- Estimates of affected inhabitants can be achieved via global population data sets
- Each city appeared to achieve near full recovery one week following the event
- Arica appeared to recover much quicker than Iquique; future work will strive to identify factors that influence rates of recovery
- Future work will also examine statistics of cloud-free DNB imagery to understand variability in emissions, useful in improving outage detection

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