Resourcesat-2/2A: ARD - Surface Reflectance
A Status Update

LSI-VC-20
16 Sep 2026

T.Radhika

NRSC/ISRO

Resourcesat-2/ 2A:

- The Resourcesat-2 satellite was launched by the Indian Space Research Organization (ISRO) on April-2011, followed by Resourcesat-2A on Dec-2016, to ensure systematic and repetitive coverage of the earth's surface
- The objective of these Indian Remote Sensing (IRS) satellites is to provide data for integrated land and water resource management.

	AWiFS	LISS-3 (L3)	LISS-4 (L4)
No of Bands	4	4	3
Resolution (m)	56	24	5.8
Swath (km)	740	140	70
Revisit period (days)	5	24	5
Spectral Band2 (μ)	0.52 – 0.59 (green)	0.52 – 0.59 (green)	0.52 – 0.59 (green)
Spectral Band3 (μ)	0.62 – 0.68 (red)	0.62 – 0.68 (red)	0.62 – 0.68 (red)
Spectral Band4 (μ)	0.77 – 0.86 (NIR)	0.77 – 0.86 (NIR)	0.77 – 0.86 (NIR)
Spectral Band5 (μ)	1.55 – 1.70 (SWIR)	1.55 – 1.70 (SWIR)	-

A Quick Recap..



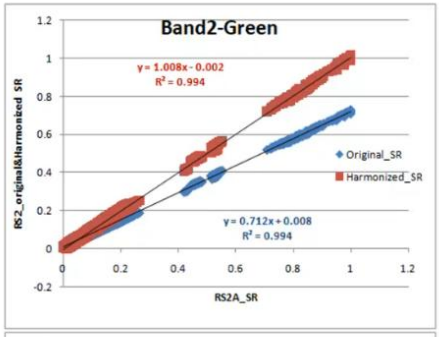
Control & Confidence In Algorithms

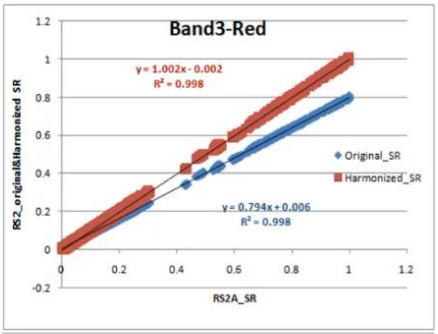
- RS-2/2A SR generation is fully automated for L3 & AWiF
- RS2 is harmonized with reference to RS2A
- Radiometric Accuracy is around 95 % - Validated with In-situ & OLI over Indian terrain
- SR Products are made available from Bhoonidhi portal since 2022.

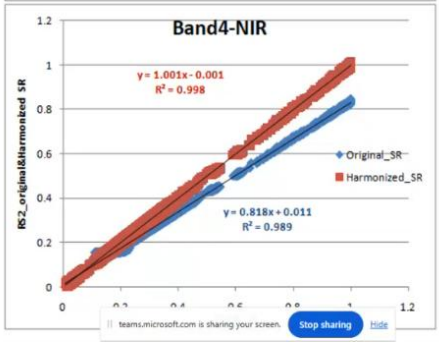
Incremental update..

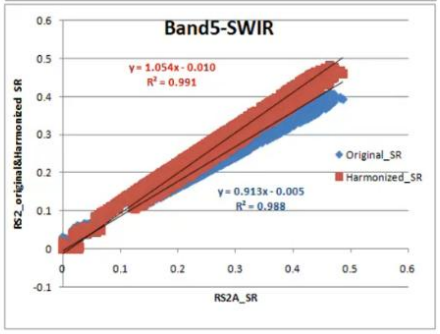
- Absolute validation of SR over RADCALNET sites for L3 & AWiF
- Geometric accuracy is further refined for L3 & L4
- Metadata is made STAC compliant
- QA layer is implemented
- L3 ARD Products have been submitted for the endorsement

