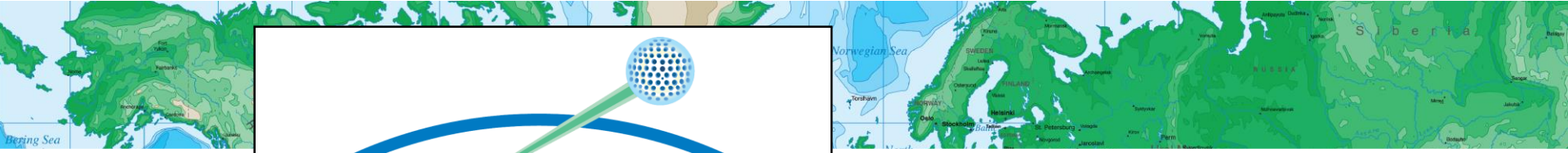

International Laser Ranging Service

SLR Data: from Station to User

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ILRS Central Bureau

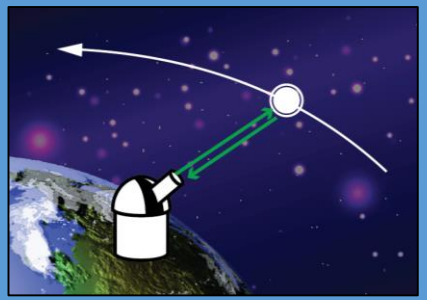
SLR School
October 20, 2019
Stuttgart, Germany

Outline

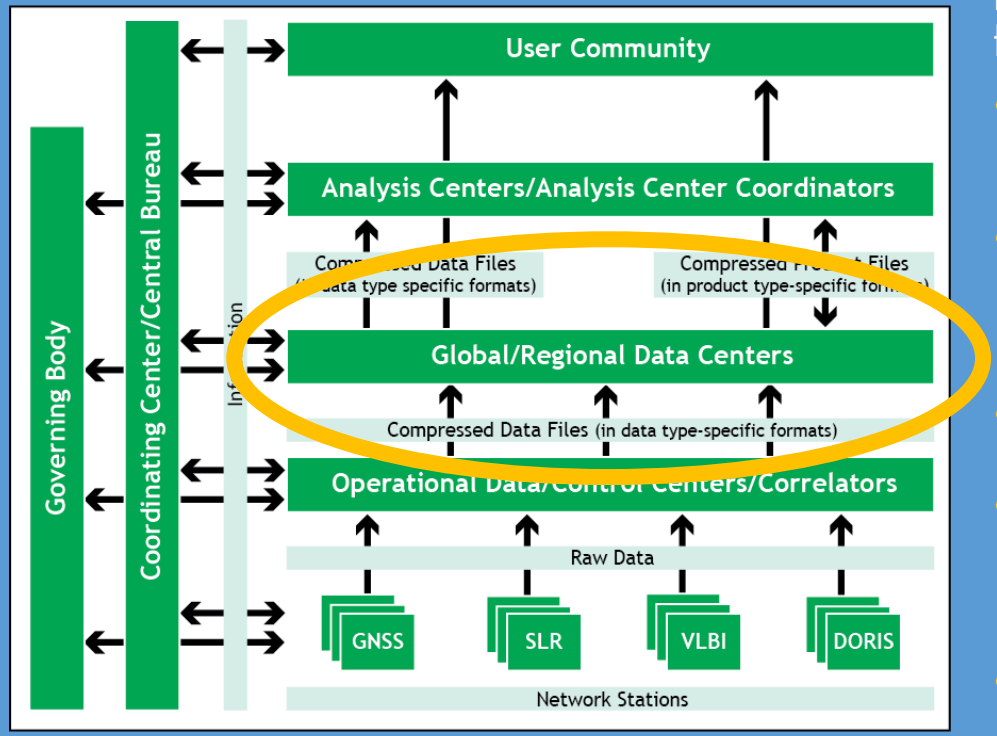
- Background
- ILRS data flow
- OCs and DCs
- Getting data
- ILRS website

