GRAS Meteorology SAF

EUMETSAT
Satellite Application
Facilities

GRAS Meteorology SAF
Project Manager
G. B. Larsen, **DMI**

UKMO
SAF coordinator
D. Offiler

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SAF coordinator
H.-H. Benzon

IEEC
SAF coordinator
J. M. Aparicio

The GRAS instrument on EPS

Occultation Antenna
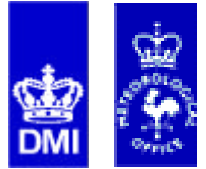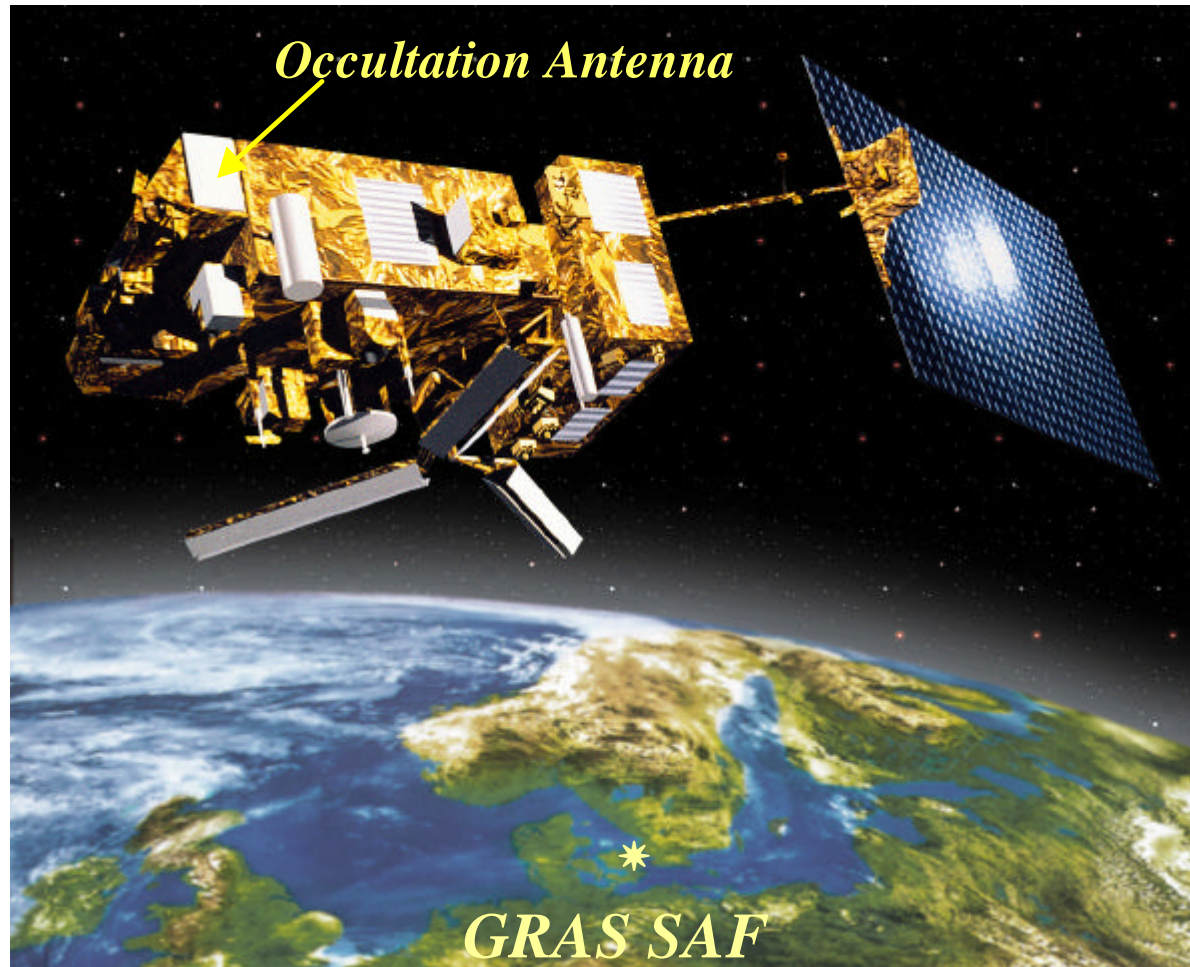
GRAS SAF