Before & After Harmonization: RS2- L3

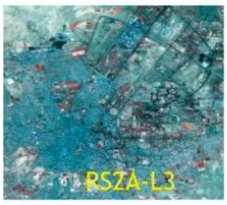


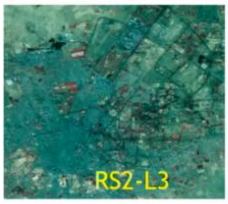


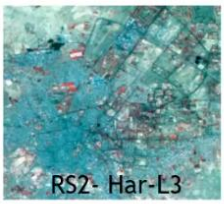




RS2A-L3 05Mar2022 92/52
RS2-L3 17Mar2022 92/52

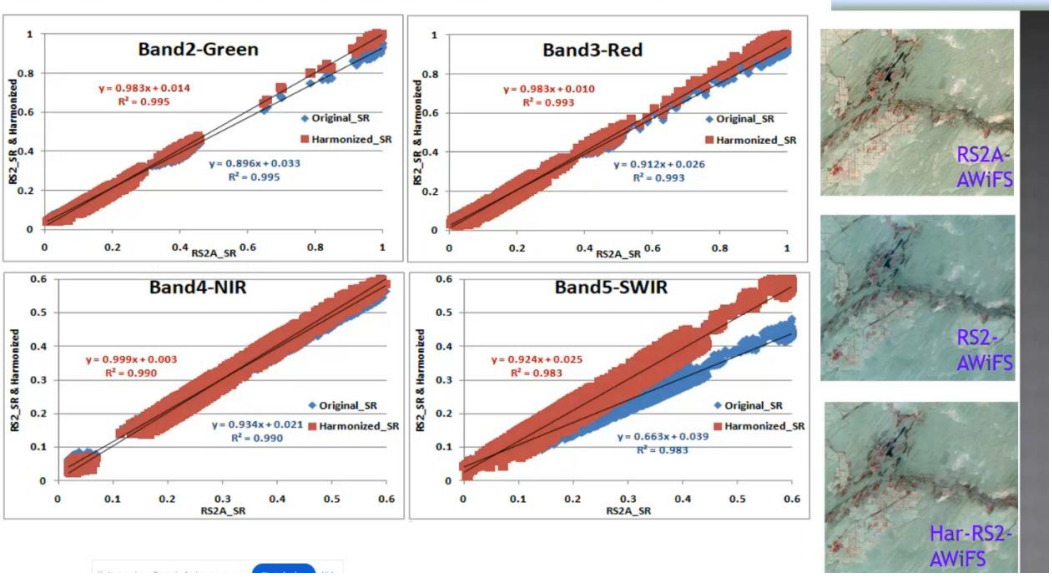


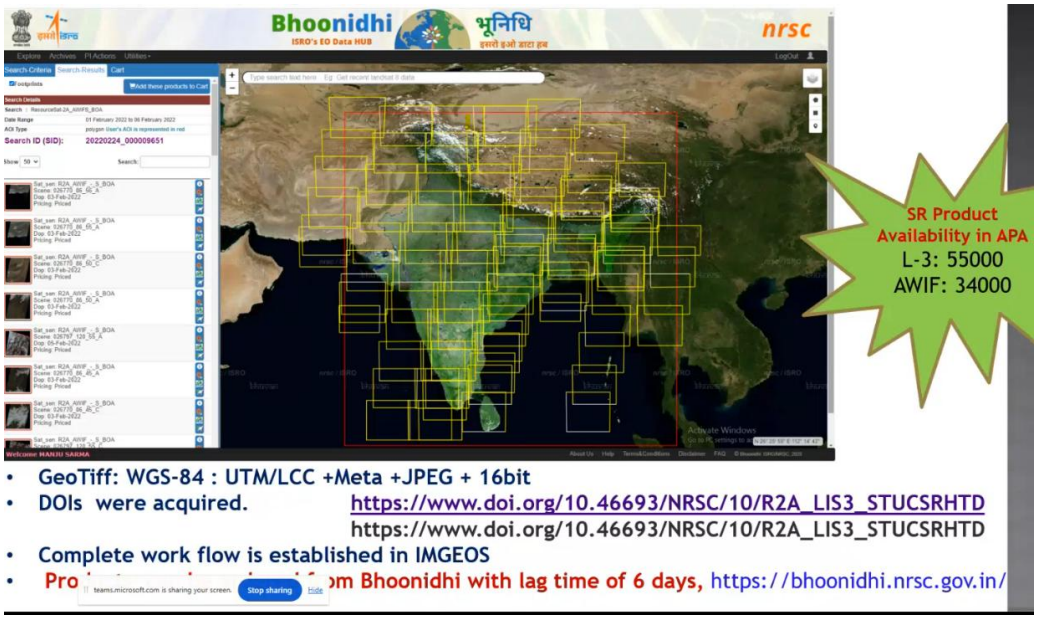




Before & After Harmonization : RS2- AWIFS

RS2A-AW 22Apr2022 92/52
RS2-AW 10Apr2022 92/52





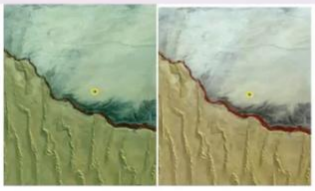
- GeoTiff: WGS-84 : UTM/LCC +Meta +JPEG + 16bit
- DOIs were acquired. https://www.doi.org/10.46693/NRSC/10/R2A_LIS3_STUCSRHTD
  https://www.doi.org/10.46693/NRSC/10/R2A_LIS3_STUCSRHTD
- Complete work flow is established in IMGEOS
- Pro[illegible]om Bhoonidhi with lag time of 6 days, https://bhoonidhi.nrsc.gov.in/

OBJECTIVE -1 : ABSOLUTE VALIDATION WITH RADCALNET

