MIIC Server-side Filtering Outline

1. **DEMO Web User Interface (leftover from last meeting)**
2. **VIIRS SDR Tuple and 2Dhistogram MIIC Server-side Filtering**
3. **L2 CERES SSF OPeNDAP dds structure (*dim_alias* and *fixed_dim)***
4. **Cloud Object Filtering – Comparison to CERES Cloud Object Database**
5. **Large Batch Filtering runs – use MIIC REST ICPlans**
6. **Server-side Filtering Design (Aron)**

MIIC Server-side Tuple Filtering

wget -q
'dataserver2.larc.nasa.gov:8080/opendap/hyrax/VIIRS/NPP/03110/2013/224/NPP_VIMD_SS.A2013224.0605.P1_03110.2014130070042.hdf.nc?tuple(DIM_FORMAT,define_filter_var(Longitude_Sub,68.0,123.),define_filter_var(Latitude_Sub,38.0,65.0),define_var(SolarZenithAngle_Sub),define_var(Latitude_Sub),define_var(Longitude_Sub),define_var(Radiance_I1_Avg),define_var(BrightnessTemperature_I5_Avg),define_filter_var(BrightnessTemperature_I5_Avg,0,65530))' -O VIIRS_Global_Tuple_Filter.nc

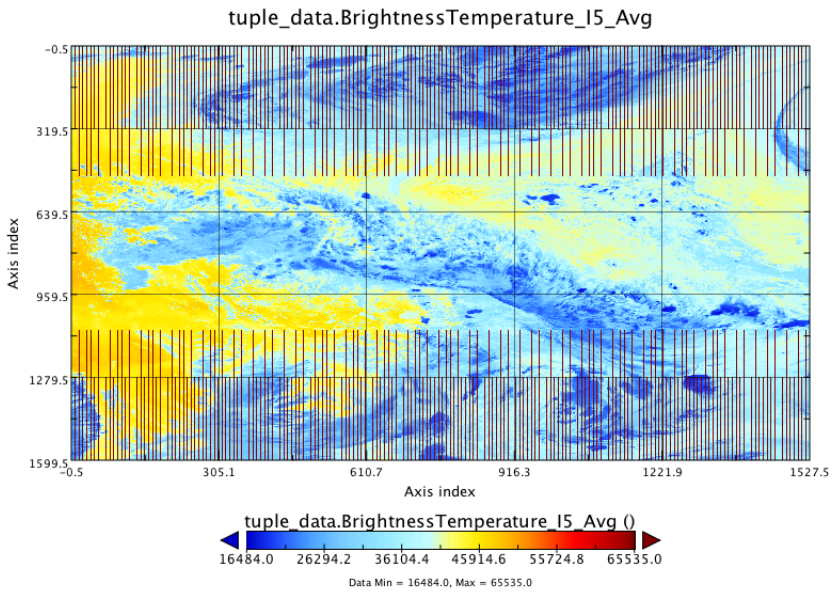


Figure 1. VIIRS SDR Tuple Brightness Temperature filter to exclude "bowtie" fill value (65533); set fill value (65535) correctly.

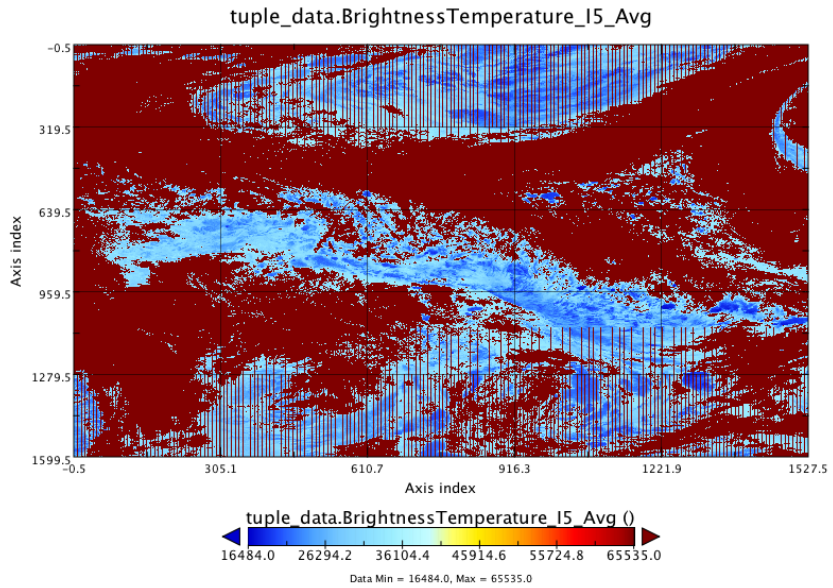


Figure 2. VIIRS SDR Tuple Brightness Temperature filter to exclude pixels >35000 counts; filtered data correctly set to fill value.

