

CSI RD&D3 Subtask 4.2 Final Report:
Sky Imager Forecasts for SDG&E Distribution Feeders

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Abstract

Sky imagers can provide granular solar resource estimates for distribution feeder monitoring and control. Three UC San Diego sky imagers were deployed at three distribution feeders in the San Diego Gas & Electric territory. Between 7 months and 2 years of data have been collected and 3 months of forecasts are validated here. Since ground station data was not available for validation, forecast validation is conducted using future sky images. On two feeders the forecasts improved by about 30% over persistence forecasts, while on the other feeder no improvement was observed. Cloud dynamics and false cloud detection are the main sources of error.

1. Introduction

One objective of the CSI3 contract to UC San Diego was distribution feeder power quality analysis under high solar photovoltaic (PV) penetration, which is described in a separate report for Task 4.3 called “High PV Penetration Impact Simulations Using Solar Resource Assessment with Sky Imager and Distribution System Simulations”. To enable highly granular solar resource input to the distribution feeder models, sky imagers were deployed in Fallbrook, Alpine, and Point Loma, California for several months. In order to make feedforward voltage control, sky imager forecast accuracy needs to be assessed. This report describes the sky imager setup, data collection, and forecast validation. Due to lack of viable high fidelity ground station data within the footprint of the imagers, an internal self-consistent validation using the imagery is presented in this report.

2. Sky imager setup and operation

The UCSD sky imager (USI) is a high resolution fisheye-lens sky camera that captures an image of the sky every 30 seconds. Three UCSD Sky Imagers (USI) were deployed at different distribution feeders. The names, locations, altitude, and timeframe of analysis for each USI are listed in Table 1.

Forecasts were analyzed for periods spanning at least 90 days. The time period of Dec 2014- March 2015 was chosen because all three USIs were operating concurrently and contained the minimum required of 90 days of images to analyze. The winter season in coastal California brings about different distinct weather regimes. Frontal passages that bring rain and/or overcast conditions intermittently affect the region. On the opposite end of the cloud spectrum, Santa Ana winds cause very dry and clear conditions. Other days often contain partial cloud cover due to advection of marine air inland and these clouds are more frequent at the coastal feeder (Point Loma) than further inland.

Table 1 Sky Imager serial number, geographic information, and setup and forecast analysis periods.

Sky Imager	Location	Latitude [°]	Longitude [°]	Altitude [m MSL]	Dates analyzed	Install Date
USI 1_8	ACW Farms Fallbrook, CA	33.4473	-117.3366	160	12/6/14- 3/15/15	April 2014
USI 1_9	Marine Physical Laboratory Point Loma, CA	32.7072	-117.2384	10	12/8/14- 3/15/15	April 2013
USI 1_14	Alpine, CA	32.8461	-116.7879	538	11/19/14- 3/19/15	November 2014

USI 1_8 was located on a farm shed roof at ACW Farms, Fallbrook CA , USI 1_9 was placed on the rooftop of the Marine Physical Laboratory in Point Loma CA, and USI 1_14 was ground mounted on a ~4 foot high stand in a storage lot in Alpine CA.

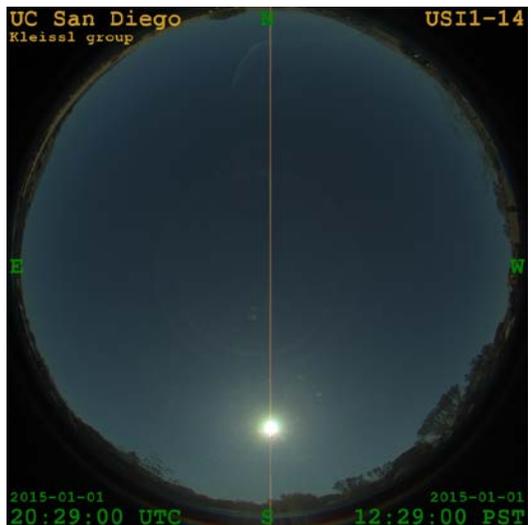
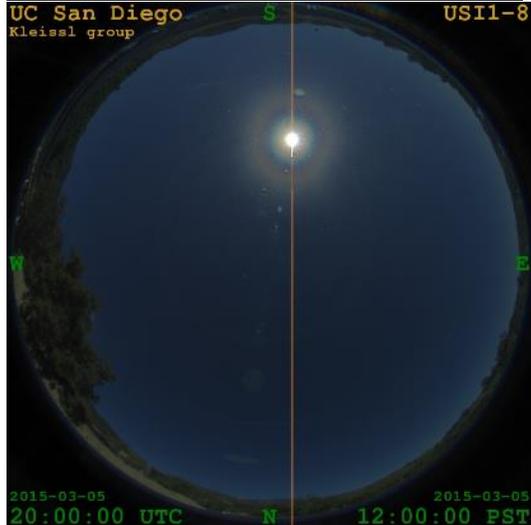
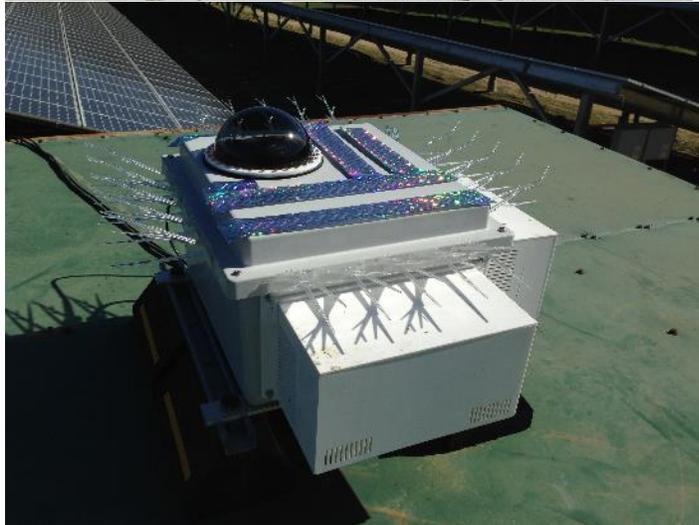


Figure 1 Top: USI 1.9 setup on the roof of the marine physical laboratory at Point Loma and sky image. Middle: USI_1.8 setup on top of a farm shed at ACW farms in Fallbrook, CA and example clear sky image. Bottom: USI_1.14 setup mounted on a ~4 foot stand in Alpine, CA and example sky image

Still images collected from the USIs were compiled into daily videos. From the daily videos different cloud types, sky conditions, and conditions of the USI were observed and recorded.

The daily logs of the USIs can be found in the Appendix in Table A1-A4. Using the daily logs, the forecast timeframes were selected with specific dates for each USI recorded in Table A5.

3. Forecast Generation and Error Metrics

The USI forecast follows the procedure described by Yang et al. (2014). USI forecasts were broken into two steps: one which operates purely upon sky images, specifically cloud detection and cloud motion, and one which is specific to the location and equipment at the site of interest. A power or irradiance forecast for a specific pixel on the ground requires executing both sections, but the image-based forecast validation shown here is independent of ground sites. While this does not allow validating the complete sky imager forecast procedure, it tests the consistency of cloud detection and the accuracy of cloud motion algorithms yielding insights into the validity of some fundamental assumptions in the forecast process. A more comprehensive validation using ground sites was also attempted. While no known solar resource sensors exist within the sky imager footprints, several PV systems are installed within the footprint. However, the 15 min resolution data commonly collected for incentive programs is not granular enough for sky imager forecast validation. A major PV installer kindly provided 1 min resolution power output data, but the data contained an excessive amount of noise likely due to random variations in the metering time interval. While noisy datapoints can be linearly interpolated on clear days, on cloudy days it was not possible to separate noise from real variability due to clouds. Despite best efforts the data was therefore not useable for validation.

3.1. Sky imager geometric calibration and image preprocessing

Each USI image pixel is associated with a geographic azimuth and zenith angle based on the projection function of the lens. However, inaccuracies in the setup cause rotation and tilt of the optical system that must be corrected. The known position of the sun is leveraged to find these correction angles as follows. Geographic azimuth and zenith coordinates were measured from images taken on clear days by recording the calculated solar position for all saturated pixels (assumed to be within the solar disk). Details of which clear sky days were used for the solar calibrations of the various USIs can be found in Table A5 in the Appendix. All recorded solar positions for a given pixel throughout the day were averaged to produce a single estimate of solar azimuth and zenith angles for each saturated pixel. Then, the image center (the zenith), the precise focal length, and the orientation of the lens w.r.t. geographic coordinates were obtained from a nonlinear fit which minimizes the Euclidean distance between the measured and modeled directions projected onto a unit sphere. Once the geographic azimuth and zenith angles are known, the angle between the vector to the sun and the direction vector for a given image pixel, or “sun-pixel angle,” describes the distance of an image pixel from the sun. Image quality control was completed by cropping to remove static objects on the horizon (buildings, trees, etc.), white balancing

by a 3 x 3 color correction matrix, and correcting for any known sensor errors (e.g. dark current noise).

3.2. Sky imager clear sky library and cloud detection

The first objective was to determine which regions (if any) of the image contain clouds. Following the cloud decision algorithm detailed in Ghonima et al. (2012), image pixels were classified as clear, thin cloud, or thick cloud based on the ratio of the red image channel to the blue image channel, or red-blue-ratio (RBR). Thresholds were applied on the difference between the RBR of a specific pixel and the clear sky RBR of the same pixel (let $\Delta RBR = RBR - RBR_{clear}$) which describe the minimum ΔRBR values representative of thin clouds and thick clouds. To determine the background clear sky RBR of image pixels, a “clear sky library” (CSL) was compiled, which contains the clear sky RBR as a function of image zenith and sun-pixel angles in the form of lookup tables for each solar zenith angle. Instead of the rigorous procedure performed in Ghonima et al. (2012) to determine thin and thick ΔRBR thresholds, thresholds were visually calibrated by comparing resulting cloud decision images with raw images and their ΔRBR images.

Due to variations in composition of the atmosphere (primarily related to aerosol concentration), clear sky RBR values stored in a given CSL will be less representative of days farther from the day from which the CSL was generated. For this reason, only the nearest CSL will be used by the cloud decision algorithm. Since this analysis was performed on historical data, CSLs could be constructed from completely clear days within the data set. See Table A5 for days used for CSL creation of each USI.

The area near the sun is prone to cloud decision errors, as high RBR_{clear} values near the solar disk reduce ΔRBR of clouds. A “CSL bypass” procedure based on the sunshine parameter used by Chow et al. (2011) was developed: when the sun was determined to be obstructed (taken to be times when less than half of the pixels within sunpixel angle $< 1^\circ$ possess RBR of unity, which indicates saturation of both red and blue channels), the CSL was not used within regions of sun-pixel angle $< 35^\circ$, and only binary cloud decision was performed by assigning pixels with $RBR > 0.7782$ as thick clouds.

Markings such as smudges, soiling, and scratches can possess high RBR values, particularly as the position of the sun in the image approaches these markings. A correction algorithm was applied to mitigate the appearance of false small thick clouds: if the brightness histogram of all pixels within constant 1° sun-pixel angle rings between 2° and 10° has remained similar to the previous image, those pixels are automatically declared clear (unless cloud fraction exceeds 98% or the mean brightness is low).

After completion of all cloud decision and correction algorithms, the blooming stripe was detected in the RGB image by searching near the sun for columns of uniform brightness. If present, the blooming stripe (typically only about 10 pixels wide) was corrected by bi-linear interpolation across the stripe in the cloud decision image.

3.3. Sky imager cloud height, cloud map, cloud velocity, and cloud map advection

Next, cloud base height (CBH) measurements were obtained from Meteorological Aerodrom Reports (METAR) weather reports, which are typically generated once per hour (sometimes more frequently) from automated weather observation stations at airports. The METAR stations in closest proximity to the USIs (see Table 2) are similar to the METAR stations used to perform the previous advective forecast analysis in Yang et al. (2014) with the exception of the Alpine USI and METAR station, which are approximately twice the distance apart as the setup in Yang et al. (2014).

Table 2 METAR Stations closest to USIs

USI name	Nearest METAR station	Distance [mi]
USI_1_8	Fallbrook Community Airport, CA	8
USI_1_9	San Diego, North Island, Naval Air Station, CA	2
USI_1_14	San Diego/El Cajon, Gillespie Field Airport, CA	11

A geometric transform similar to the pseudo-Cartesian transform of Allmen and Kegelmeier (1996) was then performed to map cloud information to a latitude-longitude grid at the selected CBH. The resulting “cloud map” is a two dimensional planar mapping of cloud position at the obtained CBH above the forecast site, centered at the location of the USI.

Cloud pixel velocity was obtained by applying the cross-correlation method (CCM) to the RBR of two consecutive cloud maps Chow et al. (2011). The vector field resulting from the CCM contains the wind vector field where vectors with small cross-correlation coefficients have been excluded. The vector field was processed through a series of quality controls to yield a single average cloud velocity vector that was applied to the entire cloud map. In other words, the velocity of all clouds is assumed to be homogeneous. A physical cloud velocity was then calculated by linearly scaling the cloud pixel velocity using measured CBH.

Following, the current cloud map was advected at the calculated cloud pixel velocity to generate cloud position forecasts at each forecast interval (30 s).

3.4. Error metrics for 5 minute-ahead forecasts

Many inputs contribute to USI forecast accuracy including errors in cloud detection, cloud optical depth misclassification, cloud motion vectors, cloud height, cloud shadow projection, and 3-dimensional radiative transfer effects. Some of these errors arise solely from image analysis, while others related to how the future cloud positions in the images are converted to irradiance values on the grounds. Since no ground data was available for validating the final solar irradiance or solar power forecasts, only the errors sources inherent to image analysis were investigated. Outputs from steps based solely on image analysis were analyzed to assess performance of the cloud decision and cloud motion algorithms.

As in Chow et al. (2011), two quantities were used to characterize the performance of image-based algorithms: matching error and cloud-advection-versus-persistence (cap) error. The fh -minute forecast cloud map generated at time t_0 was overlaid onto the actual cloud map at time t_0 (fh min) in order to determine pixel-by-pixel forecast error, or “matching error.” No distinction between thin and thick clouds was made in determining matching error; a pixel is either cloudy or clear. Matching error was defined as:

$$e_m = \frac{P_{false}}{P_{total}} * 100\%$$

Cap error was computed in order to determine whether cloud advection improves forecast performance by comparing the number of falsely matched pixels of the fh -minute advection forecasts $P_{false,advection}$ with those of an image persistence forecast, where the fh -minute persistence forecasts are obtained by assuming the cloud map at t_0 persists statically until fh minutes later. Cap error was therefore defined as:

$$e_{cap} = \frac{P_{false,advection}}{P_{false,persistence}} * 100\%$$

A cap error of less than 100% indicates that cloud advection provides forecast skill over a naïve image persistence forecast.

Matching errors for mostly uniform sky conditions (i.e. completely clear sky or completely overcast) are by default close to zero and are not an interesting test of forecast skill, so the mean and standard deviation were only computed using matching errors for times corresponding to $5\% < \text{cloud fraction} < 95\%$.