1. SR products from RS-2/2A L3 and AWiFS sensors over the sites since launch (2011 & 2017) are generated using ACT-RS code by using auxiliary information provided with Meta file and ancillary data sets from CAMS.
2. The Radcalnet provides the corrected reflectance values over four instrumented reference test sites namely Railroad Playa(USA), Baotou(China), La Crau (France) and Gobabeb(Namibia) at 30 minute intervals from 9am to 3pm.
3. Data measured at satellite overpass local time is considered for the comparison.

RVU- Left: RA -252/43, DOP: 14Oct2022, Right: R2-252/53, DOP: 08Sep2022

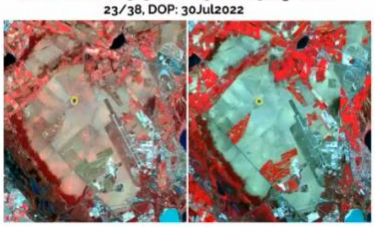




GONA- Left: RA -49/95, DOP: 05Jun2023, Right: R2-49/95, DOP: 30Apr2023



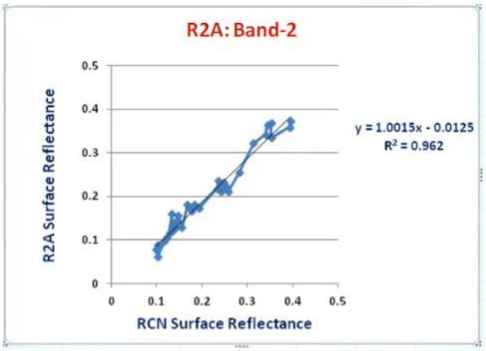
LFCR- Left: RA -23/38, DOP: 19Feb2023, Right: R2-23/38, DOP: 30Jul2022

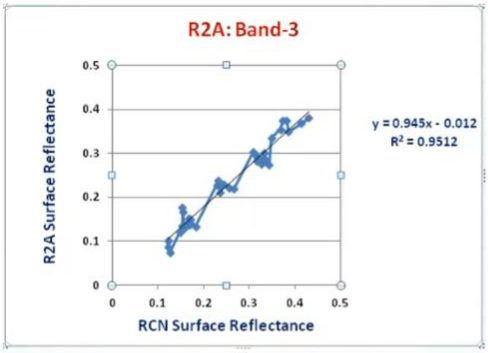


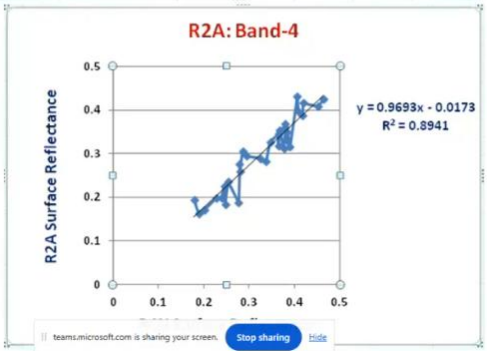
BSCN &BTCN-Left: RA -123/41, DOP: 22May2023, Right: R2-123/41, DOP: 03Jun2023

