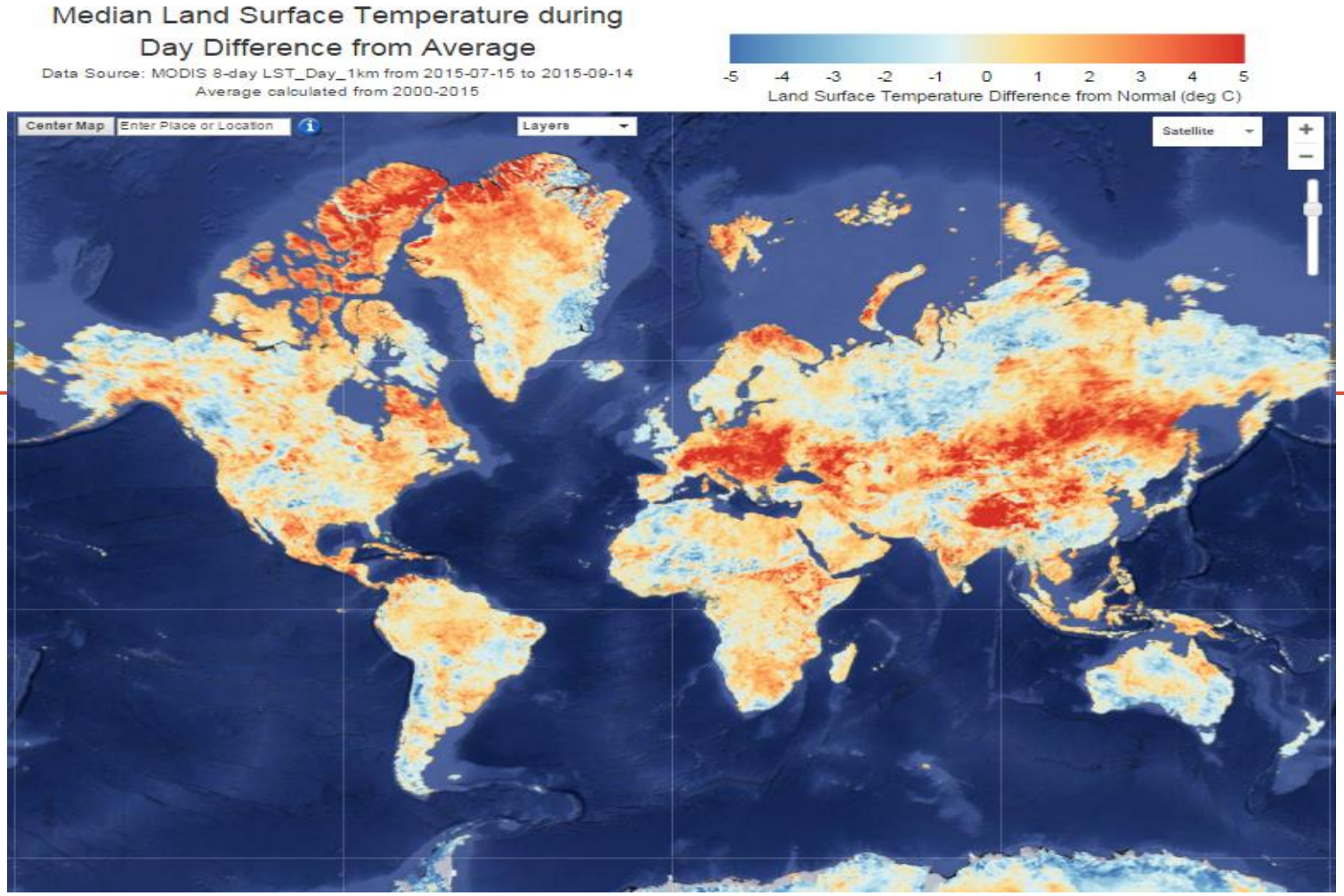
ClimateEngine.org

CLOUD COMPUTING AND VISUALIZATION OF CLIMATE AND REMOTE SENSING DATA

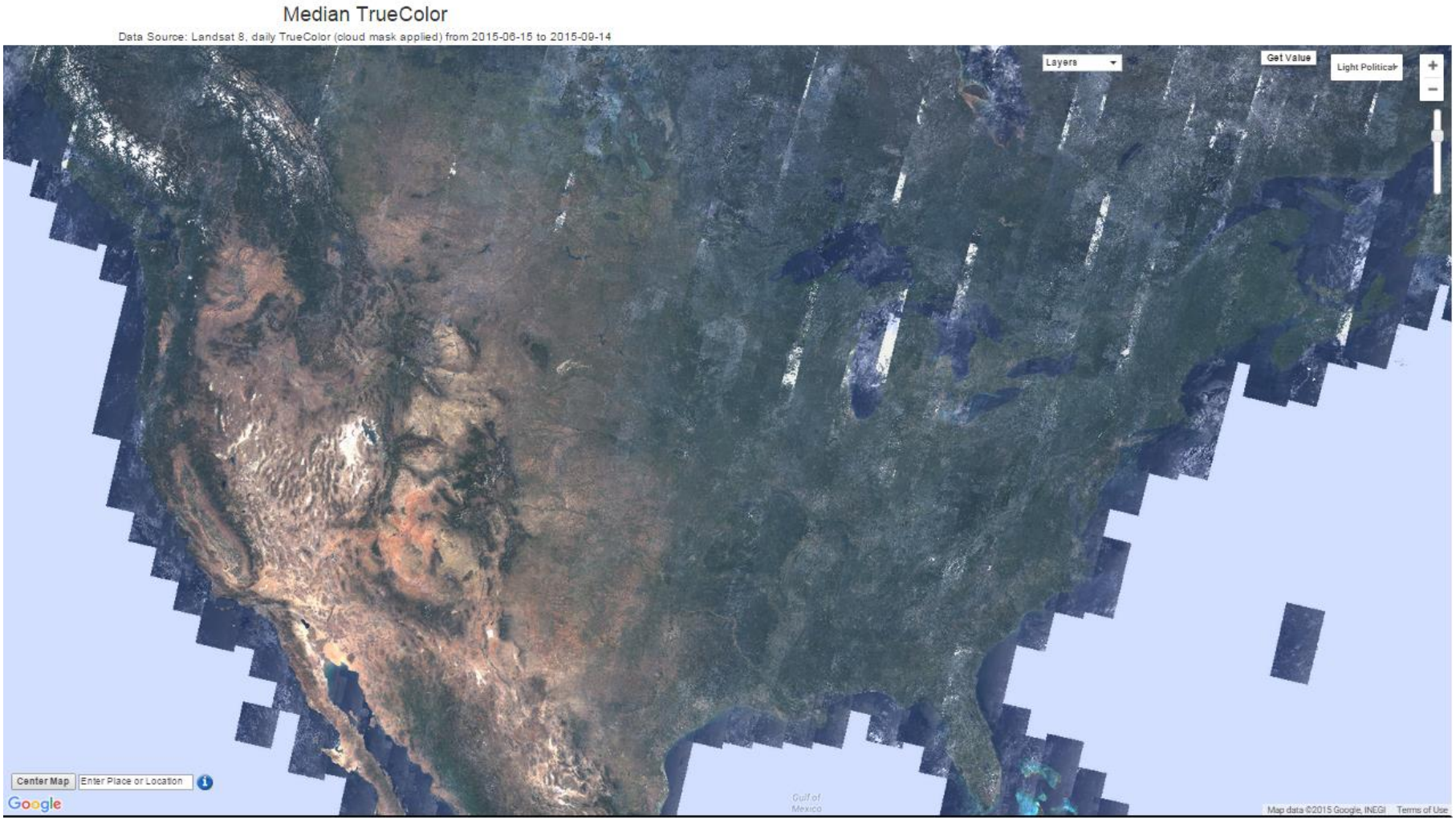


Justin Huntington, Desert Research Institute

2015 International Workshop on Evapotranspiration for Water Security September 15-17, The World Bank

ClimateEngine.org

- Climate Engine is a free web application that allows users to access and process global climate and remote sensing archives in the cloud



Landsat 8 true color composite for last 90 days

How We Started, Motivation, Our Team

How We Started

- Our project was funded through a Google Faculty Research Award in Summer of 2014

Motivation