MIIC Server-side 2DHistogram Filtering

wget -q
'dataserver2.larc.nasa.gov:8080/opendap/hyrax/VIIRS/NPP/03110/2013/224/NPP_VIMD_SS.A2013224.0605.P1_03110.2014130070042.hdf.nc?histogram_2d_avg(x_axis(Longitude_Sub,68.0,123.,100.0,-180.,180.),y_axis(Latitude_Sub,38.0,65.0,100.0,-90.,90.),define_var(SolarZenithAngle_Sub),define_var(Latitude_Sub),define_var(Longitude_Sub),define_var(Radiance_I1_Avg),define_var(BrightnessTemperature_I5_Avg),define_filter_var(BrightnessTemperature_I5_Avg,0,65530))' -O
VIIRS_Global_Histo_Filter.nc

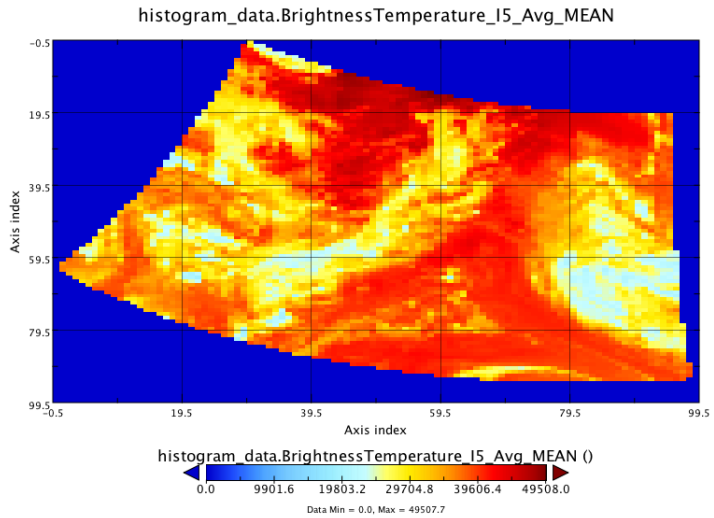


Figure 1. MIIC Server-side 2Dhistogram Brightness Temperature Filter for VIIRS SDR; excludes "bowtie" fill value (65533); max. bin value 49508; need to set bins with no data to fill value (not 0).