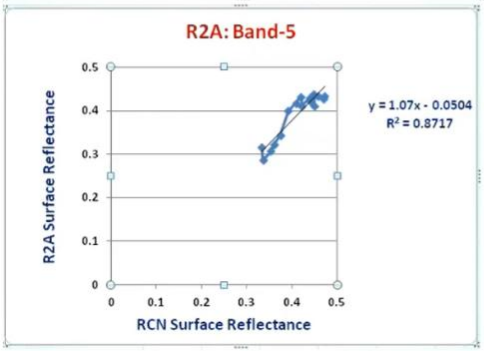
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RCN VS R2A-L3 : ALL SITES SINCE 2017







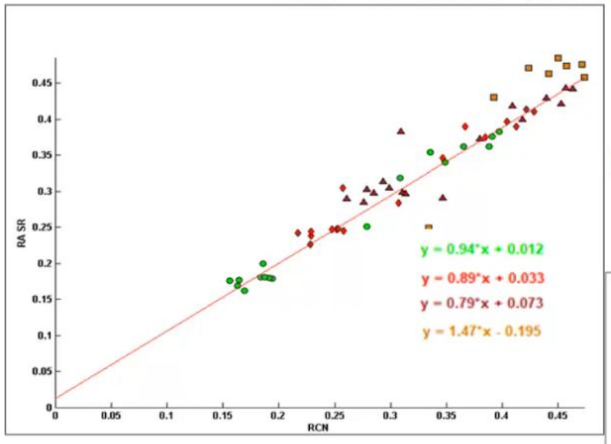


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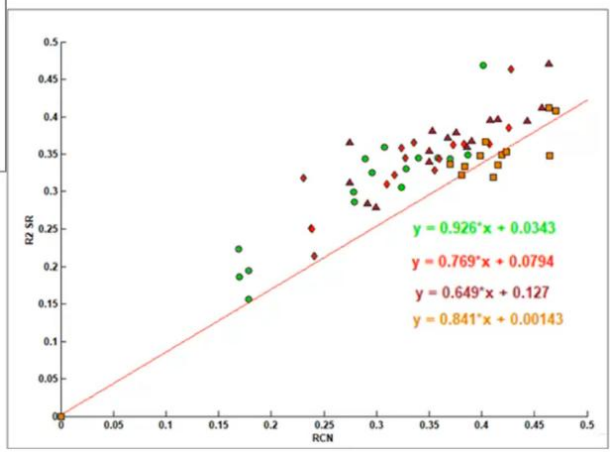
L3-Accuracy metrics over RCN : from all the observations for R2/RA/L8 over five sites

RS-2	SSIM	RMSE	slope	offset	R^2	SMAPE
B2	0.809	0.018	0.702	0.007	0.945	15.009
B3	0.819	0.021	0.748	0.006	0.943	12.802
B4	0.778	0.030	0.589	0.081	0.877	9.383
B5	0.806	0.037	0.576	0.083	0.585	12.232
RS-2A						
B2	0.908	0.015	1.001	-0.012	0.962	5.247
B3	0.871	0.017	0.945	-0.012	0.951	6.874
B4	0.792	0.019	0.863	0.021	0.868	5.898
B5	0.728	0.025	1.046	-0.051	0.787	5.555
L8-OLI						
B3	0.8423	0.020	0.932	0.01	0.941	3.748
B4	0.8442	0.022	0.972	0.008	0.944	3.477
B5	0.813	0.024	0.884	0.043	0.898	3.621
B6	0.8348	0.027	1.010	-0.008	0.781	2.527