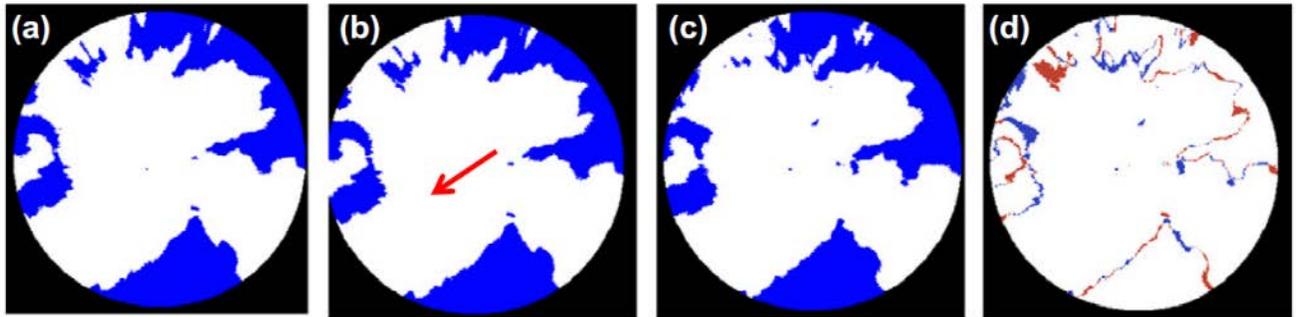


Figure 2: Illustration of cloud advection and matching error. The forecast cloud map (b) is produced by advecting the cloud map at time t_0 (a) in the direction of the motion vector (indicated by the red arrow). To determine the forecast error (d), the future cloud map at $t_0 + 30$ sec (c) is compared to the forecast (b). Blue and red colors in (d) show forecast errors and white indicates accurate forecasts.

4. Forecast validation

Daily mean match errors and median cap errors were calculated using the 5-minute forecast for each USI over a span of at least 90 days. The match error bars represent a two standard deviation span centered on the daily mean match error. The cap error bars represent the interquartile range (IQR) of the daily median cap error. As discussed in

Section 3.2.1, images with $5\% > \text{cloud fraction} > 95\%$ do not contribute to daily error calculations. The error data points are color coded to reflect the mean cloud fraction for the day, with dark blue and dark red representing clear sky and overcast conditions, respectively. Days with $20\% < (\text{daily mean cloud fraction}) < 80\%$ were analyzed and the findings reported in the following sections.

4.1. Fallbrook Fallbrook Validation

The advective forecast validation for USI_1_8 analyzes USI images from Dec. 6th, 2014 to Mar. 15th, 2015. The daily match error for USI_1_8 ranges from 5.2% to 25.2% with a 12.9% average (Figure 1a). This implies, on average, the advective forecast correctly predicts the locations of clouds in the sky 87.1% of the time on a per pixel basis.

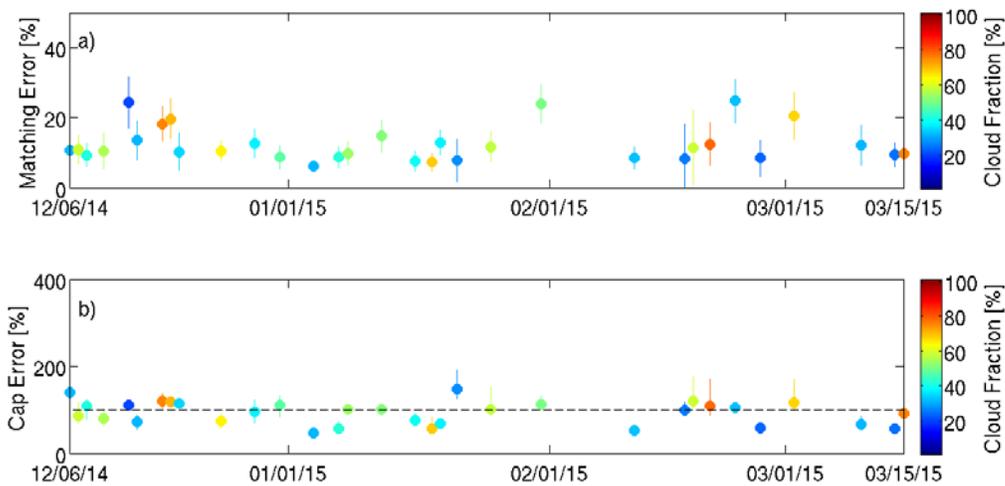


Figure 3 Matching (subplot a) and cap error (subplot b) for 5 min forecasts using the USI_1_8 at Fallbrook for Dec. 6th, 2014-Mar. 15, 2015. The dashed horizontal black line in (b) represents the threshold where advective forecasts versus persistence forecasts perform better, with cap errors below the threshold representing better performance by the advective forecast. The color of the data points and colorbars reflect the daily cloud fraction. Days with average cloud fraction $>95\%$ (overcast) or $<5\%$ (clear) are omitted.

The daily cap error ranges from 29.0% to 132.4% with a median score of 88.7% (Figure 1b). This implies the USI 1_8 advective forecast performs slightly better than the persistence forecast, with instances of the persistence forecast outperforming the persistence forecast. While the cap error for USI 1_8 is larger than the other USIs, the matching errors between the USIs are small and similar (see sections 4.2 and 4.3), meaning for USI 1_8 the persistence forecast are comparably more accurate, causing the larger cap error.

4.2. Point Loma Forecast Validation

The advective forecast validation for USI 1_9 analyzes USI images from Dec. 8th, 2014 to Mar. 15th, 2015. The daily match error for USI 1_9 ranges from 4.5% to 33.5% with a 14.8% average (Figure 2a). This implies, on average, the advective forecast correctly predicts the locations of clouds in the sky 85.2% of the time on a per pixel basis.

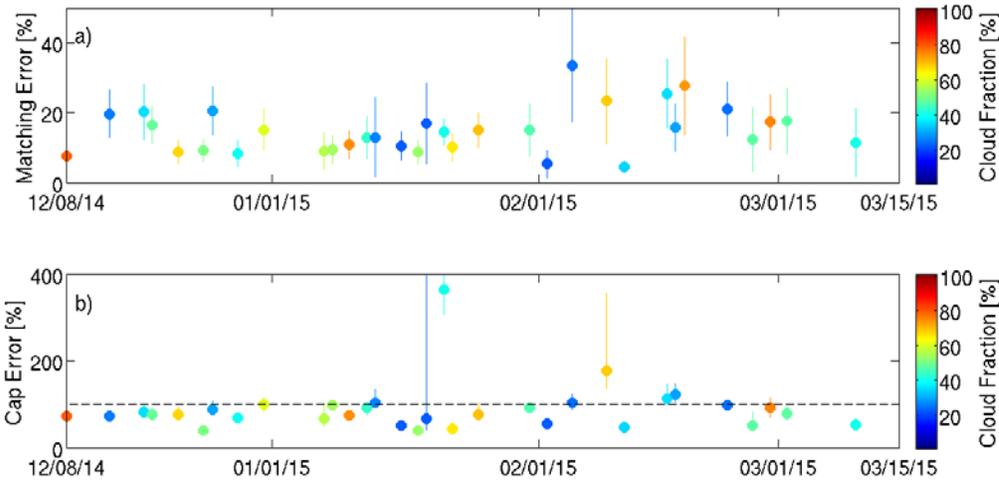


Figure 4 same as Figure 3 for Point Loma (USI 1_9).

The daily median cap error (Figure 2b) ranges from 38.9% to 511.5% with a median value of 75.8%, implying the advective forecast for partially cloudy days outperforms the persistence forecast the majority of the time with a few outlier events. Table 3 contains dates, comments, and causes of daily cap errors for USI 1_9 that significantly exceed the cap error threshold of 100% or are of particular interest:

Table 3 USI 1_9 cap error outlier analysis for Point Loma forecasts.

Date	Comment	Cause
1/19/15	The median cap error is well below the 100% threshold, however, the IQR spans several hundred % (large blue line in Fig. 2b).	The morning and evening time periods have large cap errors well above 100%. This is a result of almost (not meeting the >95% or <5% cloud cover thresholds) overcast and clear sky conditions, which favor persistence forecasts. The daily median is reduced below 100% because the cap error for the rest of the day is improved.
1/21/15	The median cap error and the IQR are above 100%	Haze surrounding the solar region enhances the red-blue-ratio causing false detection of thin clouds around the solar region. These artificial detections are stationary and persistence is therefore superior to cloud advection, large cap errors.
2/9/15	The median cap error and the IQR are above 100%	The day consists of multi-level clouds moving in different directions and cloud formation/dissipation, which the forecast can not emulate in its current state
2/18/15	The median cap error is	Condensation exists on the USI until 1100

511% while the matching error is 27.8%

PST, which causes false cloud detection and favors the persistence forecast. In addition, there are thin clouds/haze around the solar region causing similar issues as on 1/21/15

Overall, the advective forecast using images from USI 1_9 outperform a persistence forecast on a 5-minute horizon. The three days (Jan. 21, 2015, Feb. 9, 2015, Feb. 18th, 2015) the persistence forecast significantly outperformed the advective forecast were a result of: (1) the advective forecast using a velocity vector to advect the entire cloudmap which can not track multi-directional cloud movement, (2) the advective model assumes clouds maintain their shape and size and does not account for cloud formation or dissipation, and (3) the Δ RBR method still has issues around the solar region resulting in false detections in and near the solar region.

4.3. Alpine Forecast Validation

The advective forecast validation for USI 1_14 analyzes USI images from Nov. 19th, 2014 to Mar. 19th, 2015. The daily match error for USI 1_14 ranges from 5.2% to 25.8% with a 12.9% average (Figure 3a). This implies, on average, the advective forecast correctly predicts the locations of clouds in the sky 87.1% of the time for partially cloudy days on a per pixel basis.

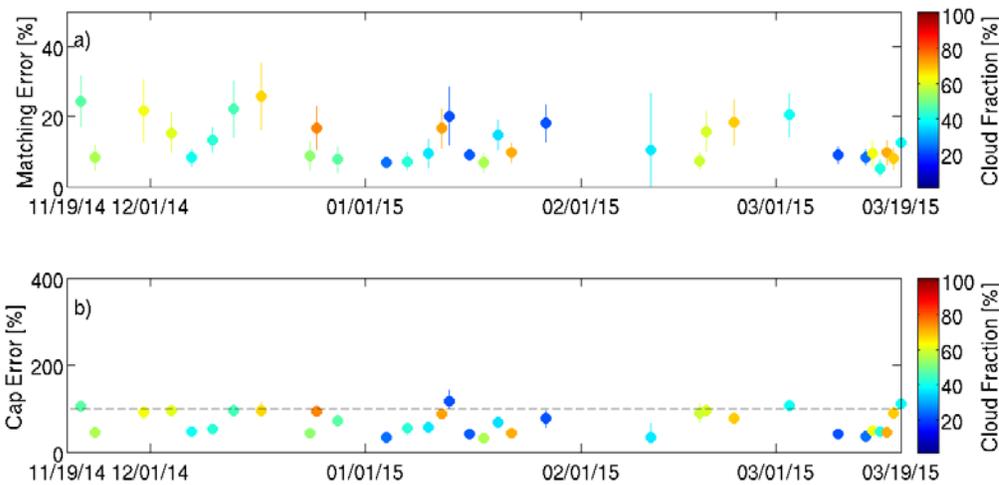


Figure 5 same as Figure 3 for USI 1_14 at Alpine.

The cap error for USI 1_14 ranges from 32.0% to 117.4% with a median of 68.3% (Figure 3 b), which means the advective forecast outperforms the persistence forecast. For USI 1_9 there are no outlier daily cap errors.

5. Conclusions

The validation of the sky imager forecast at Fallbrook, Point Loma, and Alpine resulted in average daily matching errors of 12.9%, 14.8%, and 12.9%, respectively. Larger matching errors can result from a greater prevalence of partly cloudy conditions that are

more challenging to forecast rather than improved forecast skill. The median daily cap errors Fallbrook, Point Loma, and Alpine were 88.7%, 75.8%, and 68.3%, respectively. The lack of correspondence between matching error and cap error between the different sites local differences in cloud conditions and/or different accuracy of persistence forecasts. Overall, the low cap errors at Point Loma and Alpine mean that the advective forecast outperforms the persistence forecast by 25 to 30%, on average. This is similar to what Yang et al. (2014) obtained for November 2013 sky imager forecasts in coastal California.

The cap error time series at Point Loma exhibited some outliers which were analyzed in greater detail. Outliers are caused by cloud decision errors that cause false stationary clouds e.g. due to haze or condensation.

Generally larger cap errors were caused by (1) the advective forecast using a velocity vector to advect the entire cloudmap which can not track multi-directional cloud movement, (2) the advective model assumes clouds maintain their shape and size and does not account for cloud formation or dissipation, and (3) the Δ RBR method still has situational issues around the solar region resulting in false detections in and near the solar region. Further research is required to create more robust cloud detection methods and advective forecasts.

References

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Appendix

Table A1 USI 1_2 log

Sky imager daily log

Daily conditions as determined from review of sky images.