GRAS Atmosphere profiling
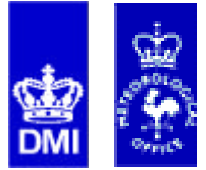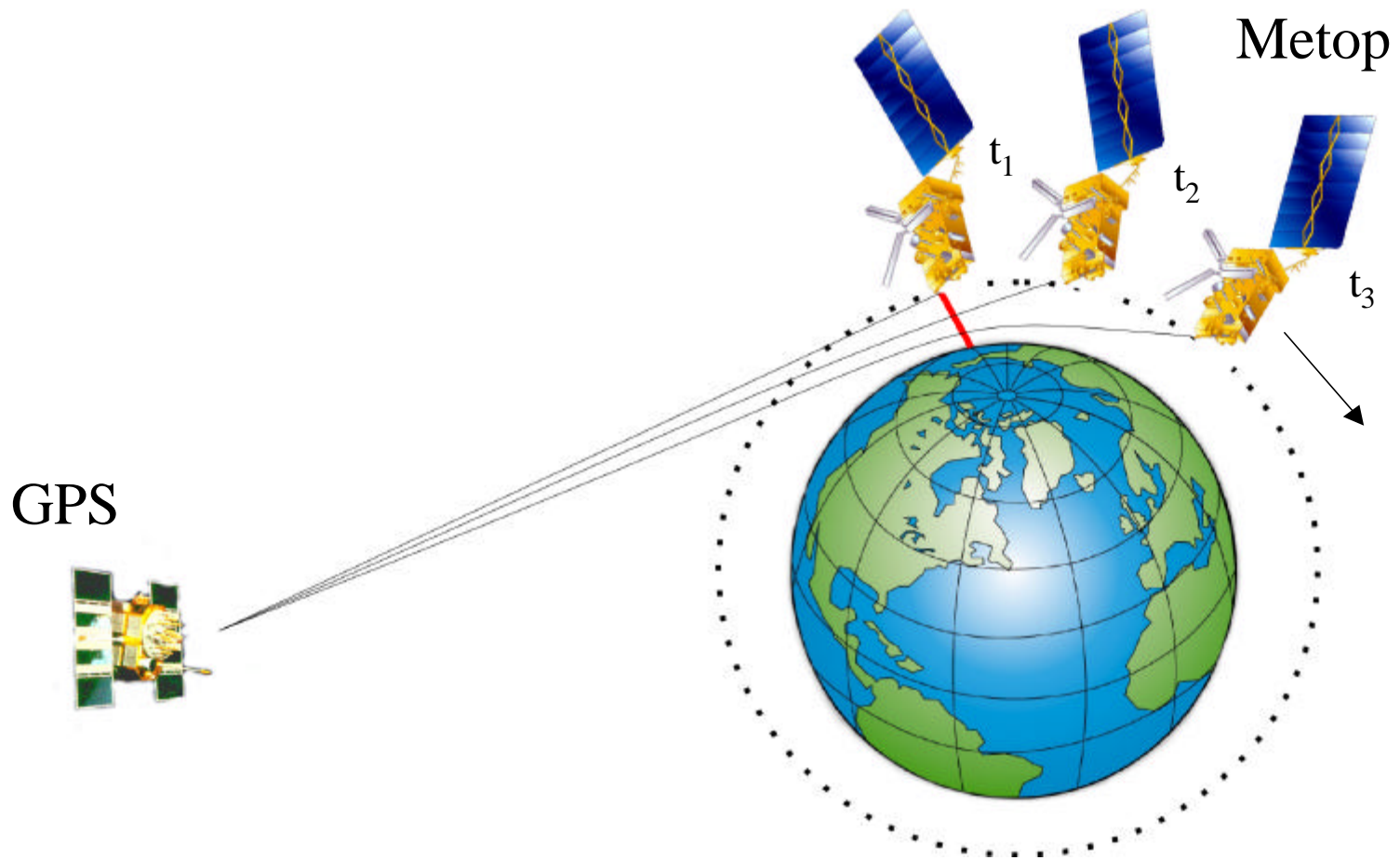
Data flow real time system

