Data Centers supporting the flow of IGS data and products are divided into three categories:
- Operational
- Regional
- Global

Hierarchy of data centers allows for
- Redundancy and backup
- Reduction in network traffic

Operational data centers download data from tracking stations

Regional data centers provide access to data from a geographic region (e.g., Australia, Europe)

Global data centers provide access to data and products to IGS and user community in general
### Operational Data Centers
- **ASI** | Italian Space Agency
- **AUSLIG** | Australian Surveying and Land Information Group
- **AWI** | Alfred Wegener Institute for Polar and Marine Research, Germany
- **CNES** | Centre National d'Etudes Spatiales, France
- **DSN** | Deep Space Network, USA
- **DUT** | Delft University of Technology, The Netherlands
- **ESOC** | European Space Agency (ESA) Space Operations Center, Germany
- **GFZ** | GeoForschungsZentrum Germany
- **GSI** | Geographical Survey Institute, Japan
- **ISR** | Institute for Space Research, Austria
- **JPL** | Jet Propulsion Laboratory, USA
- **KAO** | Korean Astronomical Observatory
- **NGI** | National Geography Institute, South Korea
- **NIMA** | National Image and Mapping Agency, USA
- **NMA** | Norwegian Mapping Authority
- **NOAA** | National Oceanic and Atmospheric Administration, USA
- **NRCan** | Natural Resources Canada
- **RDAAC** | Regional GPS Data Acquisition/Analysis Center, Russia
- **SIO** | Scripps Institution of Oceanography, USA
- **UNAVCO** | University NAVSTAR Consortium, USA
- **USGS** | United States Geological Survey

### Regional Data Centers
- **AUSLIG** | Australian Land Information Group
- **BKG** | Bundesamt für Kartographic und Geodäsie, Germany
- **JPL** | Jet Propulsion Laboratory, USA
- **NOAA** | National Oceanic and Atmospheric Administration, USA
- **NRCan** | Natural Resources Canada

### Global Data Centers
- **CDDIS** | Crustal Dynamics Data Information System, NASA GSFC, USA
- **IGN** | Institut Géographique National, France
- **SIO** | Scripps Institution of Oceanography, USA
IGS DATA FLOW

- Analysis Centers/User Community
  - Compressed Compact RINEX Data
  - Global Data Centers
    - Compressed Compact RINEX Data
    - Regional Data Centers
      - Compressed Compact RINEX Data
      - Operational Data Centers
        - Raw Data
        - GPS Stations:
          - Hourly
          - Daily
          - 1 Sec.
IGS DATA

• “Classic” GPS data product
  - Daily (24 hour time span) files (00:00 UTC to 23:30 UTC)
  - 30 second sampling rate
  - Compressed (UNIX), compact (Hatanaka) RINEX format
  - Typically available at Global Data Centers within 1 to 4 hours
  - ~150 stations at CDDIS
  - ~0.3 Mbytes/site/day (compressed Hatanaka format)

• Near real-time GPS data product
  - Hourly files (1 hour time span)
  - 30 second sampling rate
  - Compressed (UNIX), compact (Hatanaka) RINEX format
  - Typically available at Global Data Centers within 5 to 15 minutes
  - 40-45 stations
  - Retained for limited time (e.g., 3 days)
  - No QC performed on incoming data
• File formats
  - RINEX V2 format for observation, navigation, and met data
  - Observation data compacted using Hatanka software (available at IGS CB) and then UNIX compressed
  - Filenames in lowercase (except for the .Z)

• Files named $ssssddd#yyt.Z$ where
  - $ssss$ is 4-character monument ID for site
  - $ddd$ is 3-digit day of year
  - # file sequence number for the day
    - 0 indicates file contains all data for data day
    - 1, 2, ... for partial files of daily data
    - a, b, c, ... x for hourly files
  - $yy$ is 2-digit year
  - $t$ is file type
    - o is observation file
    - n is GPS navigation file
    - m is meteorological data file
    - s is summary file containing data quality information
GPS DATA DIRECTORY STRUCTURE
(CDDIS Example)

- Main GPS filesystem
  - GPS daily data subdirectory
    - Concatenated broadcast ephemerides
      - Yearly subdirectory (yyyy is year)
    - Daily GPS data subdirectories by year (yy) and day of year (ddd)
      - Daily GPS summary file
      - Compact RINEX observation files
      - RINEX meteorological data
      - RINEX broadcast navigation data
      - RINEX observation files
      - TEQC summary files
  - GPS hourly data subdirectory
    - Hourly GPS data subdirectories by year (yy) and day of year (ddd)
IGS PRODUCTS

• Precise orbits, etc.
  - Seven ACs produce precise orbits, clocks, ERP and station positions
  - Nine AACs produce station positions
  - Combined IGS orbit (10 day delay) and combined IGS ERP (10 day delay)
  - Rapid orbits (17 hour delay)
  - Predicted orbits (1 hour prior to observation day)

• Ionosphere
  - Global ionosphere maps of total electron content (TEC) in IONEX format
  - Daily files by analysis center
  - Five ACs currently participating since June 1998

• Troposphere
  - Combined zenith path delay (ZPD) calculated by GFZ since January 1997
  - Weekly files by site
IGS PRODUCTS (Continued)

- **File formats**
  - SP3 for precise orbit files
  - IGS defined formats for ERP and clock files
  - SINEX for station positions
  - All files UNIX compressed
  - Filenames in lowercase (except for the .Z)

- **Solution files named** ssswwww#.#typ.Z where
  - **sss** is 3-character source
  - **wwww** is 4-digit GPS week number
  - **#** day of the week
    - 0 for Sunday, … 6 for Saturday
    - 7 indicates data spans entire week
  - **typ** is the data type
    - sp3 or eph is an orbit file
    - erp is Earth rotation parameter data
    - clk is a file containing clock data
    - snx is a file containing precise coordinates
    - ssc is file containing precise coordinates without supporting matrices
    - sum is a summary file detailing analysis information
GPS PRODUCT DIRECTORY STRUCTURE
(CDDIS Example)

- Main GPS filesystem
  - GPS data subdirectory

- GPS product subdirectory
  - Ionosphere products in IONEX format
    - Yearly subdirectory (yyyy is year)
      - Daily IONEX files by day of year (ddd)
  - Orbit (SP3 format), clock, ERP, and station coordinate (SINEX format) products in subdirectories by GPS week (wwwww)
    - Troposphere (zenith path delay, ZPD) product subdirectory

```
/gps
  /gpsdata
  ...
  /products
    /ionex
      /yyyy
        /ddd
      /wwwww
    /trop
```
ANCILLARY FILES (CDDIS)

- Summary files to quickly view current data availability
- Daily status files (*yyddd*.status)
  - Contains statistics on data points, cycle slips, etc.
  - Extracts info from RINEX header
    - Equipment
    - Antenna height
    - DOMES number
    - etc.
  - In daily data directories (/gps/gpdata/yyddd)

- Data holdings summaries
  - Availability of daily data files
    (ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsdata/check_import.cddisa_01)
  - Availability of hourly data files
    (ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsdata/check_hourly.cddisa)
USE of IGS DATA and PRODUCTS

• Pick a data center
  - Regional vs. global
    • Do I need global coverage? Yes => GDC
    • Do I need data from a particular region? Yes => RDC
  - Access instructions
    • ftp://igscb.jpl.nasa.gov/igscb/center/data/

• Get formats for data and products
  - ftp://igscb.jpl.nasa.gov/igscb/data/format/

• Get software (e.g., Hatanaka, UNIX compress)
  - ftp://igscb.jpl.nasa.gov/igscb/software/
QUESTIONS?

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