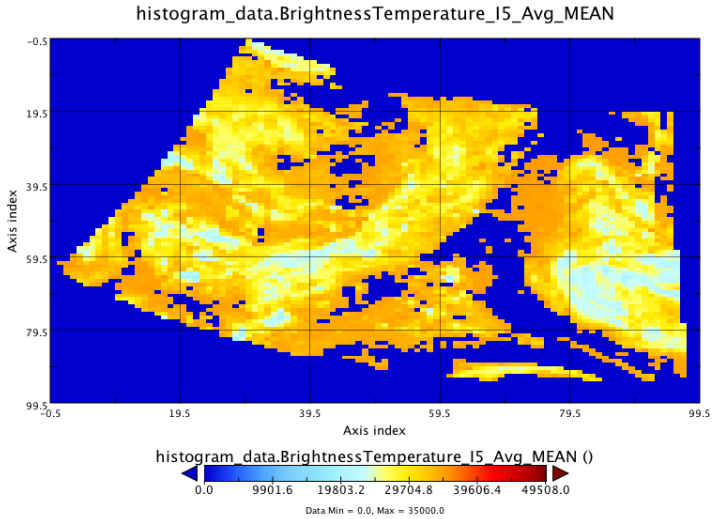


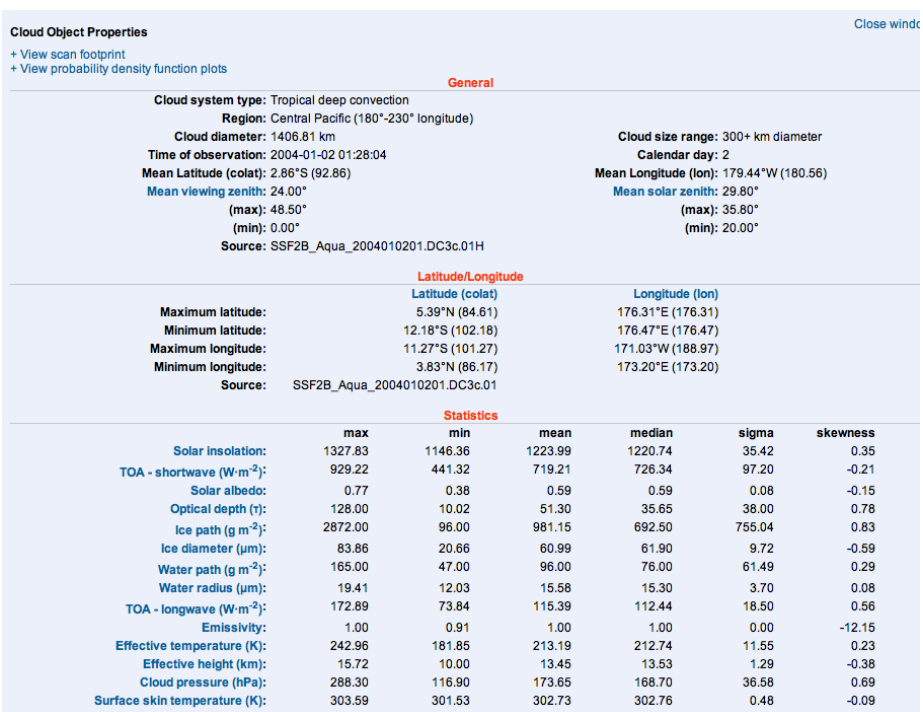
Figure 2. MIIC Server-side 2Dhistogram Brightness Temperature filter 19000-35000 (range of data to keep); set color bar max. scale to 44508 to compare with figure 1. Filter settings determine range of raw data binned.

MIIC query results vs. CERES Cloud Object database

Reference – CERES Satellite Cloud Object Database

The satellite data in this database are from the Single Scanner Footprint (SSF) data set from NASA's Clouds and the Earth's Radiant Energy System (CERES) / Tropical Rainfall Measurement Mission (TRMM) for the data period from January to August 1998 and March 2000. Similar datasets for both NASA Terra satellite from March 2000 to February 2002 and NASA Aqua satellite from July 2002 to June 2004 are also available.

http://cloud-object.larc.nasa.gov



Cloud Object Properties Close windo

+ View scan footprint
+ View probability density function plots

General

Cloud system type:	Tropical deep convection		
Region:	Central Pacific (180°-230° longitude)		
Cloud diameter:	1406.81 km	**Cloud size range:**	300+ km diameter
Time of observation:	2004-01-02 01:28:04	**Calendar day:**	2
Mean Latitude (colat):	2.86°S (92.86)	**Mean Longitude (lon):**	179.44°W (180.56)
Mean viewing zenith:	24.00°	**Mean solar zenith:**	29.80°
(max):	48.50°	**(max):**	35.80°
(min):	0.00°	**(min):**	20.00°
Source:	SSF2B_Aqua_2004010201.DC3c.01H		

Latitude/Longitude

	Latitude (colat)	Longitude (lon)
Maximum latitude:	5.39°N (84.61)	176.31°E (176.31)
Minimum latitude:	12.18°S (102.18)	176.47°E (176.47)
Maximum longitude:	11.27°S (101.27)	171.03°W (188.97)
Minimum longitude:	3.83°N (86.17)	173.20°E (173.20)
Source:	SSF2B_Aqua_2004010201.DC3c.01	