METOP/EPS Data   IGS   Other Satellites   NWP Centers

EUMETSAT Central Facility

EUMETSAT

GRAS SAF

Ground Segment

Near Real Time Products

High Precision Products

User Community

GTS
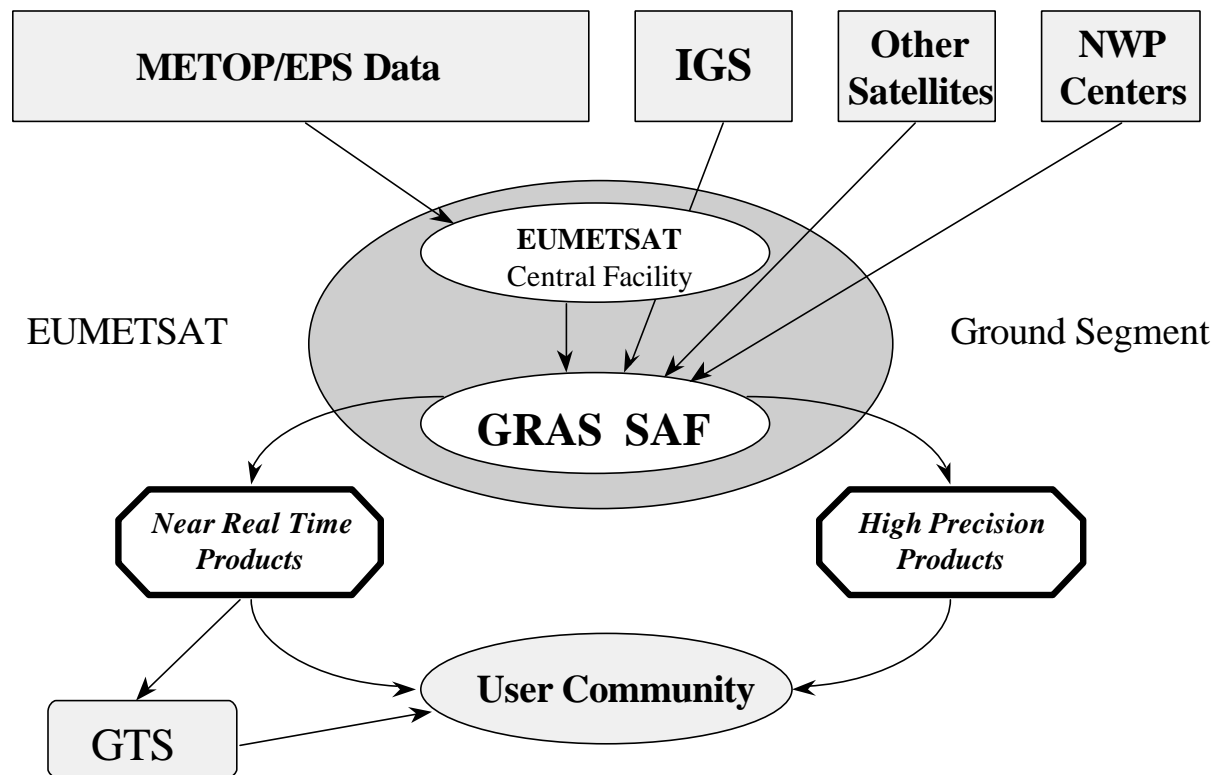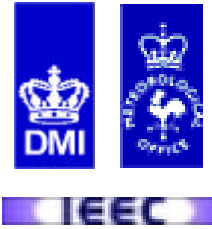
GRAS SAF Data Products (A)

A.   Sounding products

      A.1   Residual phase observations for both frequencies at each time sample of the occultation

      A.2   Space and time identification of the occultation, closest impact height, and identification of the GNSS satellite involved

      A.3   Bending angle profile as function of the sounding data time sample for each frequency

      A.4   Ionosphere corrected bending angles as function of the ray impact parameter of the occultation

GRAS SAF Data Products (B)

B.   Refractivity products

    B.1   Refractivity profile as function of height and location of the occultation

    B.2   Error profile estimates of the observables

    B.3   Time information for the occultation

    B.4   Latitude and longitude position of the occultation in geodetic coordinates
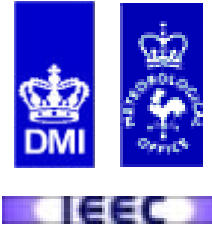
GRAS SAF Data Products (C)

C.   Atmosphere products

    C.1   Pressure profile and error estimate profile for each occultation as function of altitude and location of the occultation

    C.2   Temperature profile and error estimate profile on the temperature for each occultation as function of altitude and location of the occultation

    C.3   Humidity profile and error estimate profile for each occultation as function of altitude and location of the occultation

    C.4   Vertical integrated water vapour estimates for each occultation based on the derived humidity profile.
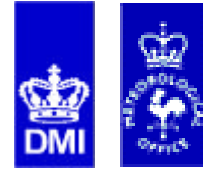
Software Deliverables for NRT Products

DMI, IEEC

- **Data products (B) and (C)**
  - ♦ Refractivity profiles
  - ♦ Temperature profiles
  - ♦ Pressure profiles
  - ♦ Water vapor profiles
  - ♦ Geographical location

UKMO

- **4DVAR Assimilation Software**
  - ♦ Forward operators
  - ♦ Error covariance matrix
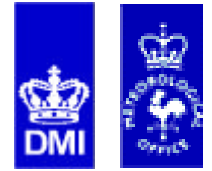
GRAS Metop User Requirements