International Laser Ranging Service

- The ILRS provides laser ranging data and products on an operational basis to geodesy analysts as well as a broader scientific community
- ILRS is one of four services within the International Association for Geodesy (IAG) supporting space geodesy
- IAG established these services to facilitate international cooperation and scientific research
  - Networks
  - Data centers
  - Analysis groups
- Services perform successful operations through cooperation of many international organizations, leveraging their respective resources to all levels of service functionality



ILRS: SLR data and products



IAG services use a hierarchy of data centers to distribute data from network to users:

- Network Stations
  - Operate continuously
  - Transmit data in timely fashion
- Data Centers
  - Interface to network stations
  - Perform QC and data conversion activities
  - Archive data for access to analysis centers and users
- Analysis Centers
  - Generate products to users
- Central Bureau/Coordinating Center
  - Manage service
  - Facilitate communications
  - Coordinate activities
- Governing Body
  - Provide general oversight of service
  - Determine future direction

ILRS data centers

- Two data centers (DCs) support the ILRS:
  - Crustal Dynamics Data Information System (CDDIS), NASA GSFC, Greenbelt, MD USA
  - EUROLAS Data Center (EDC), DGFI-TUM, Munich, GERMANY
- ILRS DCs are the primary interfaces to the Analysis Centers (ACs) and the global user community
  - Receive, archive, and provide online access to SLR data, derived products, and supporting information
  - Ensure the integrity of ILRS data and products
  - Provide reliability and redundancy
- CDDIS hosts ILRS website (*https://ilrs.gsfc.nasa.gov*)
  - Central source of information for all aspects of the service
  - Descriptions of:
    - ILRS organization, components, data, and products
    - Network stations, including performance assessments, data quality evaluations, etc.
    - Supported satellite missions (current, future, and past)

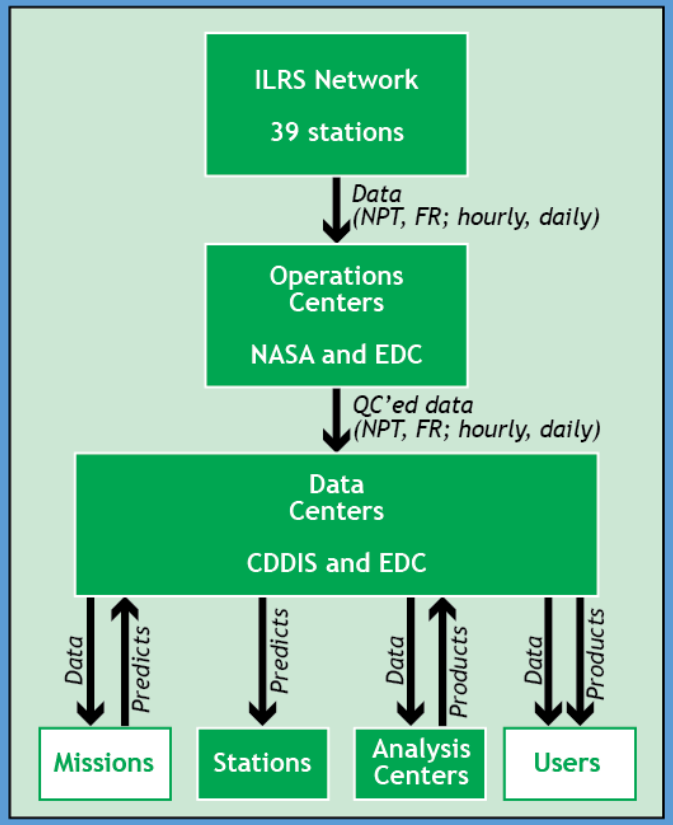
ILRS DC archives

- SLR data:
  - Normal point data: compresses full set of data (full-rate) by sampling pass over time, based upon a specified minimum number of data points (bin size)
  - Full-rate data: include all valid laser returns obtained during a satellite pass
- Official ILRS products
  - Station coordinates and EOP ("pos+eop"), generated daily
  - Precise orbits (LAGEOS-1, -2 and Etalon-1, -2), generated weekly
- Satellite orbit predictions
  - For all satellites currently tracked by network, generated daily
  - Required by stations to find satellites for tracking