Statistics

	max	min	mean	median	sigma	skewness
Solar insolation:	1327.83	1146.36	1223.99	1220.74	35.42	0.35
TOA - shortwave ($W \cdot m^{-2}$):	929.22	441.32	719.21	726.34	97.20	-0.21
Solar albedo:	0.77	0.38	0.59	0.59	0.08	-0.15
Optical depth (τ):	128.00	10.02	51.30	35.65	38.00	0.78
Ice path ($g\ m^{-2}$):	2872.00	96.00	981.15	692.50	755.04	0.83
Ice diameter (μm):	83.86	20.66	60.99	61.90	9.72	-0.59
Water path ($g\ m^{-2}$):	165.00	47.00	96.00	76.00	61.49	0.29
Water radius (μm):	19.41	12.03	15.58	15.30	3.70	0.08
TOA - longwave ($W \cdot m^{-2}$):	172.89	73.84	115.39	112.44	18.50	0.56
Emissivity:	1.00	0.91	1.00	1.00	0.00	-12.15
Effective temperature (K):	242.96	181.85	213.19	212.74	11.55	0.23
Effective height (km):	15.72	10.00	13.45	13.53	1.29	-0.38
Cloud pressure (hPa):	288.30	116.90	173.65	168.70	36.58	0.69
Surface skin temperature (K):	303.59	301.53	302.73	302.76	0.48	-0.09

Figure 1. Statistics summary for one DCC cloud object

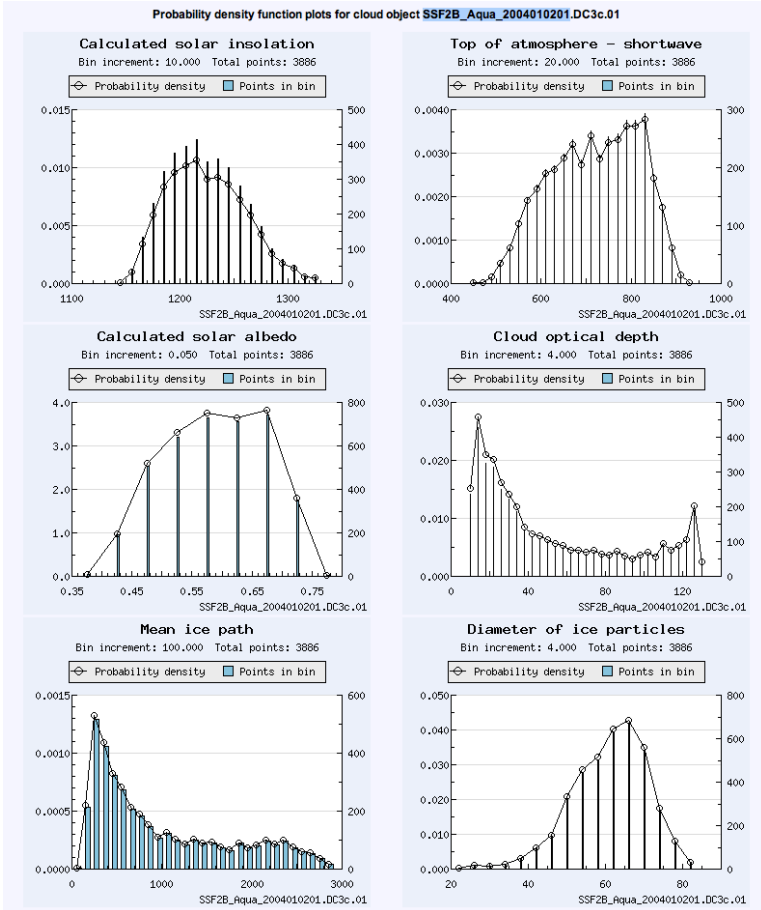


Figure 2. Cloud object sample histograms

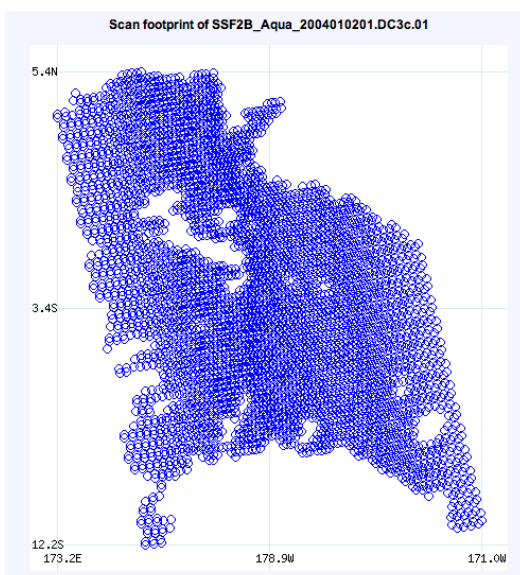


Figure 3. DCC Cloud object CERES FOV locations

MIIC Cloud Object Results (*very preliminary results w/ ExprTk lib.*)