- Develop a web application that allows the public to freely visualize global and place based maps and time series of climate and remote sensing archives together and in near real-time, for climate, drought, and vegetation, analyses, and most importantly, ***data discovery***

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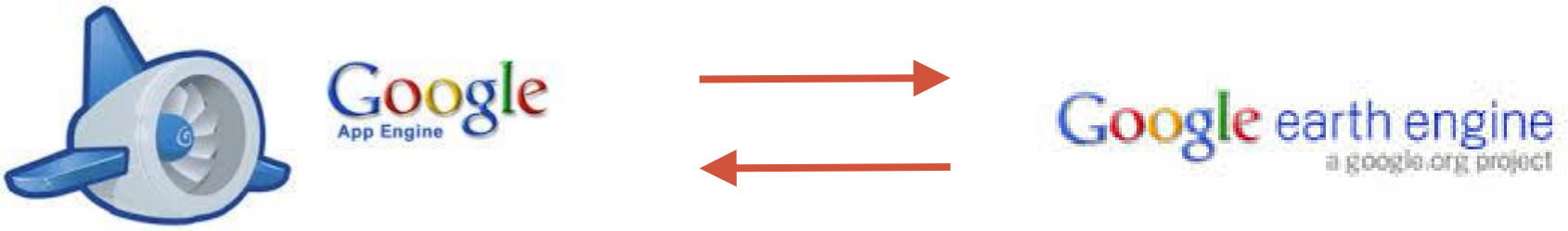
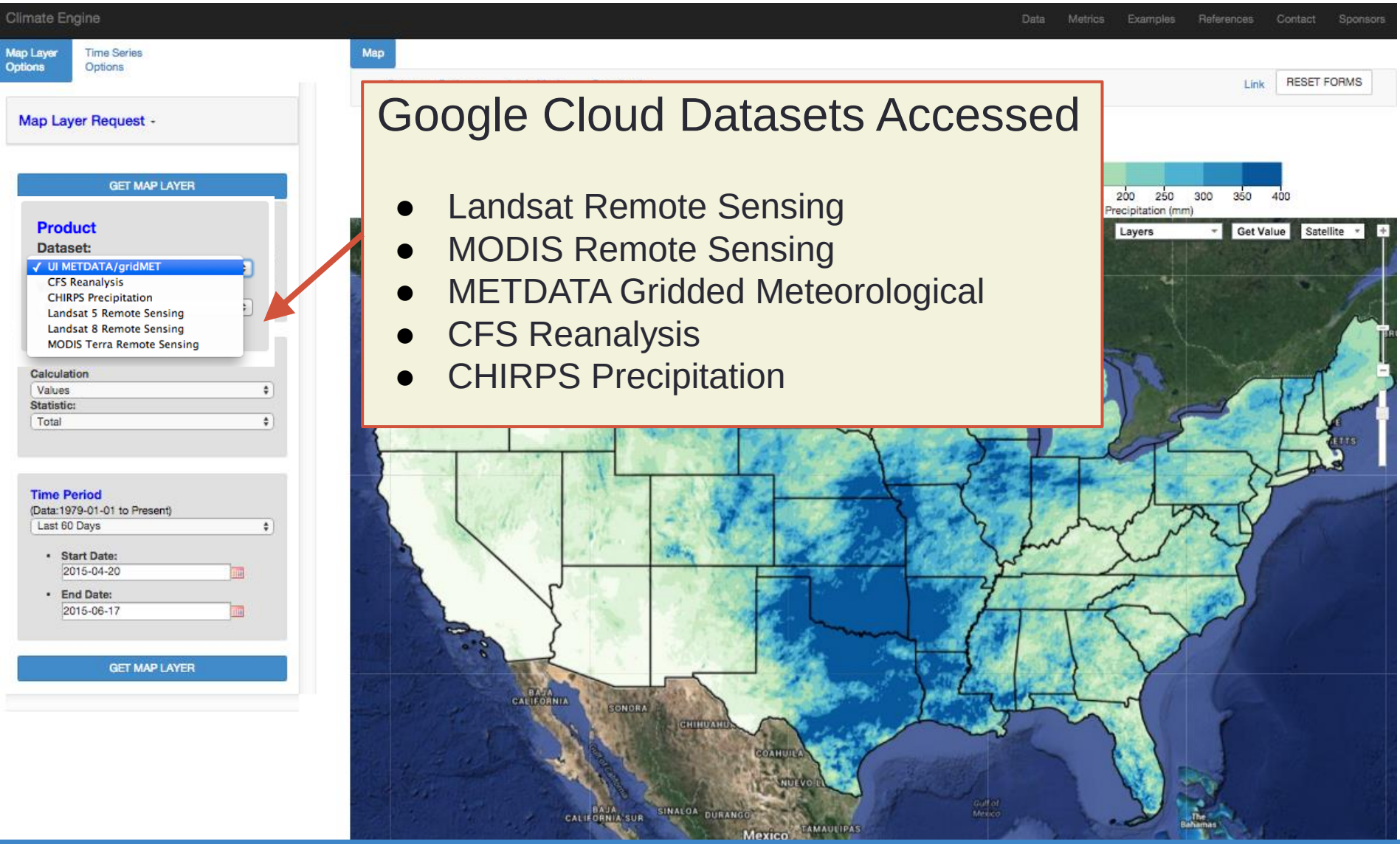
- Web application relies on Google App Engine, Google Maps API, and Google Earth Engine
- Google App Engine is linked to Google Earth Engine through the Python API and allows for on demand parallel cloud computing
- Users input collection and time parameters -> Google App Engine passes these parameters to Google Earth Engine -> results return to Google App Engine