Imager: USI 1-2

Installation: UCSD

Time Zone GMT

	Golden day
	Has potential
	Further Review
	Good Sequence, but mirror is dirty
	Missing / Bad Data
	Good for CLEAR Sky Library
	Good for CLEAR sky calibration
	(STAY AWAY) Scary period with forming and disappearing cloud multiple cloud layers

Year	DOY	Month	Day	Dirt (0-3)	Condensation or rain (0-3) & Time	Period 08:00-11:00	Period 11:00-14:00	Period 14:00-17:00	Note
2015	95	4	5	0	0	SCT Cu	few As	few As; few Cu	
2015	94	4	4	0	0	SCT Ac	SCT Cs, few Ac	SCT Cs, few As (multiple layers)	
2015	93	4	3	0	0	SCT Cc	few Cc	SCT Ci	
2015	92	4	2	0	1(few drops until 0830)	SCT Cu	SCT Ci	SCT Ci	

2015	91	4	1	0	0	SCT Cs	few Ci, CLR	few As	
2015	90	3	31	0	1(few drops until 1000)	SCT Cu; SCT Ci	SCT Cs	SCT Cs; few Cu	
2015	89	3	30	0	1(few drops until 1000)	SCT As, and Cu	SCT As; CLR	few As	
2015	88	3	29	0	1(few drops until 0900)	SCT Ci	SCT Ci, few As (multiple layers)	few Cc, few As(multiple layers)	
2015	87	3	28	0	0	CLR	few As	SCT As, few Ci	
2015	86	3	27	0	0	CLR	CLR	CLR	
2015	85	3	26	0	0	CLR	CLR	CLR	
2015	84	3	25	0	0	CLR	CLR	CLR	
2015	83	3	24	0	0	CLR	CLR	few Cu	
2015	82	3	23	0	0	SCT Cu	few Ci	CLR	
2015	81	3	22	0	0	SCT Cs and Cu	SCT Cs, few Cu	SCT Cs	
2015	80	3	21	0	1(condensation morning)	OVC	CLR, few Ci	CLR, few Ci	
2015	79	3	20	0	1(condensation morning)	OVC, CLR	SCT Sc	CLR, SCT Ac	
2015	78	3	19	0	0	CLR, Ac	CLR, Ac	SCT Cu	last period has dif wind directions
2015	77	3	18	0	0	OVC, Cu	SCT Sc, few Ccs	CLR, few Cs	
2015	76	3	17	0	0	SCT As	SCT As, few Ci	SCT As, and Ci, OVC	
2015	75	3	16	0	0	SCT As	SCT Cs	SCT Cs, Cc	maintance:114500 to 120530
2015	74	3	15	0	0	SCT Ac	SCT Ac	SCT Ac, few Ci	

2015	73	3	14	0	0	few Ci	few Ci	few Ci	
2015	72	3	13	0	0	CLR	CLR	SCT Ci	
2015	71	3	12	0	0	CLR	CLR	CLR	
2015	70	3	11	0	0	SCT Sc	SCT Sc and Ac	OVC	
2015	69	3	10	0	1(condensation morning)	SCT As	SCT As and Cs	SCT Cs	
2015	68	3	9	0	0	SCT Cu	CLR, few Cs	CLR, few Cs	
2015	67	3	8	?	?	Missing Data	Missing Data	Missing Data	
2015	66	3	7	0	0	CLR	CLR	CLR	
2015	65	3	6	0	0	CLR	CLR	CLR	
2015	64	3	5	0	0	CLR	CLR	CLR	
2015	63	3	4	0	0	CLR	CLR	CLR	
2015	62	3	3	0	0	SCT Cu	CLR	CLR	bee:095700
2015	61	3	2	0	2(rain: morning and noon)	SCT Cu and Ac	OVC	CLR, few Cu and few Ci	
2015	60	3	1	0	2(rain morning and noon)	OVC	OVC	OVC	
2015	59	2	28	0	2(rain:093900 and 112300)	SCT Sc	SCT Sc	CLR, 2 layers(Cu and Cc)	
2015	58	2	27	0	1(condensation)	SCT Cu	2 layers (Cu and Ac)	2 layers (Cu and Ac)	
2015	57	2	26	0	1(condensation)	SCT Ac and Cs	SCT Cs	SCT Cs	
2015	56	2	25	0	0	CLR, few Cs	CLR	CLR	
2015	55	2	24	0	0	CLR	CLR	few Cs, CLR	
2015	54	2	23	0	2(condensation and rain 075900)	SCT stratus	CLR, few Cu	CLR, few Sc	
2015	53	2	22	0	1(rain:161430)	SCT Ac	2 layers SCT	OVC	rain:161430

2015	28	1	28	0	1(condensation morning)	few Cs, CLR	few Ac, CLR	SCT Ac, status	
2015	27	1	27	0	0	few Cs, CLR	few Cs, CLR	few Cs, CLR	
2015	26	1	26	0	1(rain:133100)	OVC	OVC	OVC	
2015	25	1	25	0	0	SCT Sc	SCT Sc and Ac	SCT Sc and Ac	perfect Cu same direction, and "solid"
2015	24	1	24	0	0	CLR	CLR	CLR	
2015	23	1	23	0	0	CLR	few Sc, CLR	CLR	
2015	22	1	22	0	0	SCT Cs	SCT As	SCT As	
2015	21	1	21	0	0	OVC, CLR	CLR	CLR	test:110700
2015	20	1	20	0	0	fog	fog	fog	
2015	19	1	19	0	0	few Ci, CLR	2 layers (SCT Sc and Cs)	OVC	fast winds
2015	18	1	18	0	0	SCT stratus	CLR, SCT Cs	SCT Cs	
2015	17	1	17	0	0	CLR	CLR	CLR	
2015	16	1	16	0	0	CLR	SCT Cs	SCT Sc	
2015	15	1	15	0	0	few Cs, CLR	CLR	CLR	
2015	14	1	14	0	0	CLR	CLR	few Cs, CLR	
2015	13	1	13	0	1(condensation morning)	SCT Cu	CLR	few Cs, CLR	
2015	12	1	12	0	1	SCT Cu	SCT Cu	few Cu	
2015	11	1	11	0	1(rain:0700)	OVC	OVC	OVC	
2015	10	1	10	0	0	SCT Ac	CLR, SCT Ac	OVC	
2015	9	1	9	0	0	OVC	OVC	OVC	
2015	8	1	8	0	0	OVC	SCT Sc	CLR	
2015	7	1	7	0	0	SCT Ccs, CLR	SCT stratus	SCT stratus	
2015	6	1	6	0	0	CLR	CLR	CLR	
2015	5	1	5	0	0	CLR, few Cs	CLR	CLR, SCT Cs	
2015	4	1	4	0	0	CLR	CLR, few Cs	SCT stratus	
2015	3	1	3	0	0	CLR	CLR	CLR	bee:092330
2015	2	1	2	0	0	CLR	CLR	CLR	very few Citrato

2015	1	1	1	0	0	CLR	CLR	CLR	
2014	365	12	31	0	2(rain:084330&11 3730)	OVC	few Sc, CLR	CLR	
2014	364	12	30	0	3	SCT Sc, OVC	OVC	OVC	rain:141700
2014	363	12	29	0	0	CLR	CLR	CLR	bird:162830 (one frame, small part)
2014	362	12	28	0	0	SCT St and Ac	few Cs	few stratocirrus	
2014	361	12	27	0	0	CLR	few Cs	SCT stratocirrus	
2014	360	12	26	0	0	CLR	CLR	CLR	the best CLR ever
2014	359	12	25	0	3	2 layers (SCT Sc and Ac	SCT Ac, CLR	CLR	rain:112700
2014	358	12	24	0	0	few Ci, StAc	few Ci, StAc	SCT Ac	
2014	357	12	23	0	1	CLR	CLR	CLR	
2014	356	12	22	0	1	CLR	CLR	CLR	
2014	355	12	21	0	0	CLR, SCT Cs, few Sc	SCT Cs	SCT Cs	
2014	354	12	20	0	0	OVC	SCT stratus and Cs	OVC	
2014	353	12	19	0	0	CLR	CLR, few Cs	SCT Cs and stratus	
2014	352	12	18	0	1	SCT Ac	SCT Cs, CLR, Sc	SCT Sc and Cs	
2014	351	12	17	0	1	2 layers (SCT Sc and Cs)	2 layers (SCT Sc and Cs)	2 layers (SCT Sc and Cs)	
2014	350	12	16	0	3	OVC	OVC	OVC	rain:121000
2014	349	12	15	0	0	SCT As	SCT Cs	SCT Cs	cleaning:124100
2014	348	12	14	0	0	CLR, few Cs and Ac	CLR, few Cs	SCT Cs	
2014	347	12	13	0	1	CLR, few Sc	CLR, few Sc	CLR, few Sc	

2014	346	12	12	0	3	OVC	OVC, few min of light	OVC	rain: on all morning and starts at 141030
2014	345	12	11	0	0	SCT Sc, few Ac	SCT Sc	SCT Sc, few Ac	dif layers of cloud going t diferent directions
2014	344	12	10	0	1	SCT Sc	SCT Cs and Sc	SCT Sc	
2014	343	12	9	0	1	SCT Sc, mainly CLR	CLR	few Cu	
2014	342	12	8	0	0	As	SCT Cs	CLR, Ac	Cleaning:104400
2014	341	12	7	0	0	SCT Cs	SCT Cs, few Ac	SCT Cs,	bird:123800
2014	340	12	6	0	0	few Sc	CLR, very few Cs	CLR, few Sc	
2014	339	12	5	0	1	SCT Sc, Cs	As	As	Missing 10 min after 094030 and after 103000. maintance 114800 to 115400
2014	338	12	4	0	2	OVC, SCT Sc and Ac	CLR, Cs and Cu	CLR	11-14 winds flowind dif directions
2014	337	12	3	0	3	OVC	OVC	OVC	rain:all day
2014	336	12	2	0	3	SCT Sc, OVC	OVC	OVC	rain:084300
2014	335	12	1	0	0	As	As	As	
2014	334	11	30	0	0	SCT Sc, few Cu, Ac*	SCT Sc and Ac	mostly CLR	layers of clouds dif directions
2014	333	11	29	0	0	CLR, few Cs, Sc	CLR, few Ac	As, few Cu	
2014	332	11	28	0	0	CLR	CLR	CLR	
2014	331	11	27	0	0	CLR	CLR	few Cs, CLR	
2014	330	11	26	0	0	CLR	CLR	CLR	bird:062500
2014	329	11	25	0	0	CLR	CLR	CLR	bird:065730

2014	328	11	24	0	0	CLR, few Cs, Sc	CLR, few Cs	CLR	
2014	327	11	23	0	0	SCT Cs really few	few Cs, CLR really few	CLR, SCT Sc really few	
2014	326	11	22	0	0	Cs, mostly CLR	Cs, mostly CLR	Cs, mostly CLR	
2014	325	11	21	0	0	SCT Sc, CLR	CLR	CLR	
2014	324	11	20	0	0	CLR, few Cs	CLR, few Cs	SCT Sc, OVC	
2014	323	11	19	0	0	CLR, few Ac	CLR, few Ac	CLR	
2014	322	11	18	0	0	SCT Cs	SCT Sc, few Ac	SCT Cs	person:154000
2014	321	11	17	0	0	CLR, few Cs	CLR, few Cs	CLR, SCT Cs	
2014	320	11	16	0	0	, few Sc	few Cs, CLR	few Cs, CLR	
2014	319	11	15	0	0	SCT Sc	SCT Sc, few Cs	SCT Sc	bird:135030
2014	318	11	14	0	0	mostly Cu, few Cs	mostly stratus, few Cc	few Sc, mainly CLR	person:114030,13370 0
2014	317	11	13	0	0	OVC, SCT Sc and stratus	SCT Sc, few Ci	few Sc, few Ci	
2014	316	11	12	0	0	OVC, SCT Ac, CLR	CLR, few Ci	CLR	
2014	315	11	11	0	0	OVC	SCT Sc and Ac	SCT Sc, few Ac, few Ci	
2014	314	11	10	0	1	OVC	few Ac and few As	BKN Ac	Cleaning:100430
2014	313	11	9	0	2	OVC, few Ci	BKN As, few Ci	BKN As, few Ci, CLR	
2014	312	11	8	0	0	CLR	CLR	CLR	
2014	311	11	7	0	0	CLR	CLR	CLR	
2014	310	11	6	0	0	CLR	CLR	CLR	

2014	309	11	5	0	0
2014	308	11	4	0	0
2014	307	11	3	0	0
2014	306	11	2	0	0
2014	305	11	1	0	0

CLR	CLR	CLR
CLR	CLR	few Ci
CLR	CLR	CLR
SCT Cu	CLR	CLR
SCT Cu, and few Ci	SCT Cu	SCT Cu, few Ac

Bird 105530

Table A2 USI 1_8 log

Sky imager daily log

Daily conditions as determined from review of sky images.

Imager: USI 1-8
 Installation: Fallbrook feeder
 Time Zone: GMT

Golden day
Has potential
Further Review
Good Sequence, but mirror is dirty
Missing / Bad Data
Good for CLR Sky Library
Good for CLR sky calibration
(STAY AWAY) Scary period with forming and disappearing cloud multiple cloud layers

Year	DOY	Month	Day	Dirt (0-3)	Condensation or rain (0-3) & Time	Period 08:00-11:00	Period 11:00-14:00	Period 14:00-17:00	Note
2015	98	4	8						
2015	97	4	7						
2015	96	4	6						
2015	95	4	5			Missing Data	Missing Data	Missing Data	
2015	94	4	4			Missing Data	Missing Data	Missing Data	
2015	93	4	3			Missing Data	Missing Data	Missing Data	
2015	92	4	2			Missing Data	Missing Data	Missing Data	
2015	91	4	1			Missing Data	Missing Data	Missing Data	

2015	90	3	31			Missing Data	Missing Data	Missing Data	
2015	89	3	30			Missing Data	Missing Data	Missing Data	
2015	88	3	29			Missing Data	Missing Data	Missing Data	
2015	87	3	28			Missing Data	Missing Data	Missing Data	
2015	86	3	27			Missing Data	Missing Data	Missing Data	
2015	85	3	26			Missing Data	Missing Data	Missing Data	
2015	84	3	25			Missing Data	Missing Data	Missing Data	
2015	83	3	24	1(7 smudge)	0	CLR, few Cu	CLR, few Cu	Missing Data	Missing data after 1518
2015	82	3	23	1(7 smudge)	0	SCT Cu	SCT Cu	SCT Cu	s
2015	81	3	22	1(7 smudge)	0	OVC; SCT Ci	SCT Ci	SCT Ci	
2015	80	3	21	1(7 smudge)	0	OVC(As)	SCT Ci	SCT Ci	
2015	79	3	20	1(7 smudge)	0	CLR	CLR, few Cu	CLR, few Cu	
2015	78	3	19	1(7 smudge)	0	few Ac, few Cc	few Ci	few Ci	
2015	77	3	18	1(7 smudge)	0	SCT Cu, SCT Ac (multiple layers)	SCT Ac, few Cu	few Ac	missing data: 1324 to 1432; 1459 to 1502
2015	76	3	17	1(7 smudge)	0	SCT Ci	scattered Ci, Cc	SCT Ac	
2015	75	3	16	1(7 smudge)	0	SCT Ci	SCT Ci	SCT Ci	
2015	74	3	15	1(7 smudge)	0	SCT Ci	SCT Ci	SCT Ci	
2015	73	3	14	1(7 smudge)	0	SCT Ci	SCT Ci	SCT Ci	
2015	72	3	13	1(2 smudge)	0	CLR	CLR, few	CLR, few	missing data: 0756 to 1147
2015	71	3	12	1(2 smudge)	0	CLR	CLR	CLR	
2015	70	3	11	1(1 smudge)	0	SCT As, Ac	OVC (As)	OVC (As)	
2015	69	3	10	1(1 smudge)	0	few Ci	SCT Ci	SCT Ci, few Ac	
2015	68	3	9	1(1 smudge)	0	SCT As; CLR	CLR	CLR	
2015	67	3	8	0	0	Missing Data	Missing Data	Missing Data	
2015	66	3	7	0	0	CLR	CLR	CLR	