ILRS DC archive contents

Type		Frequency	Main directory	~Size	Format
Data		From network of 39 stations (currently)			
	Normal points	Daily, hourly, monthly	/slr/data/npt_crd/SATELLITE/YYYY/	1 MB/hour, 75MB/day	CRD
	Full-rate	Daily, monthly	/slr/data/fr_crd/SATELLITE/YYYY/	300 MB/day	CRD
Products		From 7 analysis centers and 2 combination centers (currently)			
	Station coordinates, EOP	Daily	/slr/products/pos+eop	1 MB/day	SINEX
	Precise orbits	Weekly	/slr/products/orbits	3 MB/week	SP3C
Predictions		From ~25 providers for 115+ satellites (currently)			
	Satellite orbit predictions	Daily	/slr/cpf_predicts/YYYY/SATELLITE	15 MB/day	CPF

ILRS OCs and DCs



- ILRS operations centers (OCs)
  - NASA and EDC
  - Collect data from sub-networks
  - Quality check (QC) data
  - Create merged daily/hourly files
  - Transmit data to DCs
- ILRS data centers (DCs)
  - CDDIS and EDC
  - Archive ILRS data, products, predictions
  - Provide access to ACs and users
  - Provide backup archives

SLR data at ILRS data centers

- DCs (EDC and NASA) exchange data (normal point/NPT and full-rate/FR) received in previous time interval (last 1 hour or last 24 hours) and deliver to DCs (CDDIS and EDC)
- EDC and NASA DCs merge each other's files to create combined files for archive at DCs
- EDC archives its SLR data as:
  - Daily and monthly files by satellite containing all data FOR a given day/month
- CDDIS archives its SLR data as:
  - Single daily/hourly file containing all data from all satellites received WITHIN the last 1/24 hours
  - Daily files by satellite containing all data received WITHIN the last 24 hours
  - Monthly files by satellite containing all data FOR a given month
- Therefore, CDDIS and EDC DCs contain the same data but store them in different types of files

Getting SLR data (NPT examples)

If you want:

- All data for all satellites submitted in the last 24 hours, get:
  - CDDIS: *https://cddis.nasa.gov/archive/slr/data/npt_crd/allsat/YYYY/allsat_YYMMDD.Z*
- All data for all satellites submitted in the last 1 hour, get:
  - CDDIS: *https://cddis.nasa.gov/archive/slr/data/npt_crd/allsat/YYYY/allsat_YYMMDDHHMI.npt*
- Data for one satellite submitted in the last 24 hours, get:
  - CDDIS: *https://cddis.nasa.gov/archive/slr/data/npt_crd/SATELLITE/YYYY/SATELLITE_YYMMDD.npt*
- Data for one satellite for a particular time period, get:
  - CDDIS: *https://cddis.nasa.gov/archive/slr/data/npt_crd/SATELLITE/YYYY/SATELLITE_YYMM.Z*
  - EDC: *ftp://edc.dgfi.tum.de/slr/data/npt_crd/SATELLITE/YYYY/SATELLITE_YYMMDD.npt*
    ftp://edc.dgfi.tum.de/slr/data/npt_crd/SATELLITE/YYYY/SATELLITE_YYMM.npt

Getting ILRS products, predictions

If you want:

- ILRS products:
  - CDDIS: *https://cddis.nasa.gov/archive/slr/products/**PRODUCT***
  - EDC: *ftp://edc.dgfi.tum.de/slr/products/**PRODUCT***
  - ***PRODUCT***=
    - ***pos+eop*** for reference frame products
    - ***orbits*** for precise orbit solutions (LAGEOS-1, -2, Etalon-1, -2)
- Satellite predictions:
  - CDDIS: *https://cddis.nasa.gov/archive/slr/cpf_predicts/YYYY/SATELLITE*
  - EDC: *ftp://edc.dgfi.tum.de/slr/cpf_predicts/YYYY/SATELLITE*

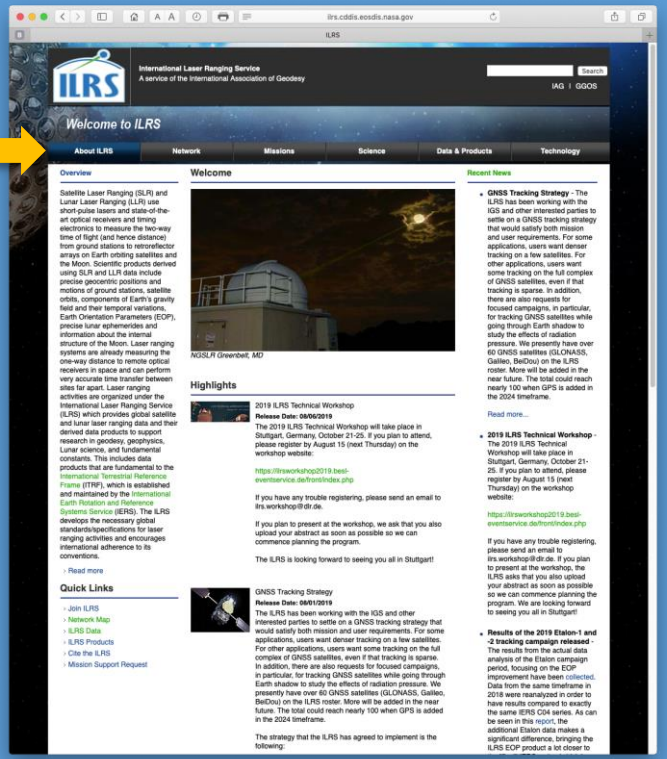
Who to contact

- CDDIS:
  - Help desk: *support-cddis@earthdata.nasa.gov*
  - CDDIS Manager, Carey Noll: *carey.noll@nasa.gov*

- EDC:
  - Help desk: *christian.schwatke@tum.de*
  - EDC Manager, Christian Schwatke: *christian.schwatke@tum.de*

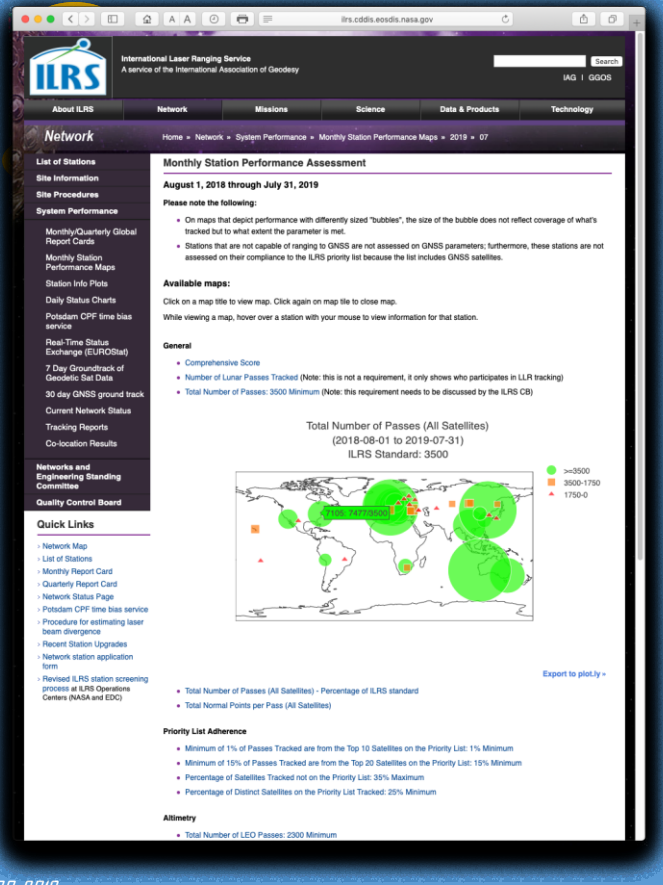
ILRS website: https://ilrs.gsfc.nasa.gov