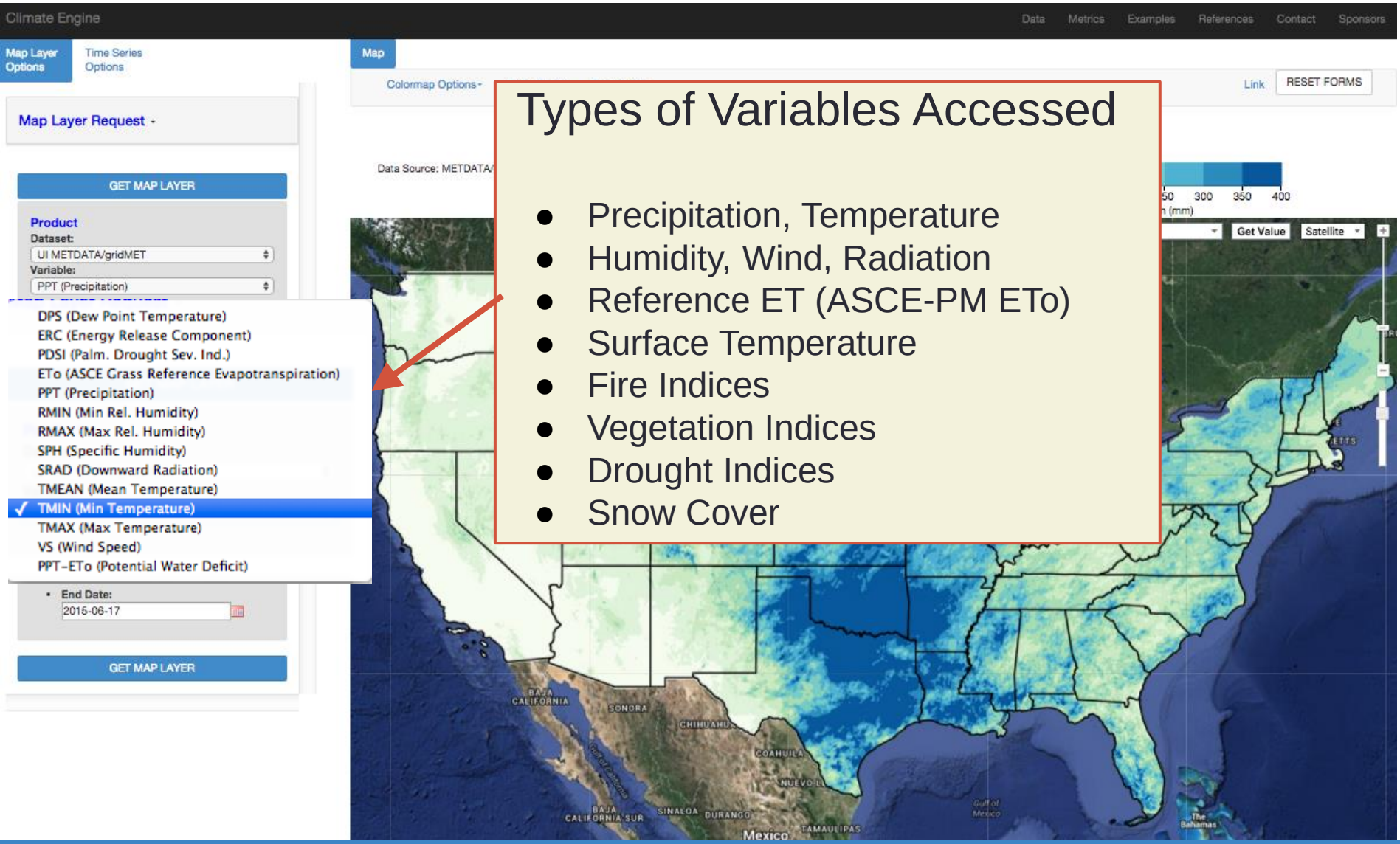
Google Cloud Datasets



Google Cloud Datasets Accessed

- Landsat Remote Sensing
- MODIS Remote Sensing
- METDATA Gridded Meteorological
- CFS Reanalysis
- CHIRPS Precipitation