2015	65	3	6	0	0	CLR	CLR	CLR	
2015	64	3	5	0	0	CLR	CLR	CLR	
2015	63	3	4	0	0	CLR	CLR, few Cu	CLR, few Cu	
2015	62	3	3	0	0	CLR	few Cu	few Cu	
2015	61	3	2	0	1(few drops in the morning, rain:1125)	OVC	OVC	BKN Cu	
2015	60	3	1	0	2(drops all day)	OVC(multiple layers)	OVC(multiple layers)	OVC(multiple layers)	
2015	59	2	28	0	1(few drops in the morning)	SCT Cu, few Ac	SCT Cu, BKN Ac	SCT Cu, BKN Ac	
2015	58	2	27	0	0	BKN Cu	BKN Cu (multiple layers)	BKN Cu (multiple layers)	missing data: 1412 to 1430
2015	57	2	26	0	0	CLR, few Ci	SCT Ci	SCT Ac	
2015	56	2	25	0	0	CLR	CLR	CLR	missing data:13443 to 1347
2015	55	2	24	0	0	CLR	few Ci	few Ci	
2015	54	2	23	0	0	SCT Cu	SCT Cu	CLR, few Cu	
2015	53	2	22	0	2(rain:0934, 1100, 1600)	OVC(Cu)	OVC(Cu)	OVC(Cu)	
2015	52	2	21	0	0	SCT Sc	SCT Ci, few Cu (2layers)	SCT Ci	missing data:1451 to 1539 & 1559 to 1603
2015	51	2	20	0	0	SCT Ci	SCT Ci	SCT Ci, Ac	
2015	50	2	19	0	0	CLR	CLR, few Cc	CLR, few Cc	
2015	49	2	18	0	0	OVC; CLR, few Ci	SCT Ci	SCT Ci	

2015	48	2	17	0	0	OVC; CLR	CLR	CLR
2015	47	2	16	0	0	CLR, few Ci	CLR, few Ci	CLR, few Ci
2015	46	2	15	0	0	CLR	CLR	CLR
2015	45	2	14	0	0	CLR	CLR	CLR
2015	44	2	13	0	0	CLR	CLR	CLR
2015	43	2	12	0	0	CLR	CLR	CLR
2015	42	2	11	0	0	CLR	SCT As	SCT As, few Ci
2015	41	2	10	0	0	CLR	CLR	CLR
2015	40	2	9	0	0	CLR, few Cu	CLR, few Cu	CLR, few Cu
2015	39	2	8	0	0	CLR	CLR	very few Cu
2015	38	2	7	0	0	CLR, few Ci	CLR, few Ci	SCT Ac
2015	37	2	6	0	0	CLR	CLR	very few Ci
2015	36	2	5	0	0	very few Ci	CLR	CLR
2015	35	2	4	0	0	CLR	CLR	CLR
2015	34	2	3	0	0	CLR, few Ci	CLR, few Ci	CLR, few Ci
2015	33	2	2	2(7 smudge)	0	CLR	CLR	few Ci
2015	32	2	1	2(7 smudge)	0	CLR	few Ci	SCT Ci
2015	31	1	31	2(7 smudge)	0	SCT Cu	SCT Cu	SCT Cu
2015	30	1	30	2(7 smudge)	0	OVC (multiple layers)	OVC (multiple layers)	OVC (multiple layers)
2015	29	1	29	2(7 smudge)	0	OVC	OVC	OVC

missing data:1027 to 1227 & 1308 to 1342

bird:0749

bird:0918, missing data from 1035 to 1044. Maintenance:1230 to 1259

bee:1023 to 1043

2015	28	1	28	2(7 smudge)	0	SCT Ci	SCT Ci	OVC(cirrus)	
2015	27	1	27	0	0	few Cu, SCT Ci	few Ci, few Cu	few Ci	
2015	26	1	26	0	3 (rain after 1307)	SCT Cc and Ci	OVC	OVC	
2015	25	1	25	0	0	few Cc	SCT Ac	SCT Ac, and Cu	
2015	24	1	24	0	0	CLR	CLR	very few Ci	
2015	23	1	23	0	0	CLR	CLR	CLR	
2015	22	1	22	0	0	SCT Ci	SCT Ci	SCT Ci	
2015	21	1	21	0	0	SCT As	CLR	CLR	
2015	20	1	20	0	0	SCT Ci	SCT Ci, few Cc	SCT Ci, few Cc	
2015	19	1	19	0	0	SCT Ci	SCT Ci, CLR	CLR	
2015	18	1	18	0	0	SCT Ci	SCT Ci	SCT Ci	
2015	17	1	17	0	0	CLR	CLR	very few Ci	
2015	16	1	16	0	0	CLR	SCT Cs	SCT Cs	
2015	15	1	15	0	0	CLR	CLR	CLR	
2015	14	1	14	0	0	CLR	CLR	CLR	
2015	13	1	13	0	0	CLR	CLR	very few Ci	
2015	12	1	12	0	0	few Ci	SCT Ci, few Cu (2layers)	few Cu	
2015	11	1	11	0	3(few drops until 1000, rain:1142, rain:1258, few drops 1509)	OVC	OVC	OVC	
2015	10	1	10	0	0	SCT Ac	SCT Ac and Cc	SCT Ac and statos	multiple layers of clouds
2015	9	1	9	0	1(few drops until 0900)	OVC	OVC	OVC	

2015	8	1	8	0	0	SCT Ac and Sc	SCT Ac, and few Ci	few Cc	bee:115530 video starts after the dawn, at 8:50 video finish at 1524
2015	7	1	7	0	0	few Ci and Cc	SCT Ci	SCT Ci	
2015	6	1	6	0	0	CLR	CLR	CLR	
2015	5	1	5	0	0	CLR	CLR	missing data	
2015	4	1	4	1 (2 smudge)	0	CLR	CLR, few Ci	SCT Ci	
2015	3	1	3	1 (2 smudge)	0	CLR	CLR	CLR	
2015	2	1	2	1 (2 smudge)	0	CLR	CLR	few Cu	
2015	1	1	1	1 (2 smudge)	0	CLR	CLR	CLR	
2014	365	12	31	1 (2 smudge)	0	SCT Ci and stratus	CLR, few Cc	CLR, few Ci	
2014	364	12	30	1 (2 smudge)	1 (few at 1400, 1630)	OVC (Cu)	OVC	OVC	
2014	363	12	29	1 (2 smudge)	0	CLR	CLR	CLR	
2014	362	12	28	1 (2 smudge)	0	few Ac	few Cc	CLR, few Ci	
2014	361	12	27	1 (2 smudge)	0	CLR	few Ci	few Ci	
2014	360	12	26	1 (2 smudge)	0	CLR	CLR	CLR	
2014	359	12	25	1 (2 smudge)	0	few Cu and Ac	CLR	CLR	
2014	358	12	24	1 (2 smudge)	0	SCT Ci	SCT Ci	SCT Ci	
2014	357	12	23	1 (2 smudge)	0	CLR	CLR	CLR	
2014	356	12	22	1 (2 smudge)	0	CLR	CLR	CLR	
2014	355	12	21	1 (2 smudge)	0	few Ci	few Ci	few Ci	
2014	354	12	20	1 (2 smudge)	0	SCT Ci	OVC(As, Cu)	OVC(As, Cu)	
2014	353	12	19	1 (2 smudge)	0	mostly CLR	few Ci and Cu	SCT Ci	

bird:1353
until 1357
missing
data:0811 to
0815

2014	352	12	18	0	0	SCT Ac and Cu	SCT Ac and Ci	SCT Ac and few Ci	
2014	351	12	17	0	1(few drops until 1110)	SCT Cu	SCT Cu and Ci	SCT Cu, few Ci	
2014	350	12	16	0	1(rain:1211 all day)	OVC	OVC	OVC	
2014	349	12	15	0	0	SCT Ci	SCT Ci	SCT Ci	cleaning:1224 the blocker isnt covering the sun region
2014	348	12	14	0	0	few Ci	few Ci	SCT Ci	the blocker isnt covering the sun region
2014	347	12	13	0	0	SCT Cu	few Cu	few Cu	
2014	346	12	12	0	1 (raining all day)	OVC	OVC	OVC	
2014	345	12	11	1 (1 smudge)	0	OVC	BKN Cu and Ci	BKN Cu and Ci	multiple layers of clouds
2014	344	12	10	1 (1 smudge)	0	few Ci	SCT Ac and Ci	SCT Ac and Ci	
2014	343	12	9	1 (1 smudge)	0	CLR	CLR	CLR	bird:085600
2014	342	12	8	1 (1 smudge)	0	SCT Ci	SCT Ci	SCT Ci	
2014	341	12	7	1 (1 smudge)	0	few Ci	few Ci	few Ci	bird:064700, 074430
2014	340	12	6	1 (1 smudge)	0	few Ci	SCT Cu	SCT Cu, few Ci	
2014	339	12	5	1 (1 smudge)	0	SCT Ci and Ac	SCT Ci	SCT Ci	multiple layers of clouds/bird:11 1000
2014	338	12	4	0	0	OVC, CLR (few Ci and Cu)	BKN Cu and Ci	few Cu	bird:065030

2014	337	12	3	1 (1 smudge)	3 (few drops in the morning, rain at 1100, 1238,1311,1409)	OVC	OVC	OVC	
2014	336	12	2	1 (1 smudge)	2 (rain:0738,1000,1429)	OVC	OVC	OVC	
2014	335	12	1	1 (1 smudge)	1 (few drops until 0900)	SCT Ci	SCT Ci	SCT Ci, few Cc	
2014	334	11	30	1 (1 smudge)	2 (few drops until 0810,and more at 113600 and 143030)	OVC, SCT Cu and Ac (multiple layers)	OVC, SCT Cu and Ac (multiple layers)	OVC, SCT Cu and Ac (multiple layers)	multiple layers of clouds
2014	333	11	29	1 (1 smudge)		very few Ci	very few Ci	CLR	
2014	332	11	28	1 (1 smudge)		CLR	CLR	CLR	
2014	331	11	27	1 (1 smudge)		very few Ci	very few Ci	very few Ci	bird:062800
2014	330	11	26	1 (1 smudge)		CLR	CLR	CLR	
2014	329	11	25	1 (1 smudge)		CLR	CLR	CLR	
2014	328	11	24	1 (1 smudge)		few Ci	few Ci	CLR	
2014	327	11	23	1 (1 smudge)		SCT Ci	SCT Cc	SCT Ci	bird:090700
2014	326	11	22	1 (1 smudge)		few Ci	few Ci	few Ci	bird:092130
2014	325	11	21	1 (1 smudge)	1 (few drops until 0900)	few Cu	SCT Cu	SCT Cu	
2014	324	11	20	1 (1 smudge)		few Ci	few Cu	BKN Ci, few Cu	
2014	323	11	19	0		few, SCT Ac	few Ac		many short periods of SCT missing images

2014	322	11	18						video begins at 1145
2014	321	11	17						unable to view
2014	320	11	16						unable to view
2014	319	11	15						unable to view
2014	318	11	14						unable to view
2014	317	11	13						unable to view
2014	316	11	12						unable to view video
2014	315	11	11						terminates before 0800
2014	314	11	10	2 (general dirt & 2 smudges)		OVC, CLR	CLR	CLR	
2014	313	11	9	2 (general dirt & 2 smudges)	0	CLR	CLR	CLR	bird on dome at 0818
2014	312	11	8	2 (general dirt & 2 smudges)	0	CLR	CLR	CLR	bird on dome at 1438
2014	311	11	7	2 (general dirt & 2 smudges)	0	CLR	CLR	CLR	
2014	310	11	6	2 (general dirt & 1 smudge)	0	CLR	CLR	CLR	
2014	309	11	5	2 (general dirt)	0	CLR	CLR	CLR	
2014	308	11	4	1 (general dirt)	0	CLR	CLR	few Ci	
2014	307	11	3	1 (general dirt)	0	CLR	CLR	CLR	
2014	306	11	2	1 (general dirt)	1 (condensation at 0700)	few Cu	SCT Cu	few Cu	
2014	305	11	1	1 (general dirt)	2 (rain at 1015-1045, 1545)	SCT Ci, SCT Cu	scatted Cu	SCT Cu, few Ci	rain cleans bomb residue
2014	304	10	31	1 (2 smudges)	0	BKN Cu	BKN Cu	BKN Cu, OVC	bird on dome at 0735 makes it a trifacta

2014	303	10	30	1 (2 smudges)		0	SCT Ci, Cc	SCT Ci, Cc	scatted Ac	bird on dome at 0940 empties bay doors once again
2014	302	10	29	1 (1 smudge)			CLR	CLR	CLR	bird on dome at 1612 drops bomb
2014	301	10	28		1	0	CLR	CLR	CLR	
2014	300	10	27		0	0	CLR	CLR	CLR	
2014	299	10	26		0	0	CLR	CLR	CLR	
2014	299	10	26		0	0	CLR	CLR	CLR	
2014	299	10	26		0	0	CLR	CLR	CLR	
2014	299	10	26		0	0	CLR	CLR	CLR	
2014	298	10	25		0	0	CLR	CLR	CLR	
2014	298	10	25		0	0	CLR	CLR	CLR	
2014	298	10	25		0	0	CLR	CLR	CLR	
2014	297	10	24							bird on dome briefly at 1230
2014	297	10	24							
2014	296	10	23							
2014	296	10	23							
2014	295	10	22	4 (12 smudges and general dirt)		1	CLR	CLR	CLR	imager dome cleaned at 1630
2014	295	10	22	4 (12 smudges and general dirt)		1	CLR	CLR	CLR	
2014	294	10	21							
2014	294	10	21							
2014	293	10	20							
2014	293	10	20							
2014	292	10	19							
2014	292	10	19							
2014	291	10	18							
2014	291	10	18							
2014	290	10	17							
2014	290	10	17							
2014	289	10	16							
2014	289	10	16							
2014	288	10	15	3 (11 smudges and general dirt)		0	SCT, BKN Cu	CLR	CLR	
2014	288	10	15	3 (11 smudges and general dirt)		0	SCT, BKN Cu	CLR	CLR	
2014	287	10	14							
2014	287	10	14							
2014	286	10	13							
2014	286	10	13							

2014	285	10	12					
2014	284	10	11					
2014	283	10	10					
2014	282	10	9					
2014	281	10	8	3 (9 smudges and general dirt)	0	few Cc	few Cc	CLR
2014	280	10	7					
2014	279	10	6					
2014	278	10	5					
2014	277	10	4					
2014	276	10	3					
2014	275	10	2	3 (9 smudges and general dirt)	0	CLR	CLR	CLR
2014	274	10	1					
2014	273	9	30					
2014	272	9	29	3 (9 smudges and general dirt)	0	CLR	CLR	few Cu
2014	271	9	28					
2014	270	9	27					
2014	269	9	26					
2014	268	9	25					
2014	267	9	24					
2014	266	9	23					
2014	265	9	22	2 (4 smudges and general dirt)	1 (condensation at 0700-0800)	fog, few Cu	CLR	CLR
2014	264	9	21	1 (4 smudges)	0	OVC, CLR	CLR	CLR
2014	263	9	20	1 (4 smudges)	0	OVC	SCT Cu	few Cu
2014	262	9	19	1 (4 smudges)	0	OVC	BKN Cu, CLR	CLR
2014	261	9	18	1 (2 smudges)	0	SCT Cu	few Cu	CLR
2014	260	9	17					no video in