RCN Vs AWiF : All sites since 2017



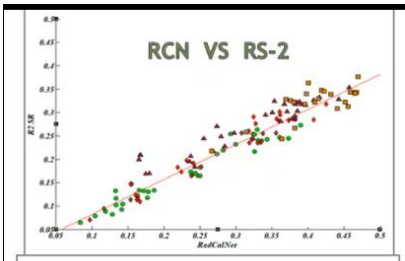
RS-2A

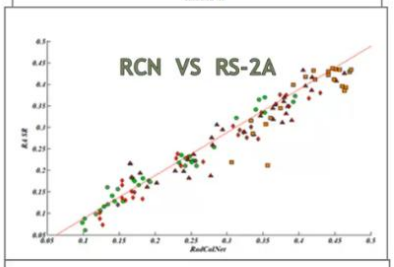


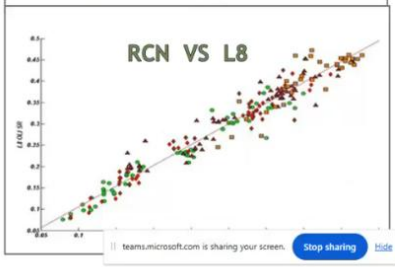
RS-2

B2-Green
B3-Red
B4-NIR
B5-SWIR

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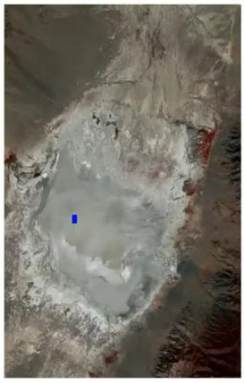


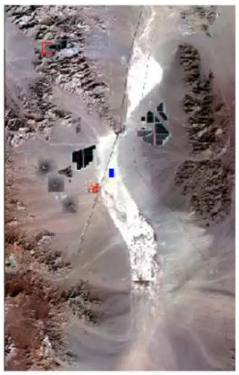
B2
B3
B4
B5

SR: Relative validation with OLI over RCN

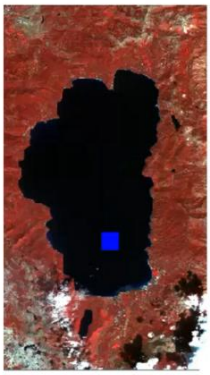
R2 vs L8	slope	offset	R^2	SSIM	corr	RMSE	SSE	MAD
B2	0.817	-0.012	0.881	0.819	0.939	0.024	0.019	0.025
B3	0.827	-0.013	0.906	0.850	0.951	0.024	0.018	0.022
B4	0.729	0.035	0.848	0.835	0.921	0.023	0.017	0.016
B5	0.649	0.049	0.807	0.842	0.898	0.024	0.019	0.021
RA vs L8								
B2	1.046	-0.018	0.989	0.971	0.994	0.009	0.002	0.008
B3	0.947	-0.013	0.982	0.942	0.990	0.013	0.004	0.012
B4	1.046	-0.045	0.956	0.913	0.977	0.018	0.009	0.010
B5	0.963	-0.015	0.938	0.891	0.968	0.021	0.012	0.009

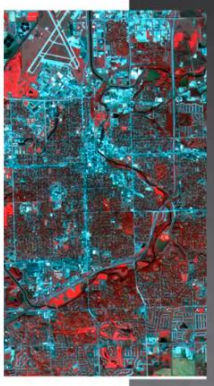
SR: Relative validation with OLI over CEOS CAL sites


