

Lightning Imaging Sensor (LIS) Science Data Validation Plan

Summary Charts

LIS Science Team

Lightning Imaging Sensor (LIS)

Mission: Tropical Rainfall Measuring Mission (TRMM)

Measurement: Lightning

Features: Detect Lightning Day / Night

Storm Scale Resolution (~ 5 km @ nadir)

High Detection Efficiency (~ 90%)

Low False Alarm Rate (< 10%)

Time Resolution 2 ms

Lightning Intensity

Background Image / Intensity

LIS Science Objectives

- Acquire and investigate the distribution and variability of total lightning
- Advance understanding of underlying and interrelated processes, e.g.,
 - Precipitation and storm processes
 - Release and transport of latent heat
 - Atmospheric chemistry (e.g., NO_x)
 - Ionospheric and magnetospheric physics
 - Global electric circuit

LIS Measurement Heritage

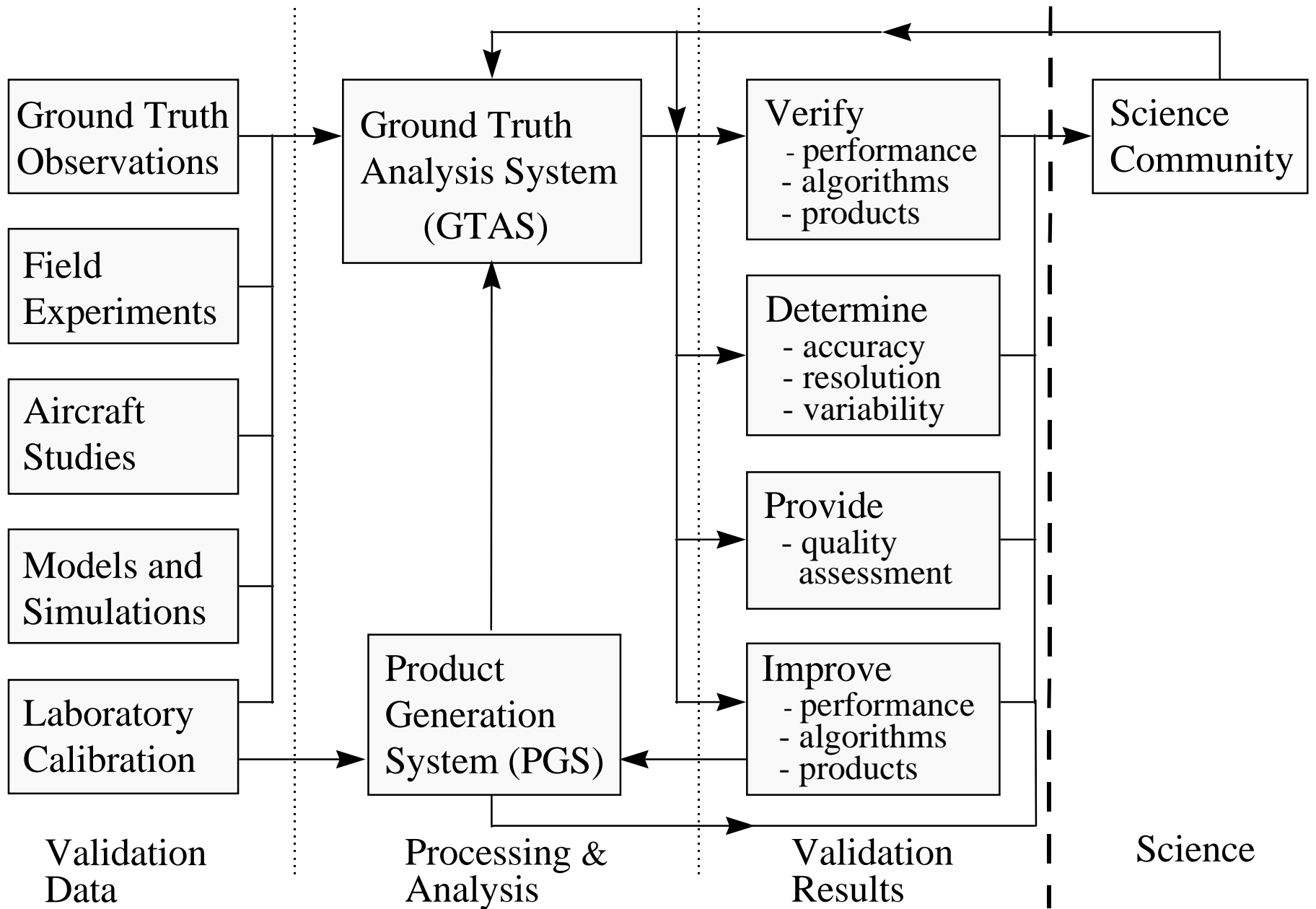
Optical Transient Detector (OTD)