Year	ID	Day	Time	Notes	0	CLR	SCT Cu	SCT Cu, SCT Ac	the repository
2014	259	9	16		0				
				2 (rain 1500-1600)					
2014	258	9	15						cant view the video
2014	257	9	14						cant view the video
2014	256	9	13		0	0 few Ci, CLR	few Cu	few Cu	
2014	255	9	12		0	0 CLR	CLR	CLR	
2014	254	9	11		0	0 CLR	CLR	CLR	
2014	253	9	10						imager dome cleaned at 1700
2014	252	9	9						
2014	251	9	8						
2014	250	9	7	2 (2 smudges + dirt accumulation around sun)		0 few Ac	SCT Ac	SCT Ac	
2014	249	9	6	2 (2 smudges + dirt accumulation around sun)		0 CLR	CLR	few Ac	08-14 not selected for CSL due to dirt accumulation
2014	248	9	5	2 (2 smudges + dirt accumulation around sun)		0 few Cu, CLR	CLR	CLR	11-17 not selected for CSL due to dirt accumulation
2014	247	9	4	2 (2 smudges + dirt accumulation around sun)		0 OVC, CLR	CLR	CLR	11-17 not selected for CSL due to dirt accumulation
2014	246	9	3	2 (2 smudges + dirt accumulation around sun)		0 SCT Cu, CLR	CLR	CLR	11-17 not

2014	229	8	17
2014	228	8	16
2014	227	8	15
2014	226	8	14
2014	225	8	13
2014	224	8	12
2014	223	8	11
2014	222	8	10
2014	221	8	9
2014	220	8	8
2014	219	8	7
2014	218	8	6
2014	217	8	5
2014	216	8	4
2014	215	8	3
2014	214	8	2
2014	213	8	1

2 (4 smudges,
water spots now
much more
conspicuous
around the sun)

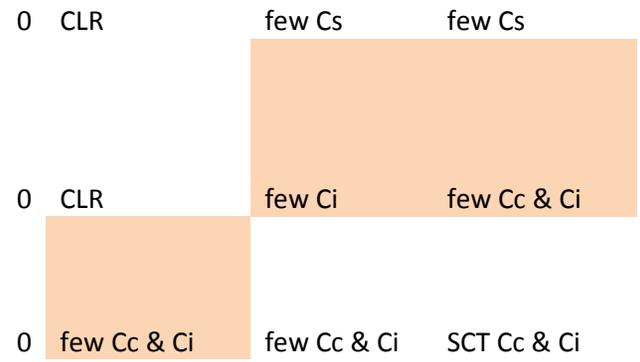
2014	212	7	31
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2 (4 smudges,
water spots now
much more
conspicuous
around the sun)

2014	211	7	30
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2 (4 smudges,
water spots now
much more
conspicuous)

2014	210	7	29
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				around the sun) 2 (4 smudges, water spots now much more conspicuous				
2014	209	7	28	around the sun) 2 (4 smudges, water spots now much more conspicuous	0	SCT Ac & Ci	few Ac	few Ac
2014	208	7	27	around the sun) 2 (4 smudges, water spots now much more conspicuous	0	SCT Cc & Ac	BKN Cc	BKN Cc, few Ac
2014	207	7	26	around the sun) 2 (4 smudges, water spots now much more conspicuous	0	SCT Cc	few Cc	few Ac
2014	206	7	25	around the sun) 2 (4 smudges, water spots now much more conspicuous	0	SCT Ac & Cc	SCT Ac & Cc	SCT Ac & Cc
2014	205	7	24	around the sun) 2 (4 smudges, water spots now much more conspicuous	0	CLR	CLR	CLR
2014	204	7	23	around the sun)	0	CLR	CLR	CLR
2014	203	7	22	2 (4 smudges,	0	CLR	CLR	CLR

missing
images: 0924-
1036

2014	202	7	21	water spots now much more conspicuous around the sun) 2 (4 smudges, water spots now much more conspicuous around the sun)	0	SCT Ac	few Ac	CLR
2014	201	7	20	water spots now much more conspicuous around the sun) 2 (3 smudges, water spots now much more conspicuous around the sun)	0	SCT Cu	CLR	CLR, few Ci
2014	200	7	19	water spots noticeable around the sun) 1 (3 smudges, water spots noticeable around the sun)	1 (rain: 0915-1000)	OVC	BKN Ac	SCT Ac
2014	199	7	18	water spots noticeable around the sun) 1 (2 smudges, water spots noticeable around the sun)	0	few Ac, SCT Cc & Ci	SCT Cc & Ci	few Cc & Ci
2014	198	7	17	water spots noticeable around the sun) 1 (2 smudges, water spots noticeable around the sun)	0	BKN Cu, CLR	CLR	CLR
2014	197	7	16	water spots noticeable around the sun) 1 (2 smudges, water spots noticeable around the sun)	0	few Ac, few Ci	CLR	CLR
2014	196	7	15	water spots	0	OVC, few Cu	SCT Cu	few Cu

				noticeable around the sun)					
				1 (2 smudges, water spots noticeable around the sun)	1 (rain around 0910)				
2014	195	7	14	1 (2 smudges, water spots noticeable around the sun)		few Cu, BKN Ac	BKN Ac	SCT Ac	
2014	194	7	13	1 (2 smudges, water spots noticeable around the sun)	0	few Ac	CLR	few Ac	
2014	193	7	12	1 (2 smudges, water spots noticeable around the sun)	0	OVC, SCT Ci	SCT Ci, few Ac	SCT Ci	
2014	192	7	11	1 (2 smudges, water spots noticeable around the sun)	0	OVC, CLR	CLR	CLR, Ci	
2014	191	7	10	1 (2 smudges, water spots noticeable around the sun)	0	few Cu, CLR	CLR	CLR	
2014	190	7	9	1 (2 smudges, water spots noticeable around the sun)	0	CLR	few Ci	CLR	
2014	189	7	8	1 (2 smudges, water spots noticeable around the sun)	0	SCT Cu, CLR	few Ac	few Ac	
2014	188	7	7	water spots	0	CLR	CLR	CLR	

2014	187	7	6	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	few Ac	CLR	CLR	
2014	186	7	5	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	few Ac	few Ac	CLR	
2014	185	7	4	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	CLR	few Ac	few Ac	
2014	184	7	3	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	stratus, CLR	CLR	CLR	
2014	183	7	2	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	OVC, CLR	CLR	CLR	
2014	182	7	1	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	OVC, CLR	CLR	CLR	
2014	181	6	30	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	OVC, CLR	CLR	CLR	
2014	180	6	29	water spots	0	OVC, CLR	CLR	CLR	bird on dome 1559-1601

2014	179	6	28	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	OVC, CLR	CLR	CLR	
2014	178	6	27	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0			CLR	missing images: 0823-1638
2014	177	6	26	noticeable around the sun) 1 (1 smudge, water spots noticeable around the sun)	0	OVC, BKN Cc	SCT Cc	SCT Cc	
2014	176	6	25	noticeable around the sun)	0	OVC	CLR	CLR	
2014	175	6	24	0 (1 smudge)	0	OVC, CLR	CLR	CLR	
2014	174	6	23	0 (1 smudge)	0	OVC, CLR	CLR	CLR	
2014	173	6	22	0 (1 smudge)	0	few Cu, CLR	CLR	CLR	
2014	172	6	21	0 (1 smudge)	0	few Cc	few Cc & Ci	SCT Cc & Ci few Cc & Ci,	
2014	171	6	20	0 (1 smudge)	0	few Cc & Ci	few Cc & Ci	CLR	
2014	170	6	19	0 (1 smudge)	0	CLR	CLR	CLR	
2014	169	6	18	0 (1 smudge)	0	CLR	CLR	CLR	
2014	168	6	17	0 (1 smudge)	0	few Cu	CLR	CLR	missing images: 0833-0842
2014	167	6	16	0 (1 smudge)	0	few Cc	CLR	CLR	
2014	166	6	15	0 (1 smudge)	0	SCT Cc	few Cc	CLR	

2014	165	6	14	0 (1 smudge)	0	CLR	few Ci	few Ci	
2014	164	6	13	0 (1 smudge)	0	OVC, CLR	CLR	CLR	
2014	163	6	12	0 (1 smudge)	0	SCT Cu, CLR	CLR	CLR	
2014	162	6	11	0 (1 smudge)	0	CLR	CLR	few Cu, CLR	
2014	161	6	10	0	0	OVC	OVC, CLR	CLR	
				2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)					
2014	160	6	9	2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)	0	OVC, CLR	CLR	CLR	dome cleaned at 1440 by kind third-party
				2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)					
2014	159	6	8	2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)	0	BKN Cu, CLR	CLR	CLR	
				2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)					
2014	158	6	7	2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)	0	OVC, CLR	CLR	CLR	
				2 (4 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)					
2014	157	6	6	2 (3 smudges, top of dome is quite		OVC, CLR	CLR	CLR	
				1 (a few drops in early morning)					
2014	156	6	5	2 (3 smudges, top of dome is quite	0	CLR	CLR	CLR	bird lands on dome at 0728

				dirty with water spots as can be seen when the sun passes over) 2 (2 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)					and leaves a present
2014	155	6	4	dirty with water spots as can be seen when the sun passes over) 2 (2 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)	1 (a few drops in early morning)	few Cc	 few Cc	few Cc	missing images: 1130 to 1327
2014	154	6	3	dirty with water spots as can be seen when the sun passes over) 2 (2 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)		0 CLR	CLR	CLR	
2014	153	6	2	dirty with water spots as can be seen when the sun passes over) 2 (2 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)		0 few Cc & Ci	few Cc & Ci	SCT Cc & Ci	
2014	152	6	1	dirty with water spots as can be seen when the sun passes over) 2 (2 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)		0 CLR	CLR	few Ac	
2014	151	5	31	spots as can be		0 CLR	CLR	CLR	

2014	150	5	30	seen when the sun passes over) 2 (2 smudges, top of dome is quite dirty with water spots as can be seen when the sun passes over)	1 (a few dew drop in early morning)	CLR, few Ac	CLR	CLR	
2014	149	5	29	1 (pine needle? 2 smudges)	0	few Cu & Ci	few Cc & Ci	CLR	
2014	148	5	28	1 (pine needle? 2 smudges)	0	SCT Cc & Ci	SCT Cc	few Cc	
2014	147	5	27	1 (pine needle? 2 smudges)	0	CLR	CLR	few Cc & Ci	
2014	146	5	26	1 (pine needle? 2 smudges)	0	CLR	CLR	CLR	
2014	145	5	25	1 (pine needle? 2 smudges)	0	CLR	CLR	CLR	some brief periods of missing images
2014	144	5	24	1 (pine needle? 2 smudges)	0	OVC	OVC	BKN Ac, Ci	
2014	143	5	23	1 (pine needle? 2 smudges)	0	SCT Ac	few Ac	few Ac	
2014	142	5	22	1 (pine needle? 1 smudge)	0	OVC	BKN Ac, OVC	BKN Ac, OVC	
2014	141	5	21	1 (pine needle? 1 smudge)	0	SCT Cu	BKN Cu	SCT Cu	
2014	140	5	20	1 (pine needle? 1 smudge)	0	BKN Cu	SCT Cu	SCT Cu	
2014	139	5	19	1 (pine needle? 1 smudge)	0	SCT Cu, CLR	CLR	CLR	bird on dome 1417

2014	138	5	18	1 (pine needle? 1 smudge)	0	SCT Cc & Ci	few Cc & Ci	CLR	
2014	137	5	17	1 (pine needle? 1 smudge)	0	few Cc	few Cc	few Cc & Ci	
2014	136	5	16	1 (pine needle? salient smudge, on the dome, ~a dozen small smudges at the top of the dome)	0	few Ci	haze from wildfires (I think)	haze from wildfires (I think)	missing images: 1658 to 1745
2014	135	5	15	1 (pine needle? salient smudge, on the dome, ~a dozen small smudges at the top of the dome)	0	CLR	CLR	CLR	wildfires to the far south of the image
2014	134	5	14	1 (pine needle? on the dome, ~a dozen small smudges at the top of the dome)	0	CLR	CLR	CLR	wildfires to the far south of the image
2014	133	5	13	1 (pine needle? on the dome, ~a dozen small smudges at the top of the dome)	0	CLR	CLR	CLR	
2014	132	5	12	1 (pine needle? on the dome, ~a dozen small smudges at the top of the dome)	0	CLR	CLR	CLR	

2014	131	5	11	1 (pine needle? on the dome, ~a dozen small smudges at the top of the dome)	0	CLR	CLR	CLR
2014	130	5	10	1 (pine needle? on the dome)	0	BKN Cu	few Cu	few Cu
2014	129	5	9	1 (pine needle? on the dome)	0	few Cc	few Cc	few Cc
2014	128	5	8	1 (pine needle? on the dome)	0	BKN Ac, few Cc	few Cc	few Cc
2014	127	5	7	1 (pine needle? on the dome)	0	BKN Cu	SCT Cu	few Cu
2014	126	5	6	1 (pine needle? on the dome)	0	BKN Cu	BKN Cu	SCT Cu
2014	125	5	5	1 (pine needle? on the dome)	0	SCT Cu, few Cc	BKN Cc	SCT Cc
2014	124	5	4	1 (pine needle? on the dome)	0	few Cc	CLR	few Cc & Ci
2014	123	5	3	1 (pine needle? on the dome)	0	CLR	CLR	few Cc
2014	122	5	2		0	CLR	CLR	CLR
2014	121	5	1		0	few Cc & Ci	few Cc & Ci	few Cc & Ci
2014	120	4	30		0	few stratus	few Cc	few stratus
2014	119	4	29		0	few Ci	CLR	few Ci
2014	118	4	28		0	CLR	CLR	CLR
2014	117	4	27		0	BKN Cu	SCT Cu, few Ci	few Cu, few Ci

2014	116	4	26	0	1 (rain - morning)	SCT Cu	SCT Cu	few Cu, few Ci
						BKN Cu, few Ci	BKN Cu, few Ci	OVC
2014	115	4	25	0	0	few Cc	few Cc	CLR
2014	114	4	24	0	0	SCT Cu, few Cc	SCT Cc	SCT Cc & Ci
2014	113	4	23	0	0	OVC	BKN - few Cu	few Cu
						BKN stratus, CLR	CLR	few Cc
2014	111	4	21	0	0	CLR	CLR	CLR
2014	110	4	20	0	0	few Cc	few Cc	few Cc
2014	109	4	19	0	0	OVC	BKN Ac, few Cu	few Cc
2014	108	4	18	0	0	OVC, BKN Cc	BKN Cc, few Ac	BKN Cc
2014	107	4	17	0	0	OVC, CLR	CLR	CLR
2014	106	4	16	0	0	CLR	few Cc	few Cc
2014	105	4	15	0	0			
2014	104	4	14					

configured in
Fallbrook

Table A3 USI 1_9 log

Sky imager daily log

Daily conditions as determined from review of sky images.