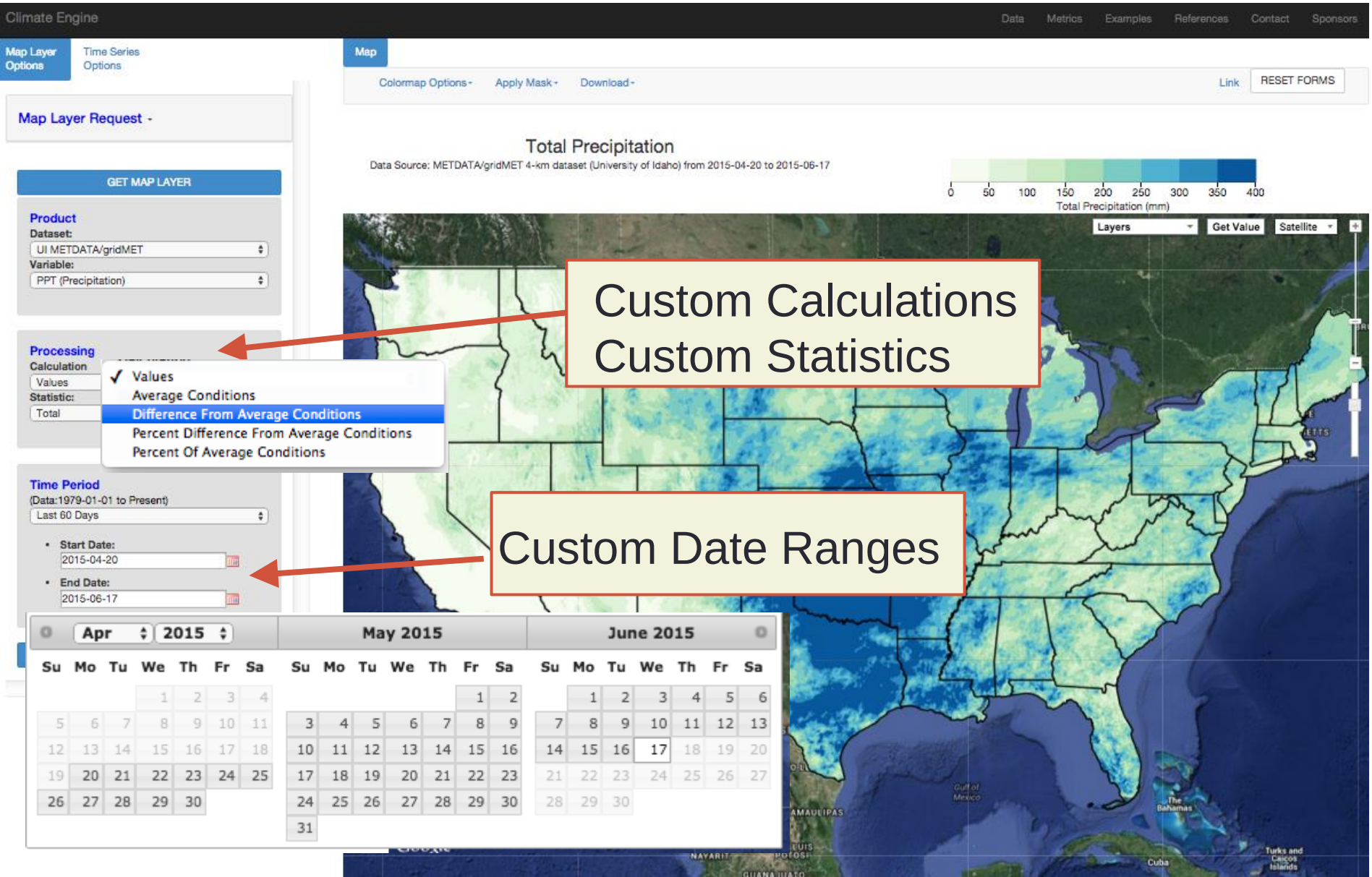
Variables Accessed



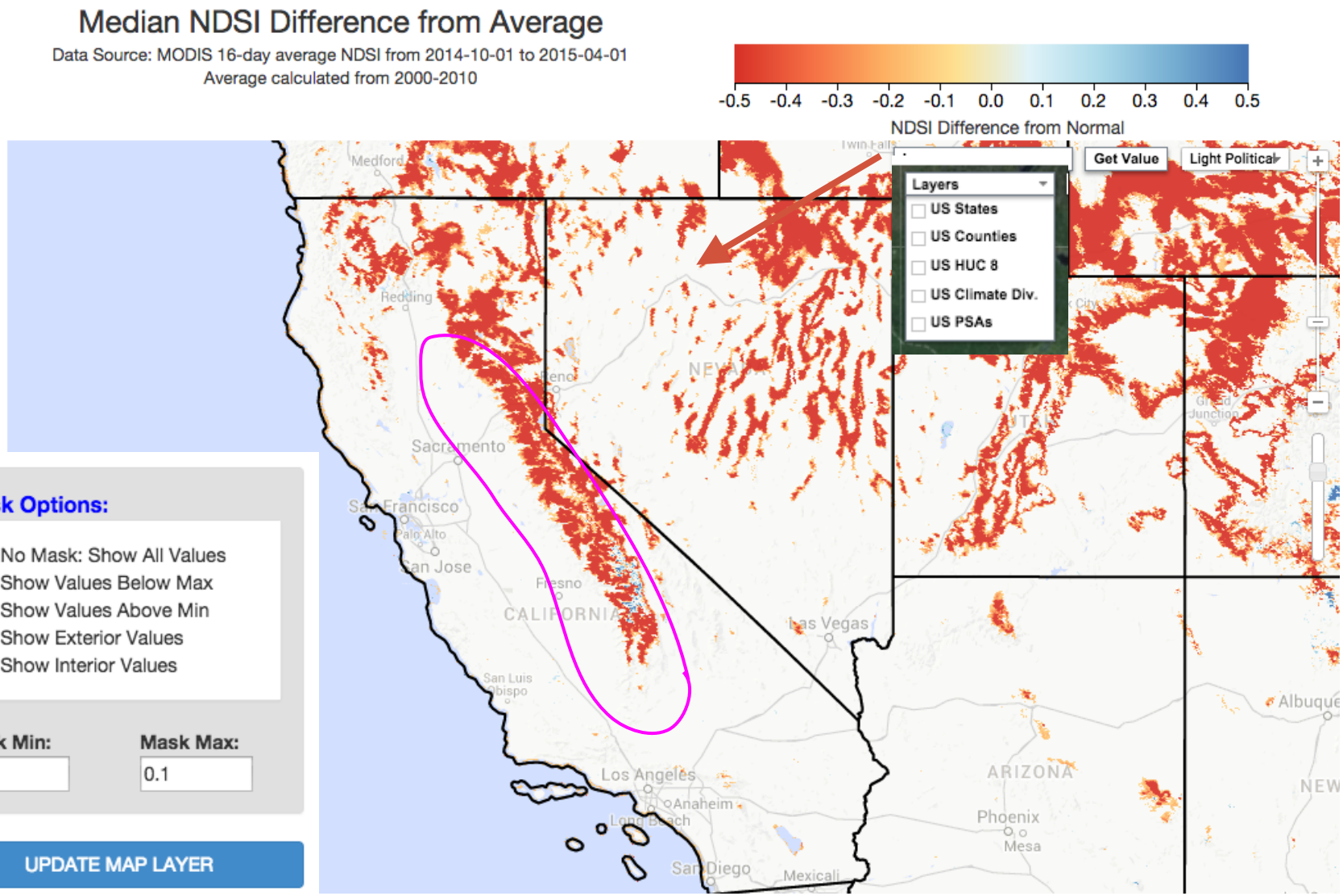
Types of Variables Accessed

- Precipitation, Temperature
- Humidity, Wind, Radiation
- Reference ET (ASCE-PM ETo)
- Surface Temperature
- Fire Indices
- Vegetation Indices
- Drought Indices
- Snow Cover