http://dataserver2.larc.nasa.gov:8080/opendap/hyrax/CERES/SSF/Aqua-FM3-MODIS_Edition3A/2004/01/CER_SSF_Aqua-FM3-MODIS_Edition3A_300301.2004010201.ascii?tuple(DIM_FORMAT,dim_alias(Footprints__FOV_,Footprints),define_var(Cloudy_Footprint_Area_Mean_cloud_effective_height_for_cloud_layer),define_var(Time_and_Position_Colatitude_of_CERES_FOV_at_surface),define_filter_var(Time_and_Position_Colatitude_of_CERES_FOV_at_surface,65.,115.0),define_var(Time_and_Position_Longitude_of_CERES_FOV_at_surface),define_var(TOA_and_Surface_Fluxes_CERES_SW_TOA_flux___upwards),define_var(TOA_and_Surface_Fluxes_CERES_LW_TOA_flux___upwards),define_var(Viewing_Angles_CERES_viewing_zenith_at_surface),define_var(Viewing_Angles_CERES_solar_zenith_at_surface),define_var(Clear_Footprint_Area_Clear_area_percent_coverage_at_subpixel_resolution),define_var(Cloudy_Footprint_Area_Mean_visible_optical_depth_for_cloud_layer),define_var(Cloudy_Footprint_Area_Clear_layer_overlap_percent_coverages),define_filter_expr(get_dim(Cloudy_Footprint_Area_Mean_cloud_effective_height_for_cloud_layer,Footprints__FOV_),

```
"for (var i := 0 ; i < Cloudy_Footprint_Area_Mean_cloud_effective_height_for_cloud_layer_shape[0] ; i += 1) {

  var index := i * Cloudy_Footprint_Area_Mean_cloud_effective_height_for_cloud_layer_shape[1];
  var index_opc := i * Cloudy_Footprint_Area_Clear_layer_overlap_percent_coverages_shape[1];
  var cloud0 := Cloudy_Footprint_Area_Mean_cloud_effective_height_for_cloud_layer(index);
  var od0 := Cloudy_Footprint_Area_Mean_visible_optical_depth_for_cloud_layer(index);
  var cf := 100.0 - Cloudy_Footprint_Area_Clear_layer_overlap_percent_coverages(index_opc);
  filter[i] := cloud0 < 10.0 or od0 < 10.0 or cf < 100.0;
}"))
```