Rail Road Playa


Ivanpah Playa


Libya-4


Lake Tahoe


Sioux Falls

Over CEOS TARGETS: Over all agreement with L8_SR

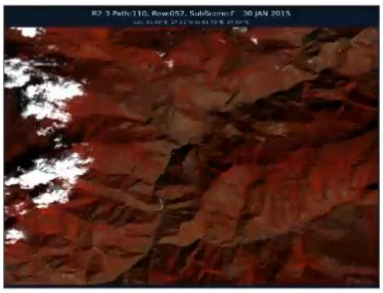
	Green Band(B2)			Red band (B3)			NIR band(B4)			SWIR band(B5)		
AWiFS	Slope	Offset	R^2	Slope	Offset	R^2	Slope	Offset	R^2	Slope	Offset	R^2
IVP	0.986	-0.002	0.968	0.936	0.01	0.971	0.756	0.095	0.799	0.95	0.014	0.965
RUV	1.003	0.002	0.994	0.935	0.02	0.995	1.052	-0.039	0.974	1.024	0.008	0.98
LIB	0.963	0.017	0.985	0.951	0.017	0.98	0.872	0.06	0.951	0.941	0.024	0.923
SF	0.869	0.024	0.947	0.961	0.013	0.955	1.123	0	0.972	0.952	0.019	0.962
LT	1.137	0.001	0.965	1.073	0.007	0.959	0.836	0.026	0.944	1.121	0.013	0.972
L3	Slope	Offset	R^2	Slope	Offset	R^2	Slope	Offset	R^2	Slope	Offset	R^2
IVP	1.035	0.068	0.978	0.944	0.106	0.884	0.933	0.069	0.968	1.001	0.085	0.828
RUV	0.917	0.008	0.991	0.837	0.012	0.993	0.887	0.001	0.948	0.928	-0.018	0.989
LIB	0.944	0.049	0.854	0.943	0.033	0.875	0.929	0.084	0.866	1.032	0.037	0.93
SF	0.94	-0.012	0.944	0.887	-0.005	0.968	0.809	0	0.887	0.971	-0.044	0.962
LT	0.901	0	0.925	0.854	0.001	0.949	0.856	0.005	0.96	0.907	-0.007	0.956

OBJECTIVE -2 : GEOMETRIC ACCURACY REFINEMENT

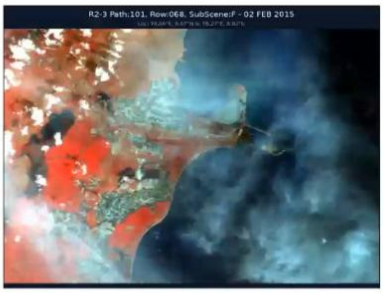
New Algorithms/frame work is realized to refine the less accurate datasets generated from various Orbit/attitude sources.