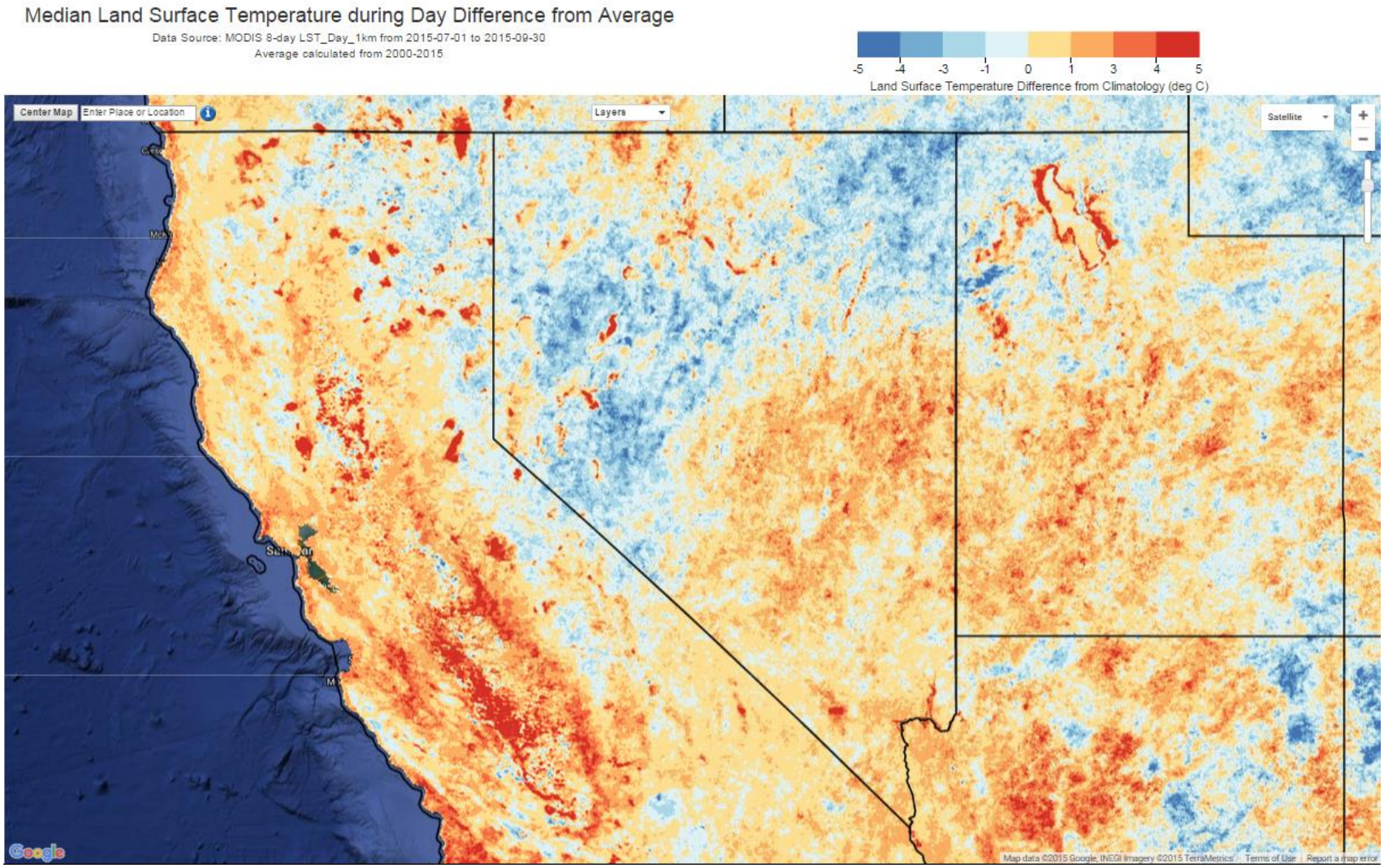
Custom Interface



Application: 2015 Sierra Nevada Snowpack

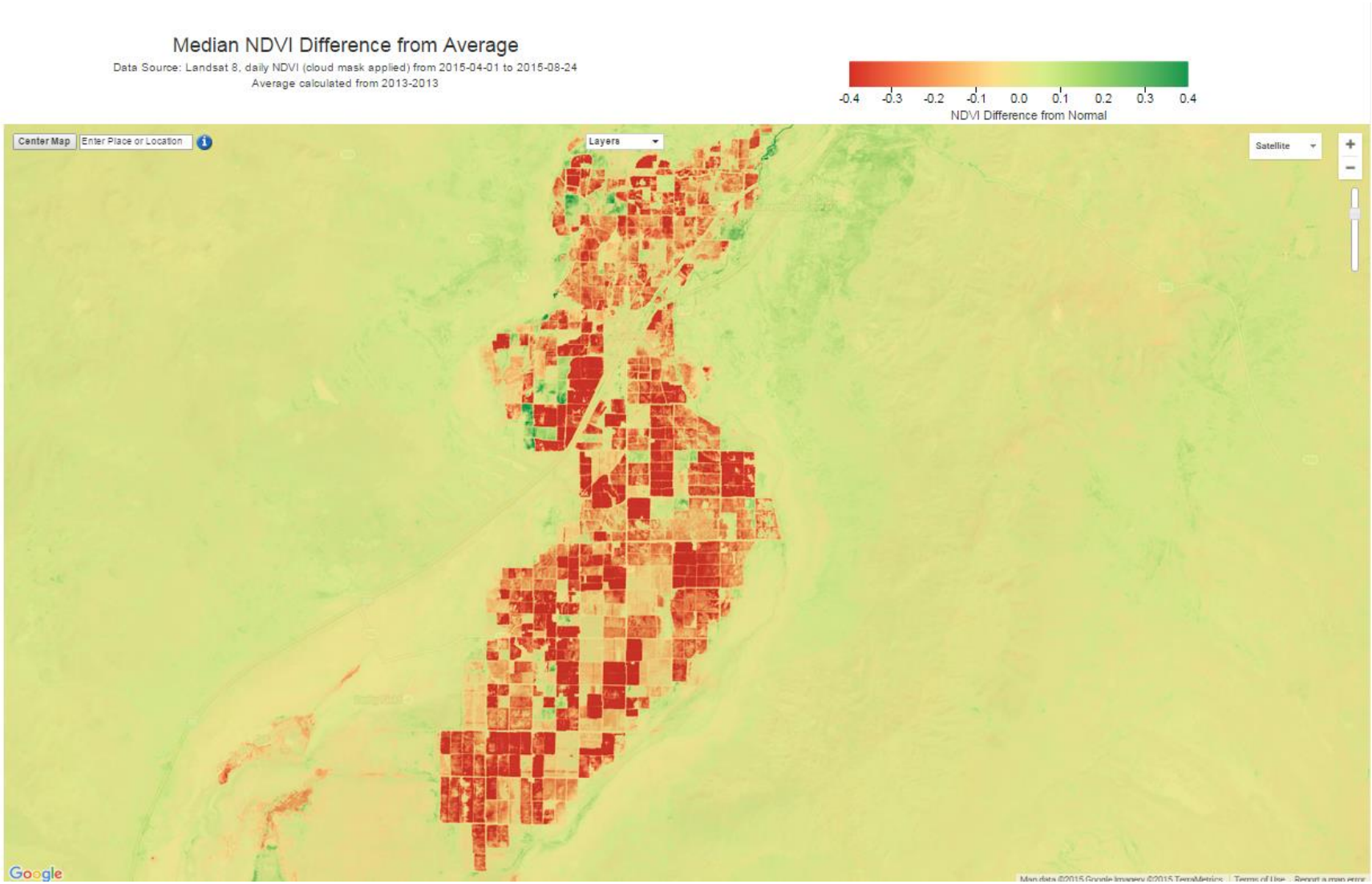


Application: 2015 Western US Drought



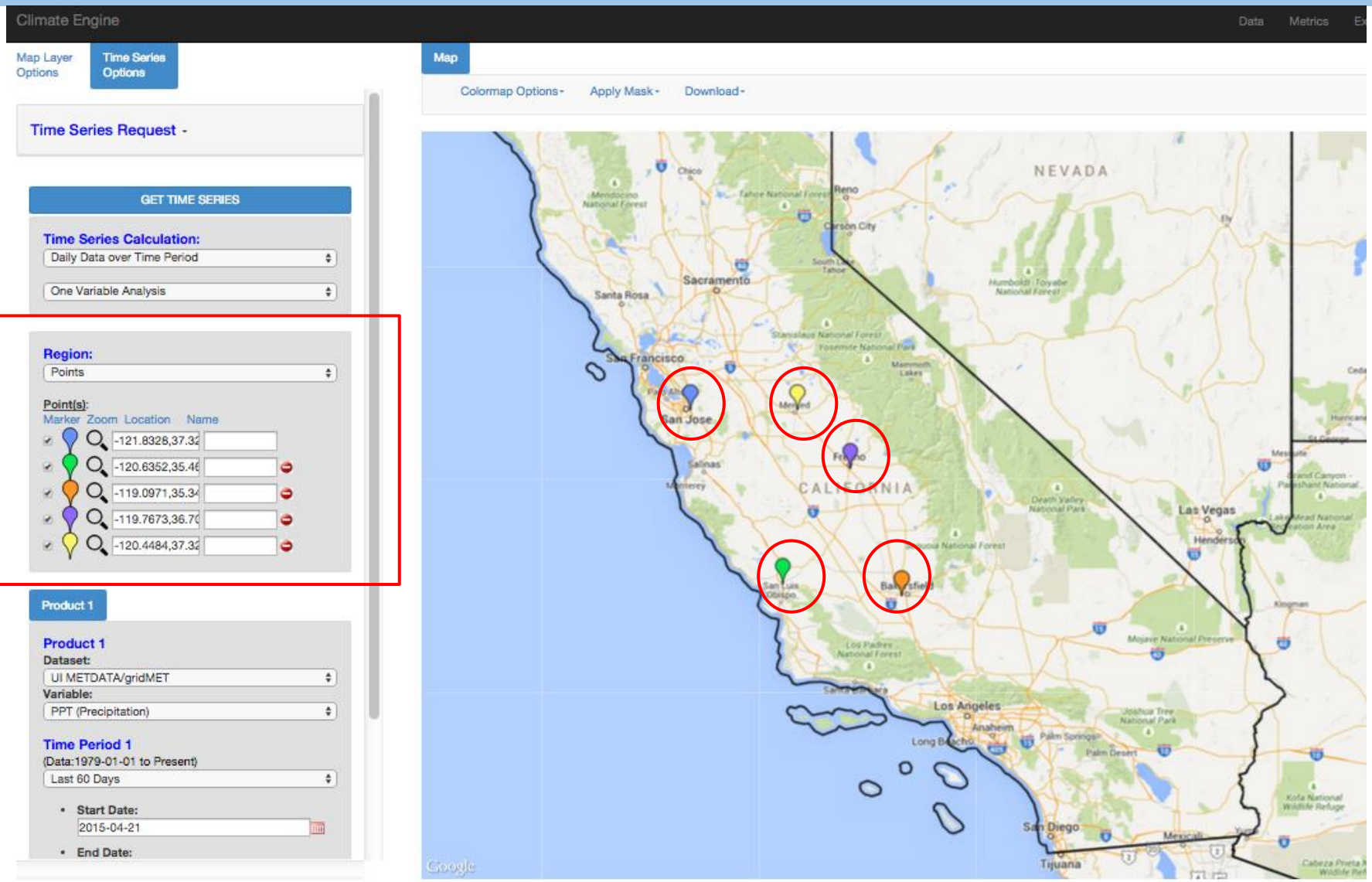