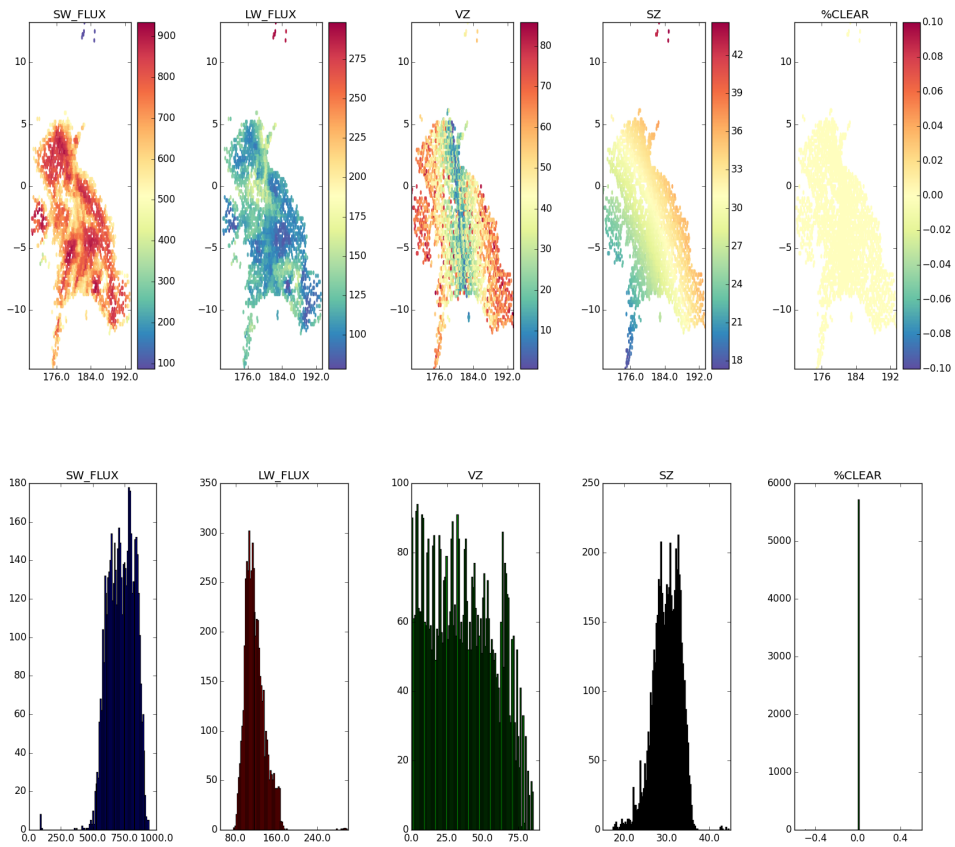


Figure 4. MIIC Cloud object filter criteria: cloud top height >10km, cloud optical depth >10, cloud fraction = 100%, Latitude band 25°S – 25°N, single layer (*table 2 K. Man, T. Wong, 2005*). 2DHistogram plots generated with offline python plots. Next version of MIIC App tier to include these type plots.

Large Batch Filtering runs – use MIIC REST ICPlans

Typical CERES L2 SSF filter parameters and dimensionality:

1D parameters:

```
Type: Float32
Name: Viewing_Angles_CERES_viewing_zenith_at_surface
Dimensionality: [Footprints = 112888]
```

2D cloud parameters:

```
Type: Float32
Name: Cloudy_Footprint_Area_Mean_visible_optical_depth_for_cloud_layer
Dimensionality: [Footprints__FOV_ = 112888][Lower_and_Upper_Cloud_Layers = 2]

Type: Float32
Name: Cloudy_Footprint_Area_Clear_layer_overlap_percent_coverages
Dimensionality: [Footprints__FOV_ =
112888][Conditions_clear__lower__upper__upper_over_lower = 4]
```

The 4 coverages are:

Index 0. clear sky
Index 1. lower cloud only
Index 2. upper cloud only
Index 3. upper over lower cloud

2D Surface Map:

```
Type: Int16
Name: Surface_Map_Surface_type_index
Dimensionality: [Footprints__FOV_ = 112888][The_8_most_prevalent_surface_types = 8]
```

1. Evergreen Needleleaf Forest
2. Evergreen Broadleaf Forest
3. Deciduous Needleleaf Forest
4. Deciduous Broadleaf Forest
5. Mixed Forest
6. Closed Shrublands
7. Open Shrublands
8. Woody Savannas
9. Savannas
10. Grasslands
11. Permanent Wetlands
12. Croplands
13. Urban and Built-up
14. Cropland Mosaics
15. Snow and Ice (permanent)
16. Bare Soil and Rocks
17. Water Bodies
18. Tundra
19. Fresh Snow
20. Sea Ice

REST Plan Example with Global Filter Parameters

REST Plan: Surface Site Data Acquisition, 25°S – 25°N, CERES SSF, <1% Clear (i.e., cloudy), SW_Flux filter (0-1400).


```
<dataCollectionOptions>
    <entry>
      <key>tupleFormat</key>
      <value>multidimensional</value>
    </entry>
    <entry>
      <key>TARGET/filterOnEventLatitude</key>
      <value>true</value>
    </entry>
    <entry>
      <key>TARGET/filterOnEventTime</key>
      <value>false</value>
    </entry>
    <entry>
      <key>returnURLsOnly</key>
      <value>false</value>
    </entry>
    <entry>
      <key>TARGET/filterOnEventLongitude</key>
      <value>true</value>
    </entry>
    <entry>
      <key>TARGET/Clear_Footprint_Area_Clear_area_percent_coverage_at_subpixel_resolution.min</key>
      <value>0</value>
    </entry>
    <entry>
      <key>TARGET/Clear_Footprint_Area_Clear_area_percent_coverage_at_subpixel_resolution.max</key>
      <value>1</value>
    </entry>
    <entry>
      <key>TARGET/Viewing_Angles_CERES_viewing_zenith_at_surface.min</key>
      <value>0</value>
    </entry>
    <entry>
      <key>TARGET/Viewing_Angles_CERES_viewing_zenith_at_surface.max</key>
      <value>40</value>
    </entry>
    <entry>
      <key>TARGET/TOA_and_Surface_Fluxes_CERES_SW_TOA_flux___upwards.min</key>
      <value>0</value>
    </entry>
    <entry>
      <key>TARGET/TOA_and_Surface_Fluxes_CERES_SW_TOA_flux___upwards.max</key>
      <value>1400</value>
    </entry>
    <entry>
      <key>TARGET/TOA_and_Surface_Fluxes_CERES_LW_TOA_flux___upwards.min</key>
      <value>0</value>
    </entry>
    <entry>
      <key>TARGET/TOA_and_Surface_Fluxes_CERES_LW_TOA_flux___upwards.max</key>
      <value>500</value>
    </entry>
  </dataCollectionOptions>
```