- LIS engineering prototype
- Launched April 1995 (2 year mission)
- Important LIS Science
- Serving as testbed for LIS Validation
 - Development / testing of Ground Truth Analysis System (GTAS)
 - Testing / refinement of the LIS data processing

LIS Validation Strategy

- Laboratory calibration
- Ground truth observations
- Intensive field experiments
- Aircraft studies (e.g., ER-2 underflights)
- Numerical models and simulations
- Statistical and objective analyses

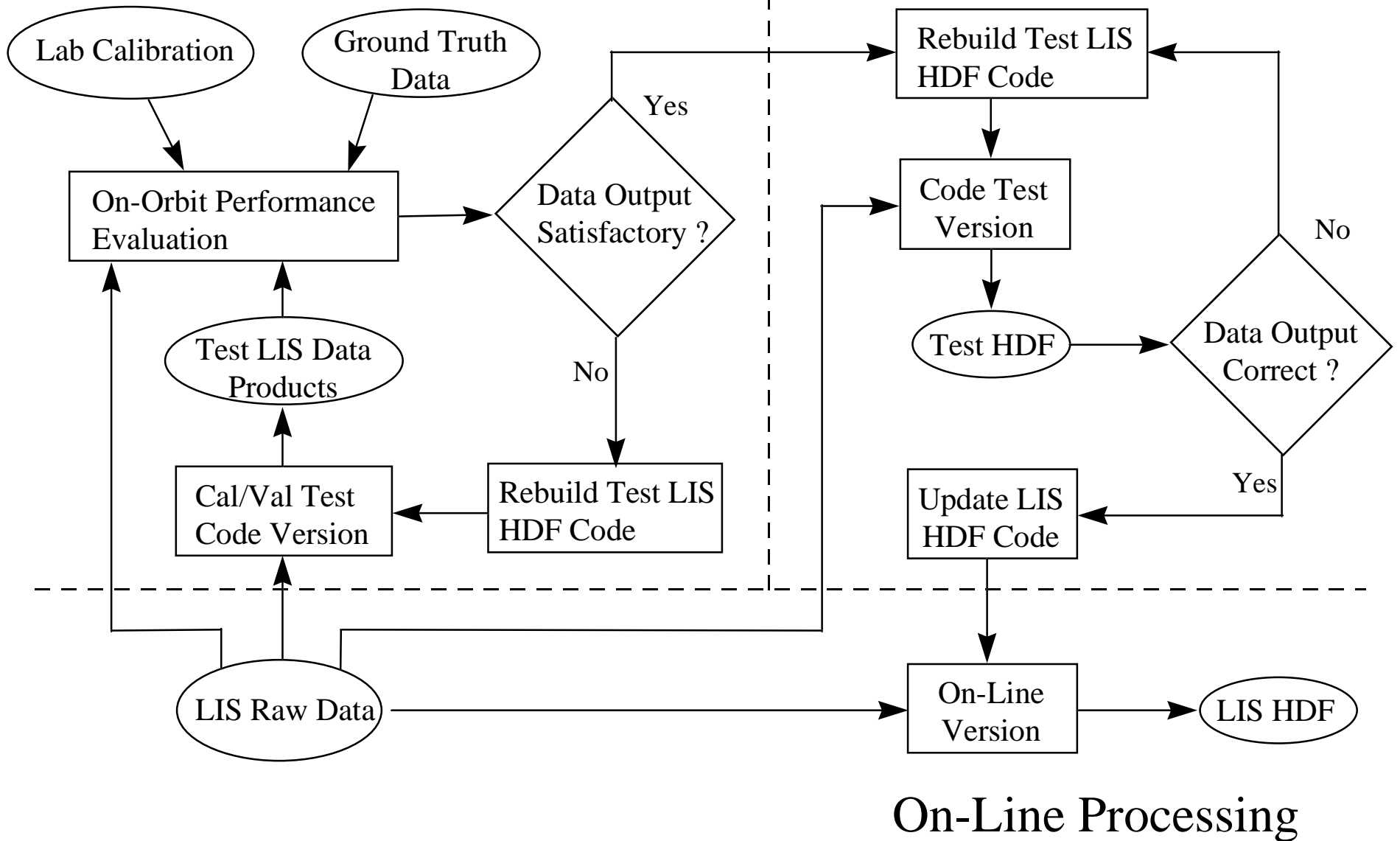
LIS Validation Process



Algorithm Validation Process

Algorithm Testing (SCF)

Code Testing (SCF)



LIS Validation Categories

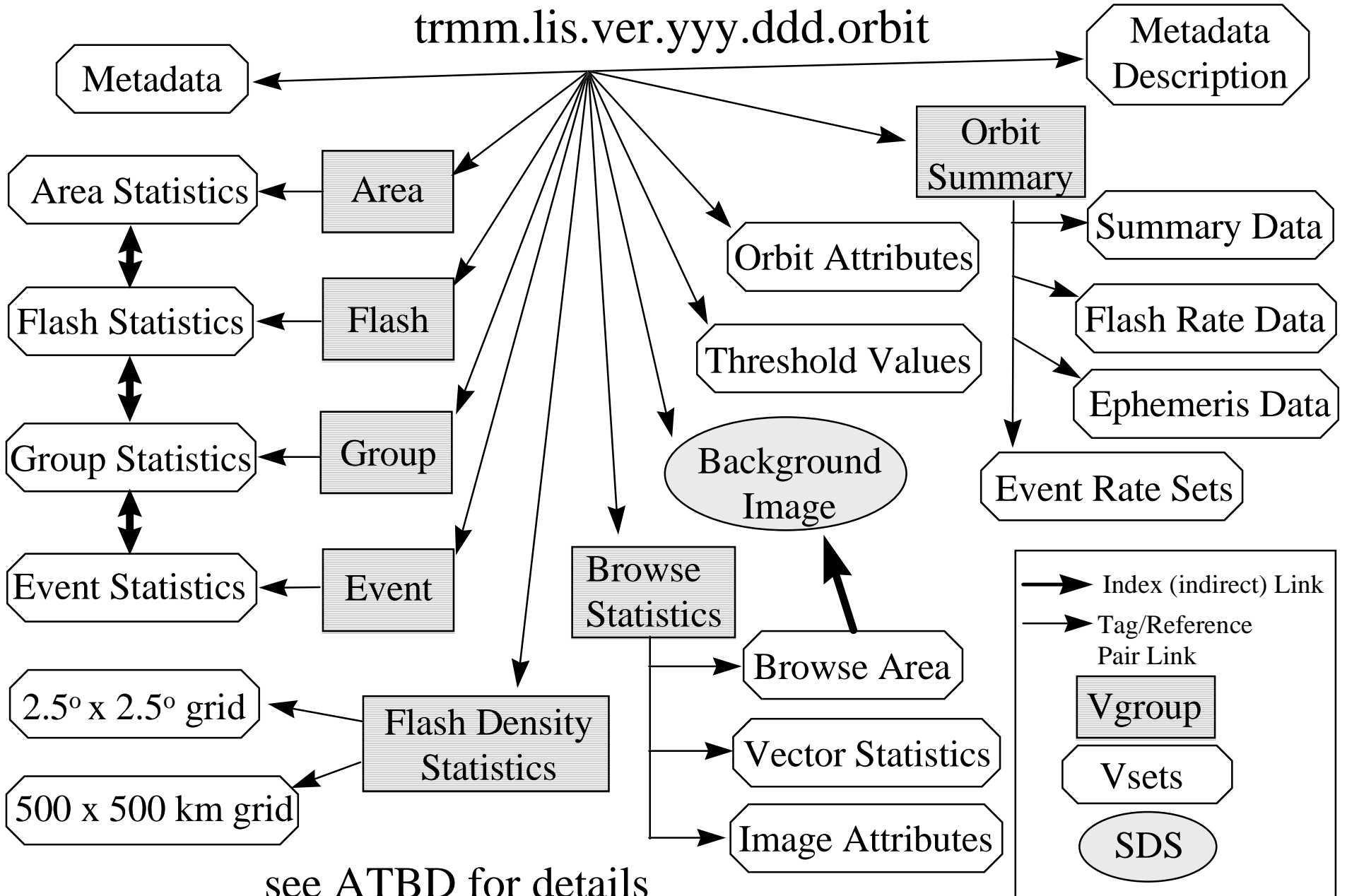
- **Sensor Performance Parameters**
 - Lightning Detection Efficiency (LDE)
 - False Alarm Rate (FAR)
 - Geo-location accuracy
 - Timing accuracy
 - Event intensity
 - Background intensity
- **Data Processing Algorithms / Products**
- **Scientific Retrieval Algorithms / Products**