MODIS Surface Temperature Anomaly for July – Sept, 2015 -- http://bit.ly/1MdPNHD

Application: 2015 Nevada Drought



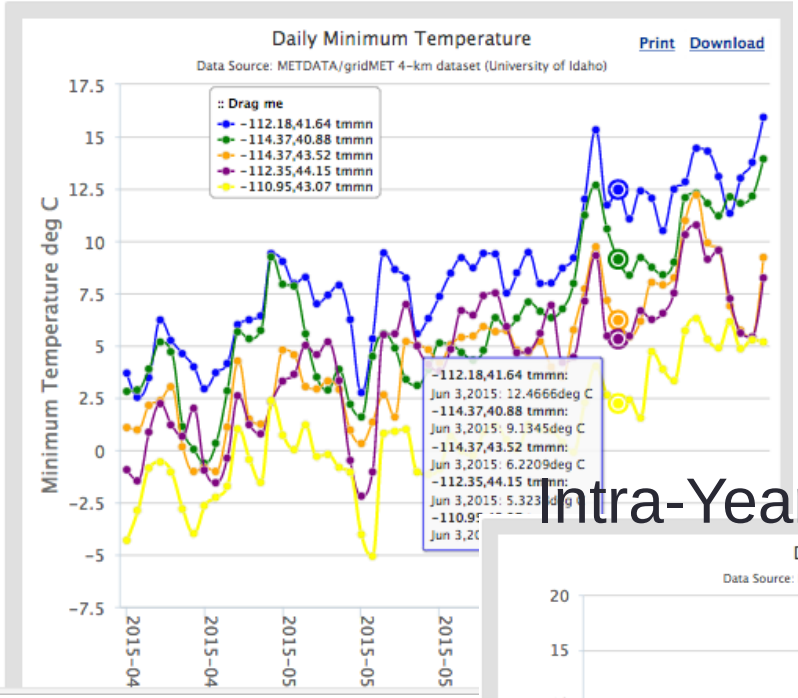
Landsat 8 Difference from Average Conditions – April – August, 2015