$ miiclogin.sh
$ miicrestget.sh miic1.larc.nasa.gov:8080/miic/rest/icplan/54 ASDC_tuple_filter.xml
$ miicrestpost.sh miic1.larc.nasa.gov:8080/miic/rest/icplan REST-ASDC-050715.xml

Download data using web page

$ python plot_CERES_Tuple_1D_2D_Histos.py -I ./IMAGES/ -p /Users/jccurrey/Downloads/eventData-2/

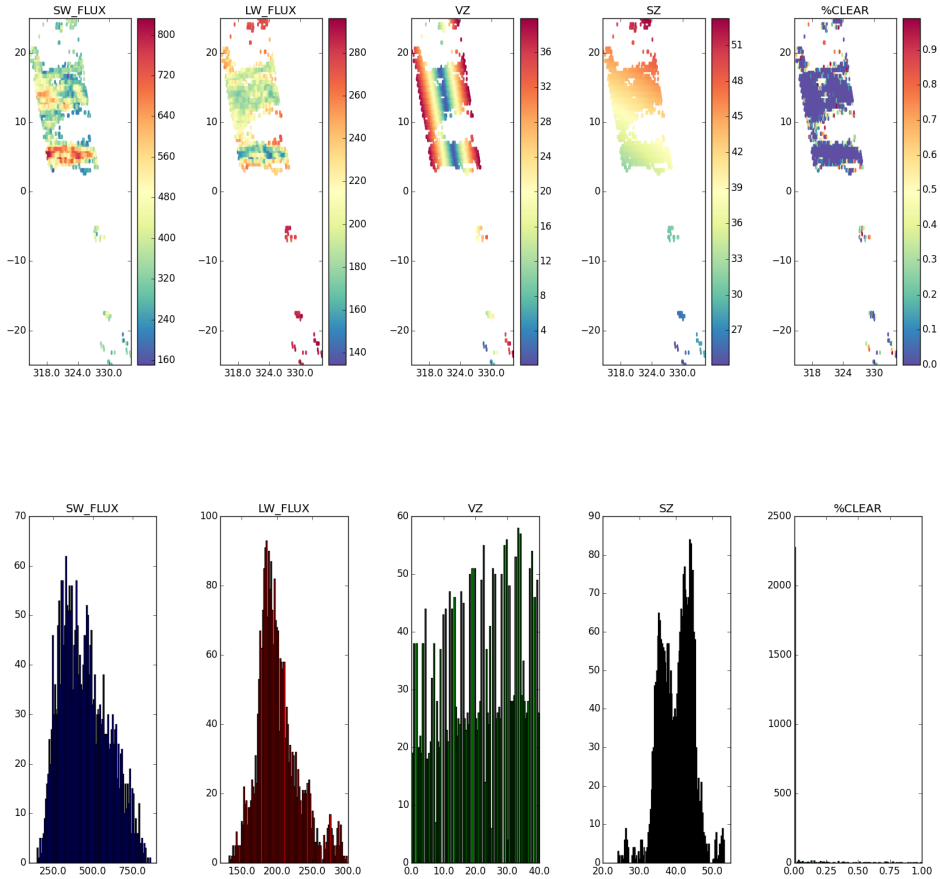


Figure 5. CERES SSF event data filtered using REST Plan for Surface Site Acquisition; 25°S – 25°N, FOVs <1% Clear (i.e., cloudy), SW_Flux filter (0-1400); data plotted for one MIIC event, one month processed, 209 events.