- Network
  - Station configuration information (site logs)
  - Station data quality reports
- Missions
  - Satellite, retroreflector characteristics
  - ILRS satellite tracking lists
  - ILRS priority list
- Data
  - Formats
- Products
  - Data analysis reports (AACs)
- Reports
  - Workshop proceedings
  - Bibliography



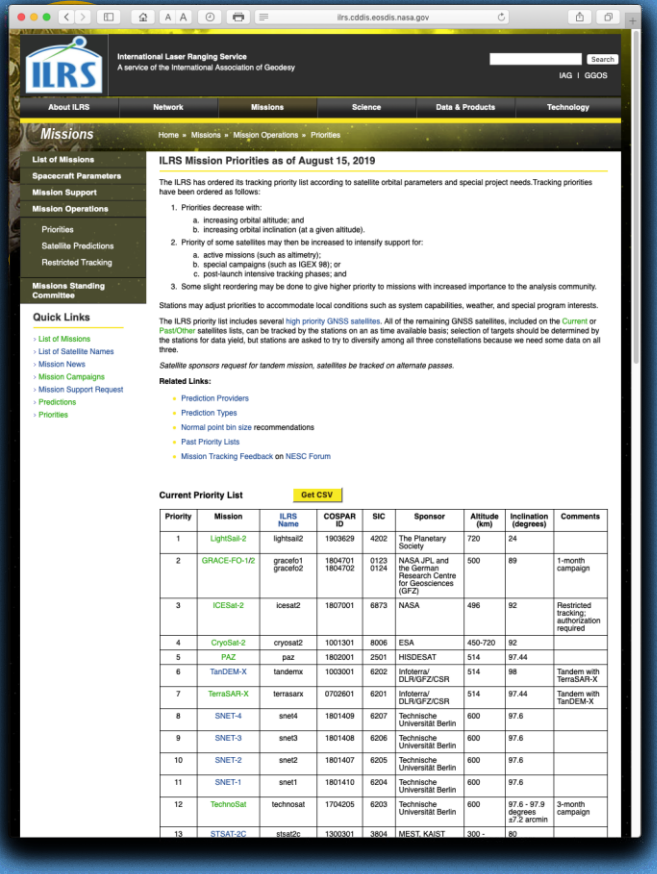
ILRS website: network+station info

- Network info
  - Map
  - Lists of stations
  - Site logs
  - Plots of data quantity, quality by station and by satellite
- Station performance reporting
  - Report cards
  - Performance assessment



ILRS website: mission info

- Satellite information
  - Lists of supported missions (current, past/other, future)
  - Mission parameters
    - Orbit information
    - Retroreflector characteristics
    - Array offsets
  - Graphs of data quantity, quality by station
- Other information
  - Satellite priorities
  - Satellite parameters (e.g., CoM)



More information

- Workshop proceedings website:
  - *https://cddis.nasa.gov/2019_Technical_Workshop/*
- First "SLR School" website (presentations, etc.):
  - *https://cddis.nasa.gov/2019_Technical_Workshop/SLR_School/index.html*
- Handout from this presentation (useful links):
  - *https://cddis.nasa.gov/2019_Technical_Workshop/SLR_School/docs/DClinks.pdf*