Point Locations

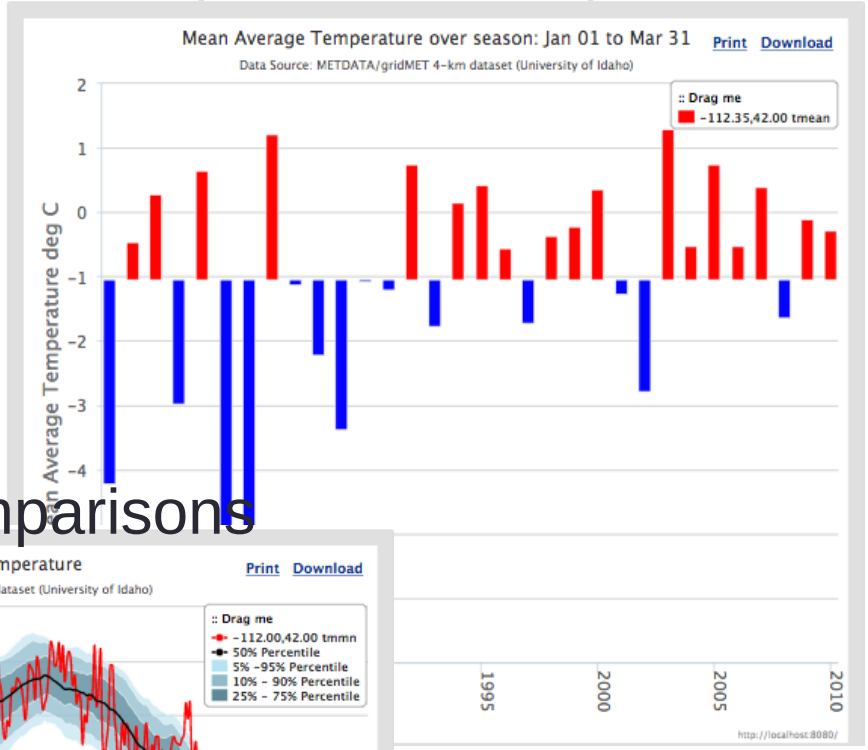


Time Series Analysis

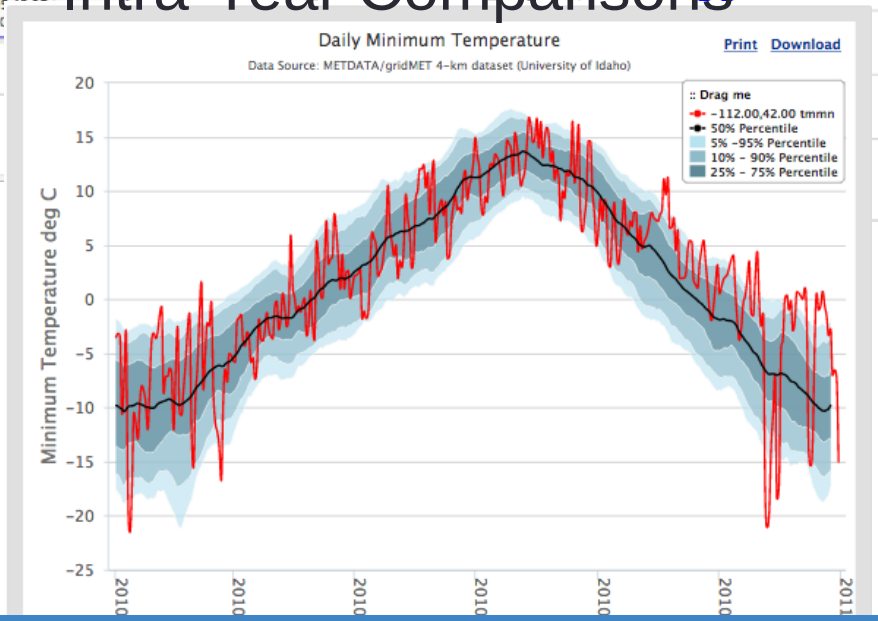
Multiple-Region Comparisons



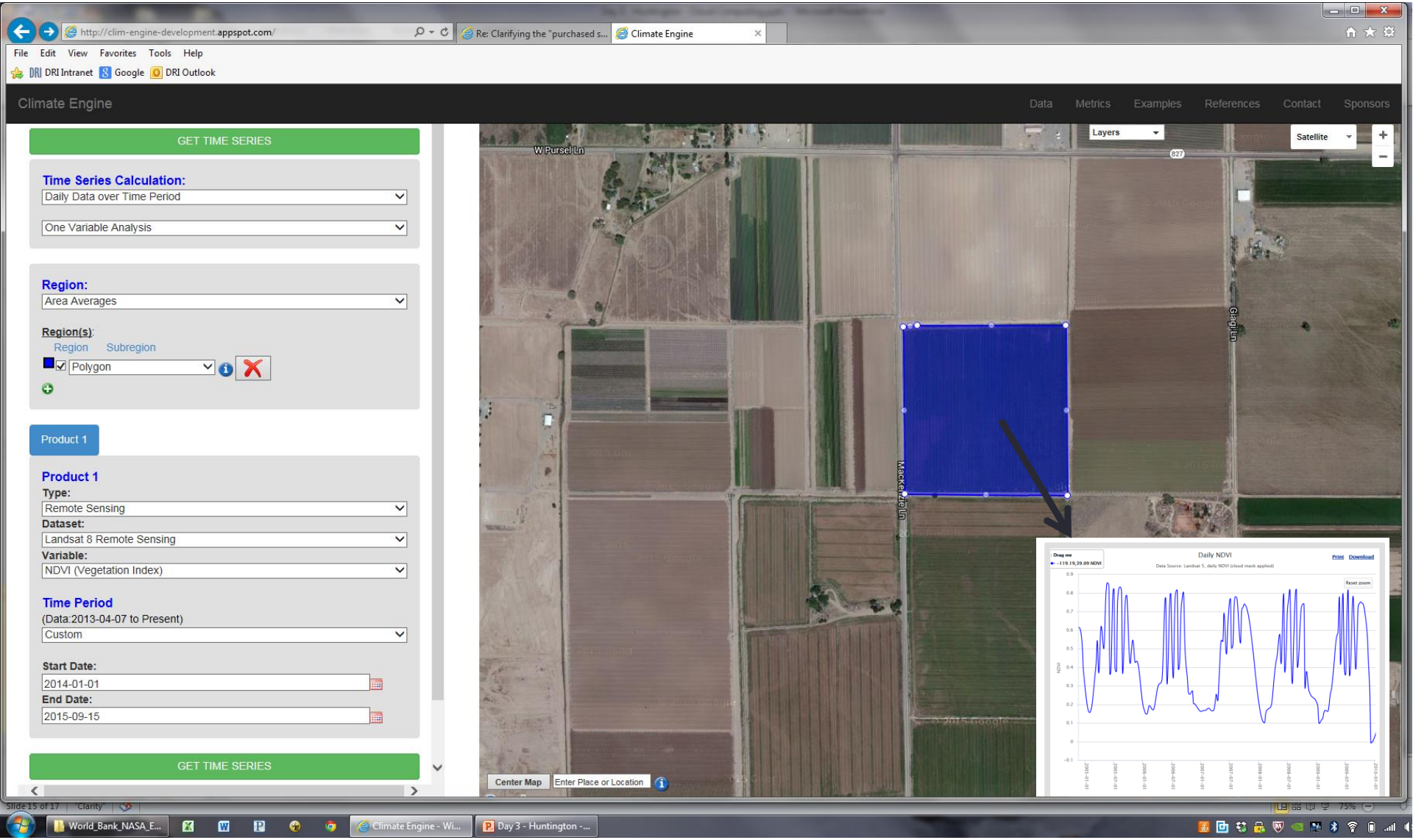
Multiple-Year Comparisons



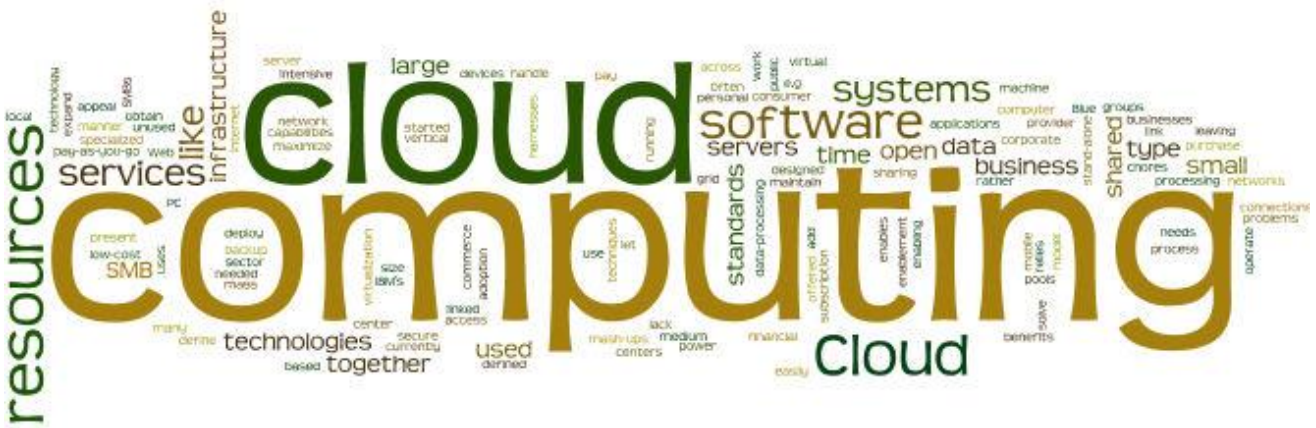
Intra-Year Comparisons



Point and Area Averages



Summary



- Creating never imagined opportunities for climate and remote sensing data discovery and applications
- Allowing easy access to data and products (developing countries, students, professors, managers, economists)
- Amazing teaching and learning tool

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Some Nevada Example Links

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  The following links make maps of Landsat 8 difference in NDVI between the growing seasons of 2015 and 2013. The more you zoom and pan around the more data it pulls and computes on the fly J - Use the transparency bar on the right to fade in and out to see the background image for perspective.

  Fallon – you can really see the field scale impacts of limited irrigations.. Also Lahontan Reservoir looks like a golf course because it is so full of grass instead of water..
  http://bit.ly/1K4dVz1

  Carson, Smith, & Mason Valley - You can clearly see where sub-irrigated areas on the west side of Carson Valley have above average greenness, and below average greenness in the down gradient flood irrigated and riparian areas. You can also see the combined effects of the fallowing / water right buyout program and drought in Mason Valley. Notice that many fields haven't been that impacted by the drought due to supplemental groundwater pumping.