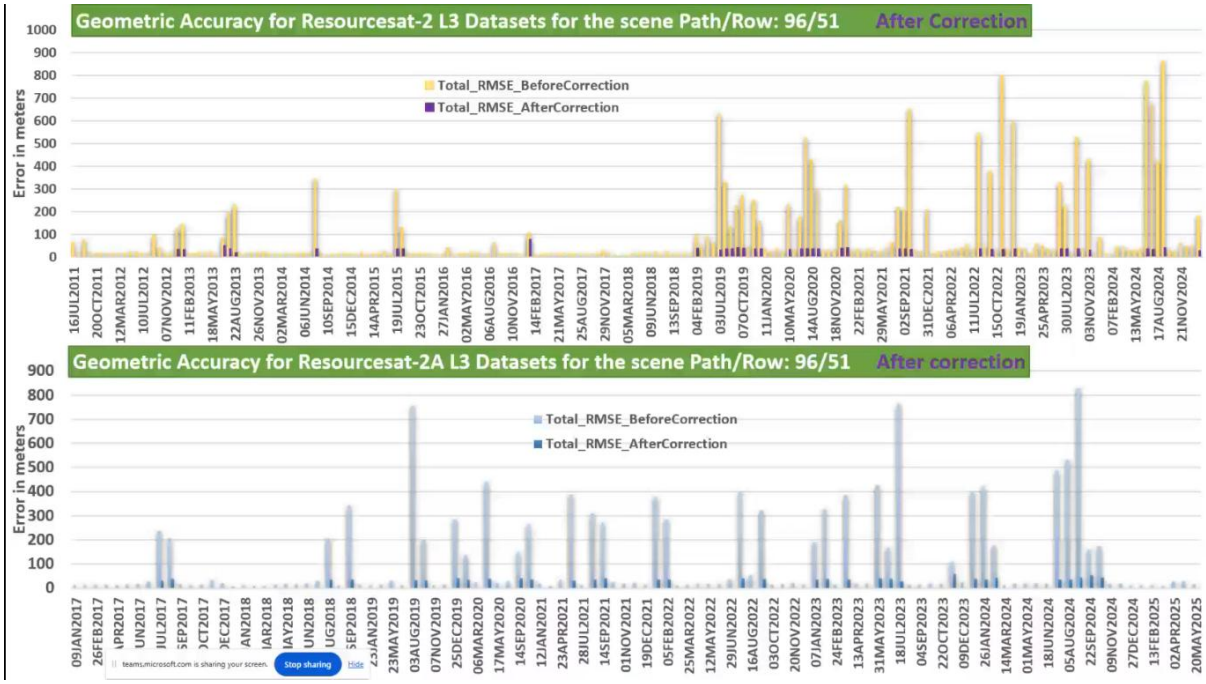
Ahmedabad- Urban



Arunachal Pradesh - Hilly

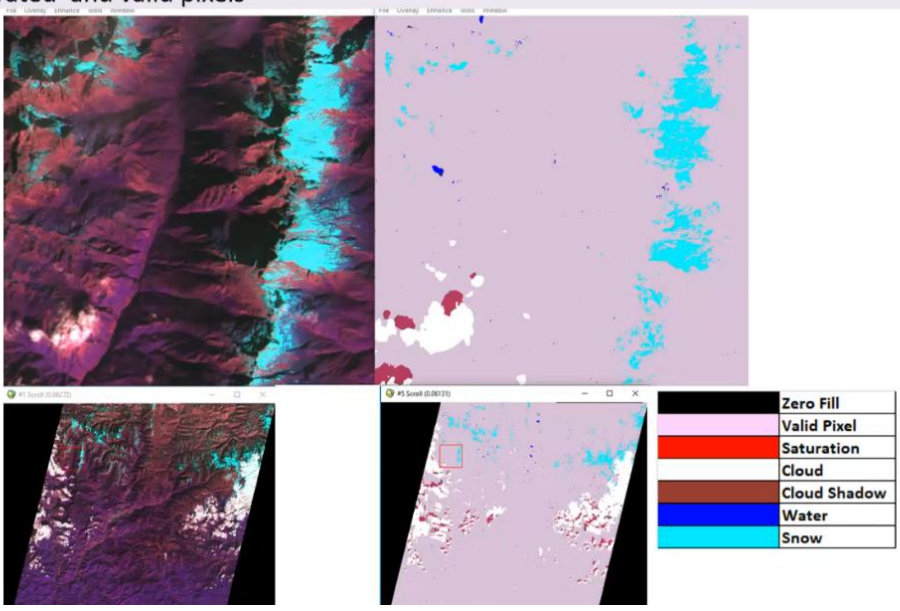


Tamil Nadu - Coastal



OBJECTIVE -3 : PIXEL QUALITY LAYER

Semantic segmentation based **ML** models are deployed to delineate cloud, cloud shadow, water, snow, zero fill , saturated and valid pixels



Sample ARD Structure (15 files)

Name	Date	Type	Size
R2302FEB20250715680101000054PSANSTUCARHTDF	24-06-2026 02:49 PM	JPG File	142 KB
R2302FEB20250715680101000054PSANSTUCARHTDF_BAND_META	24-06-2026 02:49 PM	Text Document	4 KB
R2302FEB20250715680101000054PSANSTUCARHTDF_BAND2_SR	24-06-2026 02:49 PM	TIF File	1,06,562 KB
R2302FEB20250715680101000054PSANSTUCARHTDF_BAND2_TOA	24-06-2026 02:49 PM	TIF File	1,06,562 KB
R2302FEB20250715680101000054PSANSTUCARHTDF_BAND3_SR	24-06-2026 02:49 PM	TIF File	1,06,562 KB
R2302FEB20250715680101000054PSANSTUCARHTDF_BAND3_TOA	24-06-2026 02:49 PM	TIF File	1,06,562 KB
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Wavelength_MAX=680nm
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Spectral_bandId=3
PhysicalBand=B4
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Wavelength_MAX=860nm
Central Wavelength=815nm
Spectral_bandId=4
PhysicalBand=B5
Wavelength_MIN=1550nm
Wavelength_MAX=1700nm
Central Wavelength=1625nm
DateOfDump= 02-FEB-2025
DumpingOrbitNo= 071568
ImagingOrbitNo= 071568

