Conclusions

Role of automation
Multiple sites would offer a range of opportunities for absolute calibration

- CEOS Working Group on Calibration and Validation is working to network such sites
- Provide predicted top-of-atmosphere reflectance to user community
- Goal for distribution of data is late 2016
RadCalNet Data Processing

Site 1
Raw measurements ➔ Calibration & QC & Processing ➔ Surface reflectance and atmosphere products (RadCalNet specific)

Site 2
Raw measurements ➔ Calibration & QC & Processing ➔ Surface reflectance and atmosphere products (RadCalNet specific)

RadCalNet processing & QC

Hyperspectral TOA reflectance @ 30 mn interval for nadir view

RadCalNet portal
RadCalNet Sites

- Three sites proposed for initial demonstration of network
  - Railroad Valley Playa (RVUS) [NASA]
  - La Crau (LCFR) [CNES]
  - Baotou (BTCN) [AOE]
- Fourth site identified and in process of being instrumented
  - Gobabeb (GBNA) [NPL]
Railroad Valley Playa, US

- 4 radiometers (GVRs) + sun photometer + met station
- Surface type: dry lakebed
- U.Ariz. has 20+ years working experience on the site
- Site operational with data set via sat link
On-site instrumentation includes Cimel sun photometer, Satellite communication uplink, 4 ground-viewing radiometers (GVRs), Meteorological station.
Four-radiometer case

Analysis of location of present four radiometers show an average that is 3.4% lower than full site

- Average value for 100 sets of four randomly placed radiometers
  - Average percent difference is 0.04% from average of entire site
  - Standard deviation (1σ) is 1.9%
- All cases were within ±5% of full-site average
Vary number of radiometer locations from 1 to 20

- Randomly selected pixel agrees with entire site to better than 10%
- Four radiometers produces the same uncertainty as 20 radiometers
- Evaluation only examined the panchromatic band
- Further work with more scenes and multispectral data
Gobabeb, Namibia

- Instrumentation: A photometer (model similar to La Crau) was purchased and fully characterised by NPL and met station
- Surface type: sparse dry grass and gravel/sand
- Mid-2016: install instrumentation at site
Automated approach is the University of Arizona’s RadCaTS site

- Agreement between people on site and no personnel present is very good

**Railroad Valley, NV example**

**Landsat 8 OLI example**

**TOA Spectral Radiance**

**TOA Reflectance**

- Percent Difference in TOA Spectral Radiance (Measured – OLI/OLI)
- Percent Difference in TOA Spectral Reflectance (UA – OLI/OLI)

- RadCaTS
- On-site personnel
Method has been applied to multiple sensors

Terra and Aqua MODIS as well as S-NPP VIIRS are shown here

MODIS land bands (1-7)

S-NPP VIIRS
Networked results will subset full data

Absolute, SI-traceable uncertainties will be documented

- Top-of-atmosphere reflectance for a nadir view at 30-min intervals will be available
  - 10-nm spectral sampling
  - Currently being tested for 50-m spatial areas
- Satellite sensors need only collect imagery of a site
  - Lowest uncertainties for nadir or near-nadir views
  - Corrections for off-nadir cases could be developed
- Expect <3% uncertainty for nadir view, low aerosol, high to moderate resolution sensors
Networked results match exact calculations

Sites are selected to minimize uncertainties from the network’s spectral and temporal sampling.
Network results for RRV Playa site

Non-coincident data with >4 collections for each sensor

- Three separate sensors have been used with network results to date
- Also useful for individual calibration of a given sensor
RadCalNet: Multiple Sensors at Single Site
RadCalNet: Single Sensor at Multiple Sites

TOA Reflectance Ratio (RadCalNet/OLI)

RVUS  LCFR

Wavelength (nm)
Collaborative effort between NPL and each site group in assessing quantitative uncertainties.
Automated sites allow us to switch from sensor-centric to SI-traceable source-centric

- A calibration network provides an additional tool
- In situ methods provide an SI-traceable, absolute calibration
- Automated collections ensure data are available when sensor views site
  - No need to coordinate with ground groups
  - No need for site managers to see the imagery
- Expected expansion will give more global coverage
- Well suited for expected rise in large number of imagers expected over next decade
- Plans are to have the network available this time next year