Imager: USI 1-9
 Installation
 : Point Loma
 Time Zone GMT

	Golden day
	Has potential
	Further Review
	Good Sequence, but mirror is dirty
	Missing / Bad Data
	Good for CLR Sky Library
	Good for CLR sky calibration
	(STAY AWAY) Scary period with forming and disappearing cloud multiple cloud layers

Year	DOY	Month	Day	Dirt (0-3)	Condensation or rain (0-3) &Time	Period 08:00-11:00	Period 11:00-14:00	Period 14:00-17:00	Note
2015	96	4	6						
2015	95	4	5	0	0	SCT Cu; few Ci	CLR, few As, few Ci	SCT Cu	
2015	94	4	4	0	0	few Ac	SCT Cs	few Cs	
2015	93	4	3	0	0	few Ci	few Ci	SCT Ci	
2015	92	4	2	0	0	SCT Ac	SCT Ci	few Ci	
2015	91	4	1	0	0	SCT Cs, few	SCT Ci, CLR	CLR	

2015	90	3	31	0	0	Cu	SCT Cs, few Cu
2015	89	3	30	0	0	SCT Cu, CLR	SCT Cs
2015	88	3	29	0	0	SCT Cu, CLR	CLR
2015	87	3	28	0	0	SCT Ci	SCT Ci
2015	86	3	27	0	0	CLR	CLR, few Cu in the horizont
2015	85	3	26	0	0	CLR	CLR, few Ci
2015	84	3	25	0	0	CLR	CLR
2015	83	3	24	0	0	CLR	CLR
2015	82	3	23	0	0	CLR	CLR
2015	81	3	22	0	0	SCT Cu	CLR, SCT Ci
2015	80	3	21	0	0	SCT Cu and Ci	SCT Ci, few Cu
2015	79	3	20	0	0	SCT Cu	CLR
2015	78	3	19	0	0	OVC, CLR	CLR
2015	77	3	18	0	0	CLR, few Cu, and Ci	SCT Sc, CLR
2015	76	3	17	0	0	OVC(Sc and Ac)	As and Cc few Cu (multiple layers)
2015	75	3	16	0	0	CLR, SCT Ci	CLR, SCT Ci, and Cc
2015	74	3	15	0	0	CLR, SCT Ci, and Ac	CLR, SCT Ci, and Ac
2015	73	3	14	0	0	CLR, SCT Ci	CLR, SCT Ci

2015	72	3	13	0	0	CLR	CLR	CLR, SCT Ci	
2015	71	3	12	0	0	CLR	CLR	CLR	
2015	70	3	11	0	0	SCT Cu, Ac	SCT Ac	SCT Cc and Sc	
2015	69	3	10	0	0	SCT Cu, CLR	few Ci, CLR	SCT Ci	
2015	68	3	9	0	0	CLR	CLR	CLR, few Ci	
2015	67	3	8	0	0	Missing data	Missing data	Missing data	
2015	66	3	7	0	0	CLR	CLR	CLR	
2015	65	3	6	0	0	CLR	CLR	CLR	
2015	64	3	5	0	0	CLR	CLR	CLR	
2015	63	3	4	0	0	CLR	CLR	CLR	
2015	62	3	3	0	0	few Cu in the horizon, mostly CLR	few Cu, mostly CLR	CLR	
2015	61	3	2	0	2(rain:1000&1340)	SCT Cu, few Cc, huge stratus cloud	CLR, few Ci and Cu, huge stratus	CLR, few Cu, SCT Ci	
2015	60	3	1	0	rain all day	OVC	OVC	OVC	
2015	59	2	28	0	3(few drops in the morning and at 1230 and 1730)	SCT Cu and Ac	SCT Cu and Ac	SCT Cc and Cu	
2015	58	2	27	0	0	SCT Cu	SCT Sc, BKN Cu	SCT Sc and Ac (2layers), BKN Cu	
2015	57	2	26	0	1(few condensation in the morning)	SCT Ci, few Cu	SCT Cs	CLR, SCT Ci, few Cu	maintance:0759 to 0804
2015	56	2	25	0	1(few	CLR, few Ci	CLR	CLR	

					condensation in the morning)			
2015	55	2	24	0	1(few condensation in the morning)		CLR	CLR, few Cu
2015	54	2	23	0	0		SCT Cu and Ac(multiple layers)	CLR, SCT Cu
2015	53	2	22	0	2(few condensation, until 0900; few drops 1637)		SCT Ac and few Cu	SCT Sc, OVC(Sc)
2015	52	2	21	0	0		OVC (Sc and Ac)	SCT Ci, SCT Ci
2015	51	2	20	0	0		OVC (SCT St and Ci)	OVC (SCT St and Ci), SCT Ac, few Cu
2015	50	2	19	0	0		SCT Cs	SCT Cs and few Cu (multiple layers), SCT Cs
2015	49	2	18	0	1(few drops until 0800)		CLR, SCT Ci	OVC (Cs), OVC (Cs)
2015	48	2	17	0	0		CLR, SCT Cu	CLR, few Cu, CLR, few Ci
2015	47	2	16	0	0		CLR, few Ci	SCT Sc, few Ci, SCT Sc, few Ci
2015	46	2	15	0	0		CLR	CLR, SCT Cu
2015	45	2	14	0	0		CLR, few Ci	CLR, SCT Ci
2015	44	2	13	0	0		CLR	CLR
2015	43	2	12	0	0		CLR	CLR
2015	42	2	11	0	0		CLR	CLR, SCT Ci, CLR, SCT Ci and Cu

2015	41	2	10	0	0	CLR	CLR	CLR
2015	40	2	9	0	1(few drops until 0800)	OVC(SCT St)	SCT St	CLR
2015	39	2	8	0	1(few drops until 0800)	SCT Cu, CLR	SCT Cu, CLR	CLR
2015	38	2	7	0	1(few drops until 0800)	CLR, few Cu	CLR	CLR
2015	37	2	6	0	1(few drops until 0800)	CLR	CLR	CLR, few Cu
2015	36	2	5	0	0	SCT Cu, mostly CLR	CLR	CLR, few Cu
2015	35	2	4	0	0	CLR, few Cu	CLR	CLR
2015	34	2	3	0	0	OVC, CLR	CLR	CLR, few Ci
2015	33	2	2	0	0	CLR, SCT Ci	CLR, SCT Ci	CLR, SCT Ci
2015	32	2	1	0	0	CLR	CLR, few Cu in the horizon	SCT Ci
2015	31	1	31	0	0	SCT Ac, few Cu (multiple layers)	SCT Cc, CLR	few Cu
2015	30	1	30	0	3(rain 0840 & 1020 & 1420)	OVC	OVC	OVC
2015	29	1	29	0	1(rain 1440)	OVC	OVC	OVC
2015	28	1	28	0	0	SCT Ci	SCT Ci, few Cc	OVC(cirrus)
2015	27	1	27	0	0	CLR, few Ci	CLR, SCT Ci	SCT Ci
2015	26	1	26	0	2(rain at 1227 & 1338)	OVC (Sc and Ac)	OVC (Sc and Ac)	OVC (Sc and Ac)
2015	25	1	25	0	0	SCT Ac	SCT Ac, Cc	SCT Ac, Sc
2015	24	1	24	0	0	CLR	CLR	CLR
2015	23	1	23	0	0	CLR	few Cu in	CLR

2015	22	1	22	0	0	SCT Ci	the horizont SCT Ci, and As	SCT Ci	
2015	21	1	21	0	0	few Ac	CLR	CLR	
2015	20	1	20	0	0	OVC, SCT Cu and Ci	SCT Cu and Ci	SCT Cu, SCT Cc	
2015	19	1	19	0	1(few drops until 09020)	SCT Sc & SCT Ci (multiple layers)	CLR, few Ci	CLR, SCT Cu in the horizont	
2015	18	1	18	0	0	SCT alto- stratus	SCT Ci, few Cc	SCT Ci and Ac	
2015	17	1	17	0	0	CLR	CLR	CLR	
2015	16	1	16	0	0	CLR	CLR, few Ci	SCT alto- stratus	
2015	15	1	15	0	0	CLR, few Ci	CLR	CLR	
2015	14	1	14	0	0	CLR, very few Ci	CLR	CLR, few Ci	
2015	13	1	13	0	1(few drops until 0900)	SCT Ac	few Ci	SCT Cc	
2015	12	1	12	0	1(few drops until 1100)	SCT Sc, few Ci, CLR	SCT Ac, few Ci	SCT Ci, CLR, few Cu	multiple arrays
2015	11	1	11	0	2(drops on the morning+rain at 1100)	OVC	OVC	OVC	
2015	10	1	10	0	0	SCT Ac	SCT Cc (multiple layers)	stratoCu & Ac (multiple layers)	
2015	9	1	9	0	0	OVC (Sc and Ac)	OVC(Sc)	OVC(Sc)	fly:0930
2015	8	1	8	0	0	SCT Cc, SCT	SCT Cc &	CLR, few Cu	

							Cu	Ac	
2015	7	1	7	0	0		CLR, SCT Cc	SCT altostratus, few Ac	SCT altostratus, few Ac
2015	6	1	6	0	0		CLR	CLR	CLR
2015	5	1	5	0	0		CLR	CLR, very few Ci	CLR, very few Ci
2015	4	1	4	0	0		CLR	CLR, very few Ci	SCT Ci
2015	3	1	3	0	0		CLR	CLR	CLR
2015	2	1	2	0	0		CLR	CLR	CLR
2015	1	1	1	0	0		CLR	CLR	CLR
2014	365	12	31	0	2(rain at at 0910 few drops 1144)		OVC	OVC, CLR	CLR, few Cu
2014	364	12	30	0	2(rain at at 1144 & 1416)		SCT Cu	OVC (Sc)	OVC
2014	363	12	29	0	0		CLR	CLR	CLR
2014	362	12	28	0	0		SCT stratus & Cc	few Ci	SCT Ci
2014	361	12	27	0	0		CLR	CLR, few Ci	CLR, SCT Ci
2014	360	12	26	0	0		CLR	CLR	CLR
2014	359	12	25	0	1(few drops at 1010)		SCT Cu	SCT Cu, few Ac	CLR
2014	358	12	24	0	0		CLR, SCT Ci	CLR, SCT Ci, few Cc	SCT Ci and Ac
2014	357	12	23	0	1(few drops until 0900)		CLR	CLR	CLR
2014	356	12	22	0	1(few drops until 0900)		CLR	CLR	CLR
2014	355	12	21	0	0		CLR, few Ci	CLR, SCT Ci	CLR, SCT Ci
2014	354	12	20	0	0		OVC	few Cu,	OVC (Sc)

2014	353	12	19	0	0	(multiple layers)	SCT stratus, OVC		
2014	352	12	18	0	1(few drops until 0900)	CLR, few Cc SCT Sc, SCT Cc (multiple layers)	CLR, few Ci SCT Sc, few cirro Cu, few Cu	SCT stratus	
2014	351	12	17	0	1(few drops until 0900)	CLR, SCT Cu	CLR, SCT Cu, and SCT Ci	CLR, SCT Cu, and SCT Ci	
2014	350	12	16	0	1(rain:1222 all day)	OVC (SCT stratus)	OVC (SCT stratus)	OVC (SCT stratus)	
2014	349	12	15	0	0	OVC (SCT Ci)	OVC (SCT Ci)	OVC (SCT Ci)	
2014	348	12	14	0	0	CLR, few Ci	CLR, few Ci	CLR, few Ci	
2014	347	12	13	0	1(very few drops until 1000)	SCT Cu	SCT Cu	SCT Cu	
2014	346	12	12	0	2(raining all morning, rain at 1414)	OVC	OVC	CLR, StCu in the horizont	there is drops all day
2014	345	12	11	0	0	SCT Ci, few Cu	SCT Ci, few Cu	SCT Ci, few Cu	
2014	344	12	10	0	1(few condensation, until 0900)	SCT Sc	SCT Ci, few Cu	SCT Sc	
2014	343	12	9	0	0	CLR, very few Ci	CLR, few Ci	CLR, few Ci	
2014	342	12	8	0	1(few condensation, until 0900)	OVC(SCT Ci)	OVC(SCT Ci)	OVC(SCT Ci)	
2014	341	12	7	0	1(few condensation,	SCT Ci	SCT Ci	SCT Ci	spider:0928 to 1127

					until 0900)				
2014	340	12	6	0	0	few Cu	few Ci	few Cu in the horizon	
2014	339	12	5	0	1(few drops until 0800)	SCT Ci & Cc (multiple layers)	OVC(SCT Ci)	OVC(SCT Ci)	missing data:(0940 to 0950 and 1000 to 1010)
2014	338	12	4	1 smudge	1(few drops until 1000)	SCT Cu,Ac,Cc(multiple layers)	SCT Ci, few Cu (different directions)	CLR	
2014	337	12	3	1 smudge	1(rain:0940 all day)	OVC	OVC	OVC	
2014	336	12	2	1 smudge	2(rain:0900&1530)	OVC (stratus and Cu)	OVC (stratus and Cu)	OVC (stratus and Cu)	
2014	335	12	1	1 smudge	0	OVC (Cs)	OVC (Cs)	OVC (Cs)	
2014	334	11	30	1 smudge	0	SCT Cu and Ac, multiple layers, CLR	CLR, few Cc	CLR, few Ci	
2014	333	11	29	1 smudge	1(few drops until 0800)	CLR, few cirru (SCT Ac before the dawn)	few Ci	SCT Cu and Ci (2layers)	
2014	332	11	28	1 smudge	0	CLR	CLR	CLR	
2014	331	11	27	1 smudge	0	CLR	CLR, very few Ci	CLR, few Ci	
2014	330	11	26	1 smudge	0	CLR	CLR	CLR	
2014	329	11	25	1 smudge	0	CLR	CLR	CLR	
2014	328	11	24	1 smudge	0	few Cc & Ci	few Ci, mostly CLR	few Ci, mostly CLR	

2014	327	11	23	1 smudge	0	SCT Ci	SCT Ci	SCT Ci	
2014	326	11	22	1 smudge	0	CLR	CLR, few Ci	CLR, few Ci	
2014	325	11	21	1 smudge	1(few drops until 0800)	SCT Cu	few Cu, CLR	CLR	
2014	324	11	20	1 smudge	0	few Ci	few Ci	SCT Ac and Cu (2layers)	
2014	323	11	19	1 smudge	0	SCT Ac and Cc	CLR, SCT Cc	CLR, few Cu	
2014	322	11	18	1 smudge	0	SCT Ci	SCT Ac, and stratus	SCT Ci	
2014	321	11	17	0	0	CLR	CLR, few Ci	CLR, SCT Ci	
2014	320	11	16	?	?	Missing data	Missing data	Missing data	
2014	319	11	15	0	0	few Cu and Ac	SCT Cu and Ac	few Ci and Cu	
2014	318	11	14	0	0	SCT Ac, Cc and few Cu	SCT Ac, and Ci	SCT Cu	cleaning:132730 to 133130
2014	317	11	13	0	0	OVC(Sc, few Cu)	SCT Ci, few Cc	SCT Ci	
2014	316	11	12	0	0	SCT Ac & Cu (2layers)	BKN Cc	CLR	
2014	315	11	11	0	0	OVC(Ac, few Cu)	SCT Ac & SCT Ci (2layers)	SCT Ac & SCT Ci (2layers)	
2014	314	11	10	0	0	OVC(Sc), CLR	few Cu and few Ci	few Ac	
2014	313	11	9	0	0	OVC (stratos), CLR	CLR, few As	CLR, few As	
2014	312	11	8	0	0	CLR	CLR	CLR	
2014	311	11	7	0	0	CLR	CLR	CLR	