General Meta

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SceneCenterLon=81.66356572

Product Corners

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NoPixels=7647
StartPixel= 0

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Tiltangle= 0.000000
Shift%= 0
SatelliteHeadingAngle= 194.211824
ProductSceneStartTime= 02-FEB-2025 04:31:27.441006
ProductSceneEndTime= 02-FEB-2025 04:31:51.112122
JpegNoColumns= 512
JpegNoRows= 549
Product_Version=v1.0

AcrossTrackAccuracy_RMSE= -14.471 m
AlongTrackAccuracy_RMSE= 7.513 m
Stored_ValidRange_SR=0-10000
Physical_ValidRange_SR=0-1
ScaleFactor_SR=0.0001

Scale factors

Stored_ValidRange_TOA=0-10000
Physical_ValidRange_TOA=0-1
ScaleFactor_TOA=0.0001
AngleSolar=R2302FEB20250715680101000054PSANSTUCARHTDF_SAA/SZA
AngleSensor=R2302FEB20250715680101000054PSANSTUCARHTDF_VAA/VZA
ScaleFactor_Angles=0.01
SourceAOD=MODIS
SourceWaterVapor=MODIS
SourceOzone=MODIS
Harmonization_MULT_BAND2=1.415946
Harmonization_ADD_BAND2=-0.13803813
Harmonization_MULT_BAND3=1.262765
Harmonization_ADD_BAND3=-0.009633319
Harmonization_MULT_BAND4=1.215421
Harmonization_ADD_BAND4=-0.016883938
Harmonization_MULT_BAND5=1.226494
Harmonization_ADD_BAND5=-0.023403958

Harmonization Coefficients

Quality=R2302FEB20250715680101000054PSANSTUCARHTDF_QA_PIXEL
ZeroFill=0
ValidPixel=1
Saturation=2
Cloud=3
CloudShadow=4
Water/WetLands=5
Snow=6

QA_Pixel

Summary Self-Assessment Table

	Threshold	Goal
1. General Metadata		
1.1 Traceability	Yes	
1.2 Metadata Machine Readability	Yes	
1.3 Data Collection Time	Yes	
1.4 Geographical Area	Yes	
1.5 Coordinate Reference System	Yes	
1.6 Map Projection	Yes	
1.7 Geometric Correction Methods	--	
1.8 Geometric Accuracy of the Data	Yes	
1.9 Instrument	Yes	
1.10 Spectral Bands	Yes	
1.11 Sensor Calibration	--	
1.12 Radiometric Accuracy	Yes	
1.13 Algorithms	Yes	
1.14 Auxiliary Data	Yes	
1.15 Processing Chain Provenance	Yes	
1.16 Data Access	Yes	
1.17 Overall Data Quality	Yes	
2. Per-Pixel Metadata		
2.1 Metadata Machine Readability	Yes	
2.2 No Data	Yes	
2.3 Incomplete Testing	Yes	
2.4 Saturation	Yes	
2.5 Cloud	Yes	
2.6 Cloud Shadow	Yes	
2.7 Land/Water Mask	Yes	
2.8 Snow/Ice Mask	Yes	
2.9 Terrain Shadow Mask	-	
2.10 Terrain Occlusion	-	
2.11 Solar and Viewing Geometry	Yes	
2.12 Terrain Illumination Correction	-	
2.13 Aerosol Optical Depth Parameters	-	

3. Radiometric and Atmospheric Corrections		
3.1 Measurement	Yes	
3.2 Measurement Uncertainty	Yes	
3.3 Measurement Normalisation	Yes	
3.4 Directional Atmospheric Scattering	Yes	
3.5 Water Vapour Corrections	Yes	
3.6 Ozone Corrections	Yes	
4. Geometric Corrections		
4.1 Geometric Correction	Yes	

Check list for submission- FTP

- Sample Products
- Documentation : ATBD, User manual, Published papers
- FTP details
- DOI :
  https://www.doi.org/10.46693/NRSC/10/R2A_LIS3_STUCSRHTD
  https://www.doi.org/10.46693/NRSC/10/R2_LIS3_STUCSRHTD

Sample ARD sets are ported to FTP for peer review

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LSI-VC-20: Summary..

- Accuracy is consistent since launch
- L3 ARD Products are ready for endorsement
- **AWiF ARD submission is underway**
- **Immediate goal : Refinement the meta file/ Additional meta**

Thank you..