  http://bit.ly/1Lxd3A1

  Lovelock – you can clearly see what a 0% water delivery year looks like in terms of alfalfa yields… too bad their groundwater is too salty to pump and use for irrigation water… it is probably the one place in Nevada where supplemental pumping would have minimal impact to surface water rights and the environment.. Also, notice the greener than normal rangeland areas to the north of Lovelock.
  http://bit.ly/1NInbsb

  Porter Canyon - you can see that the meadow area is quite dry this year; also the PJ uplands look stressed too..
  http://bit.ly/1hfXS3N

  Smith Creek Ranch – next door to Porter – you can see how the riparian areas along Smith Creek, and the ranch downstream have been stressed this growing season
  http://bit.ly/1EjyJzL

  Statewide 2015 growing season MODIS NDVI difference from the long term average (2001-2014). Lots of cool things to see in this image; green rangelands in Northern Nevada, irrigated areas are dry (red), recent fire scars in California and at Mt. Charleston in S. Nevada (red).. just to name a few interesting features..
  http://bit.ly/1fGT0DJ

  Same as above but for surface temperature. Amazing all the features that are in this surface temperature anomaly map, and how the features are tied to the current hydrologic drought, spring and summer rains, fires, and irrigation management. This tells a beautiful story of the average land surface energy balance for the last few months :)
  http://bit.ly/1NIrMui

  The beauty of all this cloud mapping stuff is that it is scalable across the globe and serves as such a great teaching tool.