Conditions that may affect Parameter Values

- Sensor detection threshold settings
- Background intensity
- Observation time (e.g., time of day, time of year)
- Storm characteristics (e.g., continental vs. maritime, large vs. small, developing vs. decaying, high flash rate vs. low flash rate, etc.)
- Geographical location
- Analysis software employed

LIS HDF Data Structure

trmm.lis.ver.yyy.ddd.orbit



Ground Truth Observations *Lightning Data*

- Ground-based lightning observations at the TRMM ground truth sites
- Regional lightning networks (e.g., NLDN)
- Time of Arrival (TOA) and sferics networks
- Satellites (e.g., OTD, FORTE , OLS, ALEXIS)
- Interferometers (e.g., SAFIR, NM Tech)
- Airborne (e.g., ER-2) and ground based optical and electrical observations

Ground Truth Observations

Ancillary Data

- Radar data and products (e.g., TRMM validation sites, WSR-88D sites, WSI composites)
- Rain gauge data (e.g., TRMM validation sites)
- Satellite data and products (e.g., VIS, IR, microwave imagery, precipitation products, etc.)
- Ancillary observations obtained during intensive ground truth field experiments (including ground-based, aircraft, satellite observations)
- Collaborative observations, e.g., MSX (chemistry), GRO/Batse (gamma rays from Earth)

LIS Calibration and Validation Data Sets Being Archived

Product	Source	Ingest Period	Recurring Annual Vol
OTD Raw	OSC	Daily	63.0 GB
OTD Lightning	LIS Science Team	Daily	42.0 GB
NLDN Lightning	GAI	15 minutes	14.6 GB
LIS Ground Truth	LIS Science Team	Monthly	0.4 GB
US Composite Rainfall	WSI	15 minutes	14.6 GB
US Nexrad site	WSI-NIDS	3 hours/day	13.0 GB
LDAR	KSC	Intermittent	0.4 GB
Field Mill	KSC	Intermittent	25.0 GB
OLS Lightning	NSIDC	Monthly	5.0 GB
W. Atlantic Lightning	Resolution Displays	Daily	15.0 GB
E. Pacific Lightning	NSSFC	Daily	0.02 GB
Global IR composite	NSSFC	30 minutes	52.5 GB
GOES Vis/IR	NSSFC	Intermittent	1.0 GB
SSM/I Tb	MSFC	Hourly	58.4 GB
Total			~305 GB

Field Programs

Pre-Launch

CaPE, Jul-Aug 91, Florida

STORMFEST, Feb-Mar 92, Central U.S.

CAMEX 1, 2, Sep 93, 95, East coast U.S.

TOGA COARE, Jan-Feb 93, Tropical ocean

MCTEX, Nov-Dec 95, Maritime continent, OTD
ground truth

PEM-Tropics, Aug-Oct 96, NO_x assoc. with lightning

Post-Launch

EOS and other experiments, TBD (Florida/Texas
TRMM sites, ER-2 underflights, Kwajalein, Brazil)