2014	310	11	6	0	0	CLR	CLR	CLR	fly:1057 to 1118
2014	309	11	5	0	0	CLR	CLR	CLR	
2014	308	11	4	0	0	CLR	CLR	CLR	
2014	307	11	3	0	0	CLR	CLR	CLR	fly:1115 to 1121
				0	0	SCT Cu	CLR, Cu in the horizont	CLR	
2014	306	11	2	0	0	SCT Cu, few Ci	SCT Cu	SCT Cu, few Ci	
2014	305	11	1	0	0	SCT Ac, Cu (2layers)	OVC	SCT As and Cu (2layers)	
2014	304	10	31	0	0	SCT Ac, alto- stratus,	CLR, few Ac	SCT Ac& Cu, 2 layers	
2014	303	10	30	0	0	CLR	CLR	CLR, few Cu	
2014	302	10	29	0	0	CLR	CLR	CLR, few Ci in the horizont	
2014	301	10	28	0	1(few drops intil 0800)	CLR	CLR	CLR	
2014	300	10	27	0	0	CLR	CLR	CLR	
				0	0	SCT stratus and Ci 2 different layers	SCT Ci & Cc	SCT Ci, few Cu	
2014	299	10	26	0	0	SCT Ac and Cu, forming 2 layers	CLR, few Cu, and few Ac	SCT Cu	
2014	298	10	25	0	1(few drops intil 0700)	CLR	CLR	CLR	
2014	297	10	24	0	1(few drops intil 0800)	CLR	CLR	CLR, few Ci in the horizon	
2014	296	10	23	0	0	CLR	CLR	CLR, SCT Ci	
2014	295	10	22	0	0	CLR	CLR	CLR, SCT Ci	

2014	294	10	21	0	0	SCT Sc, CLR	CLR	CLR, few Ci	
2014	293	10	20	0	0	OVC	OVC	CLR, SCT Cc	
2014	292	10	19	0	0	SCT Cu	SCT Cu	SCT Cu	
				0	0	SCT Cu and Ac, multiple layers	CLR, few Cu in the horizon	CLR, few Cu	
2014	291	10	18						
2014	290	10	17	0	0	SCT Cc & Cu	SCT Cu	SCT Cu, SCT Cc	
				0	0	OVC, SCT Ac and alto Cu	SCT Ci	SCT Ci, few small Cu	
2014	289	10	16						
2014	288	10	15	0	0	OVC	SCT Ci	few Ci	
				0	0	SCT Cu, CLR	CLR, few Cu	CLR, few Ci	
2014	287	10	14						
2014	286	10	13	0	0	OVC, SCT Ac	BKN Cu	BKN Cu	
				0	0	OVC	SCT Ac, CLR	BKN Cu	Missing:50min data (1327 to 1417)
2014	285	10	12						
2014	284	10	11	0	0	SCT Sc, few Ci, CLR	CLR	CLR	
				0	0	OVC, BKN Ac	CLR	BKN Cu in the horizon	
2014	283	10	10						
2014	282	10	9	0	0	SCT Cu, CLR	CLR	BKN Cu	
				0	0	SCT Ac and Cu	SCT Ac and Cu	CLR, BKN Cu, few Ci	
2014	281	10	8						
2014	280	10	7	0	1(few drops until 0900)	OVC	OVC(SCT Ac& Sc)	SCT Cc	
				0	0	SCT Cs, few alto Cu	SCT Cs	SCT Cs	
2014	279	10	6						
2014	278	10	5	0	0	CLR	CLR	CLR	

2014	277	10	4	0	0	CLR, very few Sc	CLR	CLR	
2014	276	10	3	0	0	CLR	SCT Ci	SCT Ci	
2014	275	10	2	0	1(few drops until 0700)	CLR	CLR	CLR	
2014	274	10	1	0	0	SCT Sc, few Cu, CLR	CLR	SCT Sc, CLR	
2014	273	9	30	0	0	CLR	CLR, few Sc	SCT Sc, CLR	
2014	272	9	29	0	0	CLR	CLR	CLR, very few Ci	
2014	271	9	28	0	0	SCT Cu	BKN Cu	SCT Ac	
2014	270	9	27	0	0	SCT Cu	few Cu, CLR	CLR, SCT Ac, BKN Cu	missing 80min of data (080300 to 102200)
2014	269	9	26	0	0	SCT Cu, CLR	mostly CLR, few BKN Ac	SCT Cu	
2014	268	9	25	0	1(few drops until 0800)	few Ac, CLR	SCT Cu, CLR	CLR	
2014	267	9	24	0	0	CLR	CLR, very few Ci	CLR	
2014	266	9	23	0	0	OVC, SCT Cu and Ci	SCT Cu and Ci, CLR	CLR, few Cu on the horizon	
2014	265	9	22	0	0	SCT Cu, CLR	CLR	CLR	
2014	264	9	21	0	0	SCT Cu, few Ac, CLR		CLR	
2014	263	9	20	0	0	OVC, SCT Ac, CLR	CLR	CLR	
2014	262	9	19	0	1(few drops until 0930)	OVC, SCT Ac, CLR	CLR	CLR, few Cu	

2014	261	9	18	0	0	SCT Ac, CLR	CLR, BKN Cu	SCT Sc	
2014	260	9	17	?	?	Missing data	Missing data	Missing data	
2014	259	9	16	0	0	CLR	CLR	BKN Cu, OVC	
2014	258	9	15	?	?	Missing data	Missing data	Missing data	
2014	257	9	14	?	?	Missing data	Missing data	Missing data	
2014	256	9	13	0	0	CLR	few Ac	CLR	
2014	255	9	12	0	0	CLR	CLR	SCT Ac, CLR, few Ci	
2014	254	9	11	0	0	CLR	few Cu	few Cu	
2014	253	9	10	0	0	CLR	CLR	few Cc	
2014	252	9	9	0	1(few drops until 0700)	SCT Sc and Ac	CLR	few Ci	
2014	251	9	8	0	0	few cirru-Cu	few cirru- Cu	CLR	
2014	250	9	7	0	0	CLR	few Ac	few Ac	
2014	249	9	6	0	0	BKN Cu, CLR	SCT Ci	SCT Cc and Ci	
2014	248	9	5	0	0	OVC, SCT Sc, CLR	few Ci	few Ci	
2014	247	9	4	0	0	OVC	BKN Cu, few Ci, CLR	SCT Cu	cleaning:123130
2014	246	9	3	0	0	OVC, SCT Sc, CLR	CLR	BKN Cu	
2014	245	9	2	0	0	CLR	CLR	SCT Cu	
2014	244	9	1	0	0	overcast, SCT Sc, CLR	CLR	SCT Ac	

2014	243	8	31	0	0	OVC, few Ci	CLR	SCT Ac
2014	242	8	30	0	1(few drops until 0700)	OVC, CLR	CLR	CLR
2014	241	8	29	0	1(few drops until 0700)	BKN Cu, few Ci	CLR, very few Ci	CLR, SCT Cu in the horizon
2014	240	8	28	0	0	CLR	CLR	CLR
2014	239	8	27	0	0	CLR	CLR	CLR
2014	238	8	26	0	0	few Ci	few Cc	CLR
2014	237	8	25	0	0	SCT Ci, few Cu	SCT Ci	SCT Ci, CLR, few Cu
2014	236	8	24	0	0	SCT Cu & Ac	SCT Ci, few Cc	SCT Ci and BKN Cu
2014	235	8	23	0	1 (few drops until 0830)	few Cu, few Cc	CLR	CLR, few Cu
2014	234	8	22	0	0	SCT Cu	CLR	CLR, few Cu
2014	233	8	21	0	0	OVC, CLR	SCT Ac	CLR, few Cu
2014	232	8	20	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	Bad Data	Bad Data	Bad Data
2014	231	8	19	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, StAc, CLR	CLR, few Cu, SCT Sc in the horizon	CLR, bronken Cu
2014	230	8	18	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Ac, OVC, CLR	CLR	CLR, SCT Cu
2014	229	8	17	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Ci, few Sc, CLR	CLR	CLR, few Ci

				dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Sc, CLR	CLR	CLR
2014	228	8	16	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	CLR	CLR	CLR
2014	227	8	15	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cu, CLR	CLR	CLR
2014	226	8	14	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, SCT Ac	CLR, BKN Cu	CLR, SCT Cu
2014	225	8	13	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, SCT Ac and Cu	CLR, few St in the horizont	SCT Sc, OVC
2014	224	8	12	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, SCT Cc	SCT Ac, SCT Ci	SCT Cu & Ac
2014	223	8	11	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	Missing Data	Missing Data	Missing Data
2014	222	8	10	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, SCT Cu	OVC	SCT Cu, CLR, few Ci
2014	221	8	9	1 (3 smudges + accumulated	0			

2014	220	8	8	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	OVC	CLR, SCT Cu
2014	219	8	7	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, SCT Sc	very few Ci, CLR	CLR, SCT Cu
2014	218	8	6	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Sc and few Ci	CLR	CLR, SCT Cu
2014	217	8	5	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	1 (dew drops until 0830)	BKN Cu	CLR	SCT Sc
2014	216	8	4	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	CLR	CLR, few Cu in the horizon	few Ci
2014	215	8	3	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	SCT Cu & Cc	SCT Cu & Cc
2014	214	8	2	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	2(few drops at 1256 and 1530)	OVC	OVC	OVC
2014	213	8	1	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, SCT Cu, few Ci	few Cc	few Cu & Cc

2014	212	7	31	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cu, few Cc	few Cc & Cu	few Cc & Cu
2014	211	7	30	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	1 (dew drops in mornign)	CLR w. haze (aersols?)	few Cu	CLR
2014	210	7	29	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Ci	SCT Ci	few Ci
2014	209	7	28	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cc	few Cc	few Ci, few Cu
2014	208	7	27	dirt -- dirt seen around sun) 2 (3 smudges + accumulated dirt -- dirt seen around sun)	1 (rain , 1100-1200)	OVC	BKN Ci, few Ac	SCT Ci, few Ac
2014	207	7	26	dirt -- dirt seen around sun + water marks) 2 (3 smudges + accumulated dirt -- dirt seen around sun + water marks)	0	OVC, few Cu & Cs	few Cu & Ci	few Cu, SCT Ac
2014	206	7	25	dirt -- dirt seen around sun + water marks)	0	BKN Ac, few Cu	few Cu, SCT Ac	SCT Ac, few Cu

2014	205	7	24	2 (3 smudges + accumulated dirt -- dirt seen around sun + water marks)	0	BKN Cu, CLR	few Cu	few Cu, few Ac
2014	204	7	23	2 (3 smudges + accumulated dirt -- dirt seen around sun + water marks)	1 (dew drops in morning)	few Cu, few Cc	CLR	CLR
2014	203	7	22	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	BKN Cu	few Cu, few Ac	few Cu
2014	202	7	21	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, few Cu, few Ci	CLR	few Cu
2014	201	7	20	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	SCT Cu	few Ci, CLR
2014	200	7	19	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	OVC	few Cu, SCT Ac
2014	199	7	18	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	BKN Cu	SCT Cc & Ci, few Cu	SCT Cc & Ci
2014	198	7	17	1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Ac	few Cu	CLR

2014	197	7	16	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cu, CLR	CLR	few Cu, CLR
2014	196	7	15	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	OVC	OVC
2014	195	7	14	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	1 (rain at 1645)	OVC	BKN Cu, few Ac	OVC
2014	194	7	13	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	BKN Cu, SCT Ac	SCT Cu, few Ac	SCT Cu
2014	193	7	12	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC, few Ci	SCT Ci & Cc	SCT Ci, few Cu
2014	192	7	11	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cu, CLR	CLR	SCT Ci
2014	191	7	10	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cu, CLR	CLR	CLR, few Cu
2014	190	7	9	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Cu, CLR	few Cu	few Cu

missing images:
1643-1652

2014	189	7	8	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Cu & few Ac	few Ac	few Cu
2014	188	7	7	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Cu, CLR	CLR	few Cu
2014	187	7	6	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Ac	few Cu & Ac	CLR
2014	186	7	5	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	SCT Ac	few Ac, CLR	CLR, few Ac
2014	185	7	4	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Ac & Ci, CLR	few Cu & Cc	CLR, few Cc
2014	184	7	3	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	few Cu, CLR	few Cu	CLR
2014	183	7	2	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	few Cu	few Cu
2014	182	7	1	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	SCT Cu & Ac	BKN Cu

2014	181	6	30	dirt -- dirt seen around sun) 1 (3 smudges + accumulated dirt -- dirt seen around sun)	0	OVC	OVC	BKN Cu	missing images: 0842-0850
2014	180	6	29	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	OVC	SCT Cu	BKN Cu	
2014	179	6	28	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	OVC	BKN Cu	SCT Cu, OVC	
2014	178	6	27	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	OVC	OVC	OVC, BKN Cu	
2014	177	6	26	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	BKN Cu, BKN Cc	BKN Cc, few Cu	few Cu, few Ci	
2014	176	6	25	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	OVC	few Cu, CLR	few Cu	
2014	175	6	24	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	SCT Cu, CLR	CLR, few Cu	few Cu	
2014	174	6	23	dirt -- dirt seen around sun) 1 (1 smudge + accumulated dirt -- dirt seen around sun)	0	BKN Cu	SCT Cu	few Cu	

2014	173	6	22	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	SCT Cu	few Cu, CLR	few Cu
2014	172	6	21	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	BKN Cu, few Cu	few Ac & Ci	few Cu & Ci
2014	171	6	20	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	BKN Cu, few Ci	few Cu, SCT Ci	few Cu, SCT Ci
2014	170	6	19	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	BKN Cu, CLR	CLR, few Cu	few Cu
2014	169	6	18	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	CLR	CLR	few Cu
2014	168	6	17	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	few Cu, CLR	CLR	CLR
2014	167	6	16	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	BKN Cu, CLR	CLR	CLR
2014	166	6	15	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	SCT Ci & Cc	few Ci & Cu	SCT Cu
2014	165	6	14	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	CLR, few Cu	few Cc	few Cc & Ci
2014	164	6	13	dirt -- dirt seen around sun) 1 (accumulated dirt -- dirt seen around sun)	0	BKN Cu, CLR	CLR	few Cu

				1 (accumulated dirt -- dirt seen around sun)				
2014	163	6	12		0	CLR	CLR	few Cu
2014	162	6	11			dead video		
2014	161	6	10	0	0	OVC	BKN & few Cu	few Cu
2014	160	6	9	0	0	OVC	OVC	OVC
2014	159	6	8	0	0	OVC, CLR	few Cu	few Cu
2014	158	6	7	0	0	BKN Cu, CLR	CLR	few Cu
2014	157	6	6	0	0	OVC	BKN Cu, CLR	few Cu
2014	156	6	5	0	0	few Cu, CLR	CLR	CLR, few Cu
2014	155	6	4	0	0	few Cu, few Cc & Ci	BKN Cc & Ci	few Cc
2014	154	6	3	0	0	few Cu, CLR	CLR	CLR
2014	153	6	2	0	0	few Cu, SCT Ci	SCT Ci, few Cu	SCT Ci, few Cu
2014	152	6	1	0	0	SCT Cu, few Ci	few Ci & Cc	few Ci
2014	151	5	31	0	0	BKN Cu	CLR	CLR
2014	150	5	30	0	0	BKN Cu	few Cu & Ci	few Cu
2014	149	5	29	0	0	SCT Cu, few Ci	SCT Cu, few Ci	CLR
2014	148	5	28	0	0	Cu, BKN Ac	few Ac	SCT Cu
2014	147	5	27	0	0	few Cu	few Cu & Ci	few Cu, SCT Ci
2014	146	5	26	0	0	SCT Cu	CLR	few Cu
2014	145	5	25	0	0	OVC, CLR	CLR	CLR
2014	144	5	24	0	0	OVC	OVC	OVC

2014	143	5	23	0	0	few Cu, SCT Ac	BKN Ac	SCT Cu
2014	142	5	22	0	0	few Cu, BKN Ac, few Ci	few Cu, BKN Ac, few Ci	SCT Cu, BKN Ac
2014	141	5	21	0	0	few Cu	few Cu	few Cu
2014	140	5	20	0	0	SCT Cu	SCT Cu	few Cu
2014	139	5	19	0	0	BKN Cu	BKN Cu	BKN Cu
2014	138	5	18	0	0	BKN Cu, CLR	few Ci	few Cu
2014	137	5	17	0	0	SCT Ci	CLR	SCT Cu
2014	136	5	16	0	0	CLR	CLR	CLR
2014	135	5	15	0	0	CLR	CLR	CLR
2014	134	5	14	0	0	CLR	CLR	CLR
2014	133	5	13	0	0	CLR	CLR	CLR
2014	132	5	12	0	0	CLR	CLR	CLR
2014	131	5	11	0	0	CLR	CLR	CLR
2014	130	5	10	0	0	SCT Ac	few Ac	SCT Cu
2014	129	5	9	0	0	few Ac & Ci	SCT Ci, few Cc	SCT Cu
2014	128	5	8	0	0	few Ac & Ci	CLR	few Ci
2014	127	5	7	0	0	SCT Cu, few Ac	few Ac	BKN Ac
2014	126	5	6	0	0	SCT Cu, few Ci	SCT Cu, few Ac	SCT Cu
2014	125	5	5	0	0	BKN Cu	BKN Cu	BKN Cu
2014	124	5	4	0	0	BKN Cu, CLR	CLR	SCT Ci
2014	123	5	3	0	0	CLR	CLR	CLR

1.5 hour skip from
1400 to 1530

2014	122	5	2	0	0	CLR	CLR	CLR	felipe walked in front for 2-4 minutes
				0	0	few Cc & Ci	few Cc & Ci	few Cc & Ci	
2014	121	5	1						missing images from 1434 to 1511
2014	120	4	30	0	0	CLR	few Cc	CLR	
2014	119	4	29	0	0	CLR	CLR	CLR	
2014	118	4	28	0	0	CLR, few Cu	CLR	CLR, few Cu	
2014	117	4	27	0	0	SCT Cu	few Cu	CLR	
2014	116	4	26	0	0	SCT Cu	SCT Cu	SCT Cu, few Ci	
2014	115	4	25	0	0	OVC, BKN Ac	BKN Ac, few Ci	BKN Ac, OVC	
2014	114	4	24	0	0	few Cu & few Cc	few Cc	CLR	
2014	113	4	23	0	0	few Cu & Cc	few Cc	few Cc	
2014	112	4	22	0	0	OVC	SCT Cu, few Cc	SCT Cu	
2014	111	4	21	0	0	OVC, CLR	SCT Cu	BKN Cu	
2014	110	4	20	0	0	OVC, SCT Cu	SCT Cu	SCT Cu	
2014	109	4	19	0	0	BKN Ac	SCT Cc, few Cu	SCT Cc, few Cu	
2014	108	4	18	0	0	OVC	SCT Ac, SCT Ci	SCT Ac, Ci	missing images from 1653 to 1745
2014	107	4	17	0	0	OVC	OVC	few Ac, SCT Cc	
2014	106	4	16	0	0	BKN Cu	SCT Cu, CLR	SCT Cu	
2014	105	4	15	0	0	OVC, SCT Cu	few Cu & Ci	few Cu, SCT Ci	

2014

104

4

14

0

0

CLR

CLR

CLR

Table A4 USI 1_14 log

Sky imager daily log

Daily conditions as determined from review of sky images. [Please read the key at the next tab.](#)

Imager: USI 1-14
 Installation:
 : Alpine
 Time Zone GMT

Golden day
Has potential
Further Review
Good Sequence, but mirror is dirty
Missing / Bad Data
Good for CLR Sky Library
Good for CLR sky calibration
(STAY AWAY) Scary period with forming and disappearing cloud

multiple cloud layers

Year	DOY	Month	Day	Dirt (0-3)	Condensation or rain (0-3) &Time	Period 08:00-11:00	Period 11:00-14:00	Period 14:00-17:00	Note
2015	78	3	19	0	0	SCT Ac	Missing data	Missing data	missing data: 1256 to 1700
2015	77	3	18	0	0	Missing data	Missing data	Missing data	6 sec of data
2015	76	3	17	0	0	few Ci	SCT Cc and Ci	OVC (Cc and Ci)	
2015	75	3	16	0	0	SCT Ci	few Ci, CLR	few Ci	
2015	74	3	15	0	0	SCT Ci	SCT Ci	SCT Ci	

2015	73	3	14	0	0	CLR, few Ci	CLR, SCT Ci	SCT Ci	
2015	72	3	13				CLR	CLR, few Ci	missing data from 0756 to 1147
				0	0	CLR			
2015	71	3	12	0	0	CLR	CLR	CLR	
2015	70	3	11	0	0	SCT Ac and As	SCT Cc	SCT Ac	
2015	69	3	10	0	0	CLR	CLR, few Ci	SCT Ci	
2015	68	3	9	0	0	CLR	CLR	CLR	
2015	67	3	8	0	0	CLR	CLR	CLR	
2015	66	3	7	0	0	CLR	CLR	CLR	
2015	65	3	6	0	0	CLR	CLR	CLR	
2015	64	3	5	0	0	CLR	CLR	CLR	
2015	63	3	4	0	0	CLR	CLR	CLR, few Cu	
2015	62	3	3	0	0	few Cu, CLR	SCT Cu	SCT Cu	
2015	61	3	2	0	1(few drops at 0900, 1030)	OVC (Cu)	BKN Cu	OVC(Cu)	
2015	60	3	1	0	rain all day	OVC	OVC	OVC	
2015	59	2	28	0	1(few drops along the morning)	BKN Cu	OVC(Cu)	BKN Cu	
2015	58	2	27	0	0	BKN Cu	BKN Cu	NO DATA	missing after 1330
2015	57	2	26	0	0	few cirrus, CLR	SCT Ci	few Ci	
2015	56	2	25	0	0	CLR	CLR	CLR	missing some hours
2015	55	2	24	0	0	CLR	CLR, very few Cu	CLR, few Ci	
2015	54	2	23	0	1(few rain in the morning)	SCT Cu, Ac (multiple layers)	SCT Cu	SCT Cu	
2015	53	2	22	0	3(few drops at	OVC (Cu)	OVC (Cu)	OVC (Cu)	

0800,1230,1330,1550)

2015	52	2	21	0	0	SCT Cs	SCT Cs	SCT Cs, few Cu OVC (cirrustratus)	missing data: 1451 to 1541
2015	51	2	20	0	0	OVC (cirrustratus)	OVC (cirrustratus)	(cirrustratus), few Ac	
2015	50	2	19	0	0	SCT Cc	SCT Cc	SCT Cc	
2015	49	2	18	0	0	SCT Ci	OVC (cirrustratus)	OVC (cirrustratus)	
2015	48	2	17	0	0	CLR, very few Cs	CLR, very few Cs	CLR, very few Cs	
2015	47	2	16	0	0	SCT Ci	SCT Ci	SCT Ci	missing data: 1300 to 1302
2015	46	2	15	0	0	CLR	CLR	CLR	
2015	45	2	14	0	0	CLR, very few Ci	CLR, very few Ci	SCT Ci, few Ac	
2015	44	2	13	0	0	CLR	CLR	CLR	
2015	43	2	12	0	0	CLR	CLR	CLR	
2015	42	2	11	0	0	CLR	SCT Ci	SCT Ci and few Cu	maintance: 0900 to 0926
2015	41	2	10	?	?	Missing data	Missing data	Missing data	
2015	40	2	9	?	?	Missing data	Missing data	Missing data	
2015	39	2	8	?	?	Missing data	Missing data	Missing data	
2015	38	2	7	?	?	Missing data	Missing data	Missing data	
2015	37	2	6	?	?	Missing data	Missing data	Missing data	
2015	36	2	5	?	?	Missing data	Missing data	Missing data	
2015	35	2	4	?	?	Missing data	Missing data	Missing data	
2015	34	2	3	?	?	Missing data	Missing data	Missing data	
2015	33	2	2	?	?	Missing data	Missing data	Missing data	
2015	32	2	1	?	?	Missing data	Missing data	Missing data	

2015	31	1	31	?	?	Missing data	Missing data	Missing data	
2015	30	1	30	?	?	Missing data	Missing data	Missing data	
2015	29	1	29	?	?	Missing data	Missing data	Missing data	data until 095230
2015	28	1	28	0	0	SCT Ci	OVC (cirrustratus)	OVC (cirrustratus)	
2015	27	1	27	0	0	SCT Cu, few Ci (multiple layers)	SCT Cu, few Ci (multiple layers)	SCT Ci, few Cu OVC	human activity 1231
2015	26	1	26	0	1(few drops at 1309)	OVC (stratus)	OVC (stratus)	(stratus); SCT Ac	
2015	25	1	25	0	0	SCT Cc	SCT Ac	OVC (Sc)	
2015	24	1	24	0	0	CLR	CLR, very few Cu	CLR, few Ci	
2015	23	1	23	0	0	CLR	CLR, few Cu	CLR	
2015	22	1	22	0	0	CLR, SCT Ci	SCT Ci	SCT Cs	
2015	21	1	21	0	0	OVC; CLR, few Ci	CLR, few Ci	CLR, few Ci SCT Ci; SCT Ac	
2015	20	1	20	0	0	SCT Ci	SCT Ci	SCT Ci	
2015	19	1	19	0	0	SCT Ci	SCT Ci	SCT Ci	
2015	18	1	18	0	0	SCT Ci	SCT Ci, CLR	SCT As and Ci	
2015	17	1	17	0	0	CLR	CLR	CLR	
2015	16	1	16	0	0	CLR	CLR, SCT Ci	CLR, SCT Ci	
2015	15	1	15	0	0	CLR	CLR	CLR	missing data:0902 to 0908
2015	14	1	14	0	0	CLR	CLR	CLR, few Ci	
2015	13	1	13	0	0	SCT Cu	SCT Cu	SCT Cu, few Ci	

2014	363	12	29	0	0	CLR	CLR	CLR	
2014	362	12	28	0	0	SCT Ac, CLR	few Ci, CLR	few Ci, CLR	
2014	361	12	27	0	0	CLR	CLR, few Ci	CLR, few Ci	
2014	360	12	26	0	0	CLR	CLR	CLR	
2014	359	12	25	0	2(few drops until 0900, rain:1130)	OVC(Cu, Ac, multiple layers)	OVC(Cu, Ac, multiple layers)	SCT Ac, CLR	
2014	358	12	24	0	0	SCT Ci	Cc	SCT Ci	
2014	357	12	23	0	0	CLR	CLR	CLR	
2014	356	12	22	0	0	CLR	CLR	CLR	
2014	355	12	21	0	0	SCT Ci	SCT Ci	SCT Ci	missing data 1214 to 1219
2014	354	12	20	0	1(few condensation)	SCT Ci	SCT Ci; SCT Ac	SCT Ac, few Cu	
2014	353	12	19	0	1(few condensation)	few cirrus, CLR	CLR	SCT Ci, few Cu	
2014	352	12	18	0	0	SCT Sc, OVC	SCT Sc, Ac	SCT stratus, and Cu	
2014	351	12	17	0	1(few drops until 1000)	SCT Cu	SCT Cu and Ci (multiple layers)	SCT Cu and Ci	
2014	350	12	16	0	1(rain after 1140 all day)	OVC(status)	OVC(status)	OVC(status)	
2014	349	12	15	0	0	OVC (SCT Cs)	SCT Cs	SCT Cs	human activity until 0957
2014	348	12	14	0	0	SCT Ci, mostly CLR	SCT Ci, mostly CLR	SCT Ci and Cc, mostly CLR	
2014	347	12	13	0	1(few drops until 0900)	SCT Cu	SCT Cu	SCT Cu	

2014	346	12	12	0	1(raining all morning)	OVC(status)	OVC(status)	OVC(status); SCT Cu	
2014	345	12	11	0	0	SCT Ci, and Cc	SCT Ci	SCT Ci, few Cu	
2014	344	12	10	0	0	CLR, SCT Ci	CLR, SCT Ci and Sc	CLR, SCT Ci and Sc	A lot of human activity until 1200, and afternoon few human activity around 121330
2014	343	12	9	0	0	CLR	CLR	CLR	
2014	342	12	8	0	0	OVC (SCT Cs)	OVC (SCT Cs)	SCT Ci	
2014	341	12	7	0	0	SCT Ci	SCT Ci	SCT Ci	
2014	340	12	6	0	0	CLR, very few Ci and Cu	few Cu and Ci	CLR	
2014	339	12	5	0	1(condensation until	SCT Cs	SCT Cs, very few Cu	SCT Cs	missing data 102030 to 102130/person: 1500
2014	338	12	4	0	1(few drops until 1100)	SCT Cu	SCT Cu, few Ci	SCT Cu	
2014	337	12	3	0	2(drops in the morning, rain all day)	OVC(stratus)	OVC(stratus)	OVC(stratus)	
2014	336	12	2	0	1(rain:0950, 1140, 1455)	OVC(stratus)	OVC(stratus)	OVC(stratus)	
2014	335	12	1	0	0	OVC(cirrostratus)	OVC(cirrostratus)	OVC(cirrostratus)	
2014	334	11	30	0	0	SCT Cu, few Ac	SCT Cu, few Ac	SCT Ac, few Cu (multiple	

Table A5 USI dates used for solar calibrations, CLRsky libraries, and forecasts

Date	USI 1_8 Fallbrook	USI 1_9 Point Loma	USI 1_14 Alpine	Table Legend
3/19/15				Day used for Solar Calibration
3/18/15				Day used for CLR Sky Library
3/17/15				Day used for both SC and CSL
3/16/15				Day has bad/missing data
3/15/15				Day used for forecasting
3/14/15				
3/13/15				
3/12/15				
3/11/15				
3/10/15				
3/9/15				
3/8/15				
3/7/15				
3/6/15				
3/5/15				
3/4/15				
3/3/15				
3/2/15				
3/1/15				
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