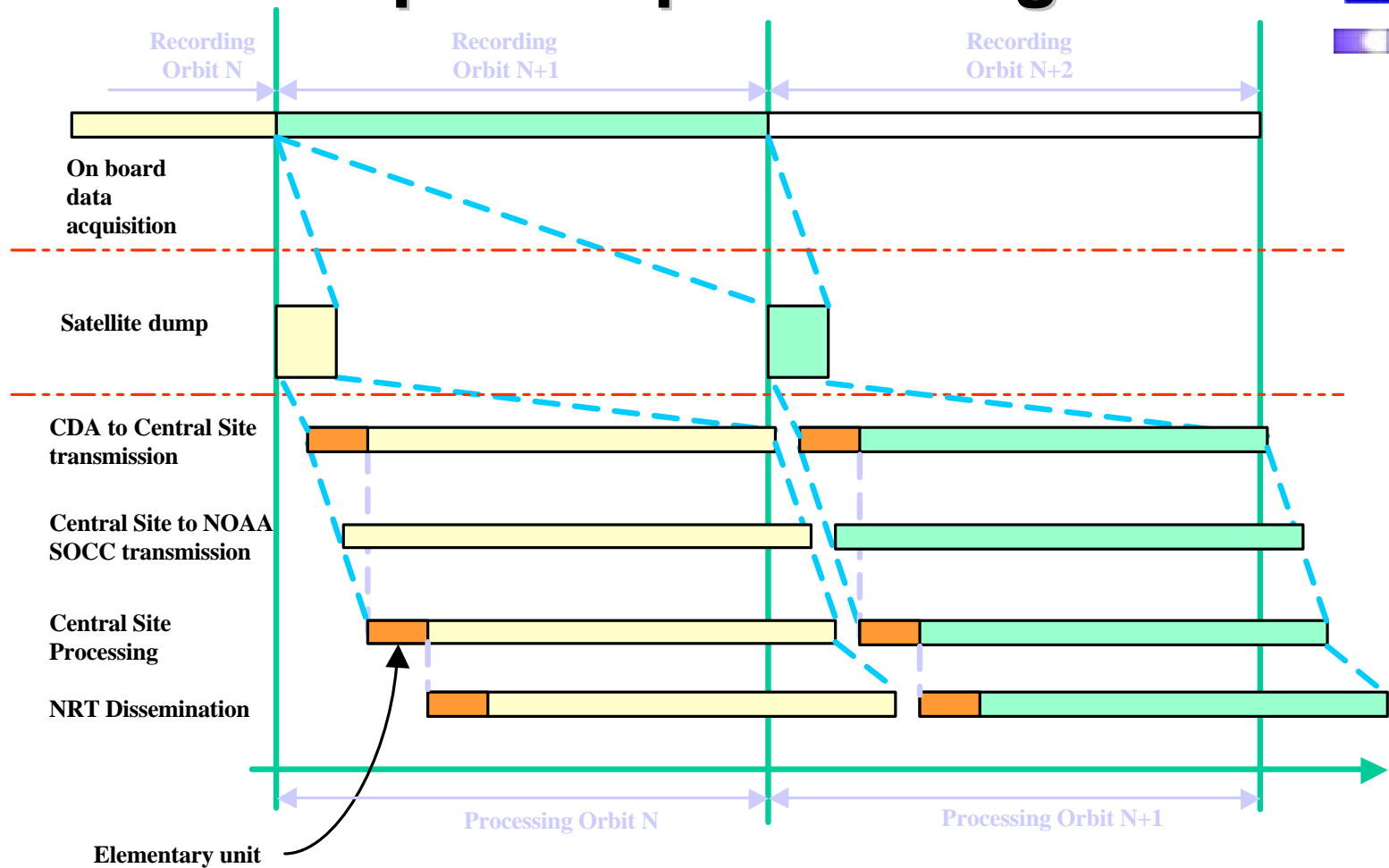|	Temperature	Humidity	Bending Angle
Horizontal Domain	Global	Global	Global
Horizontal Sampling[1]	< 1000 km	< 1000 km	< 1000 km
Vertical Domain	500 hPa to 10 hPa (5-30 km)	surface to 300 hPa (0-10 km)	surface to 80 km
Vertical Resolution	0.5-1.0 km	0.5 km	< 0.5 km or equivalent in time sampling
Time Window[2]	< 12 hrs	< 12 hrs	< 12 hrs
Absolute Accuracy	< 1.0 K	< 10 % or < 0.2 g/kg[3]	< 1 µrad or 0.4 %[3]
Timeliness	< 3 hrs	< 3 hrs	< 3 hrs

Table 5.1: GRAS/Metop Requirements for Operational Meteorology

Notes:
(1) This should be interpreted as the mean distance of individual soundings globally over the specified time window.
(2) This would be the time to achieve global coverage.
(3) whatever is larger.

GRAS-SAG Report
May 1998

Pipe line processing

Recording Orbit N

Recording Orbit N+1

Recording Orbit N+2

On board data acquisition

Satellite dump

CDA to Central Site transmission

Central Site to NOAA SOCC transmission

Central Site Processing

NRT Dissemination

Elementary unit
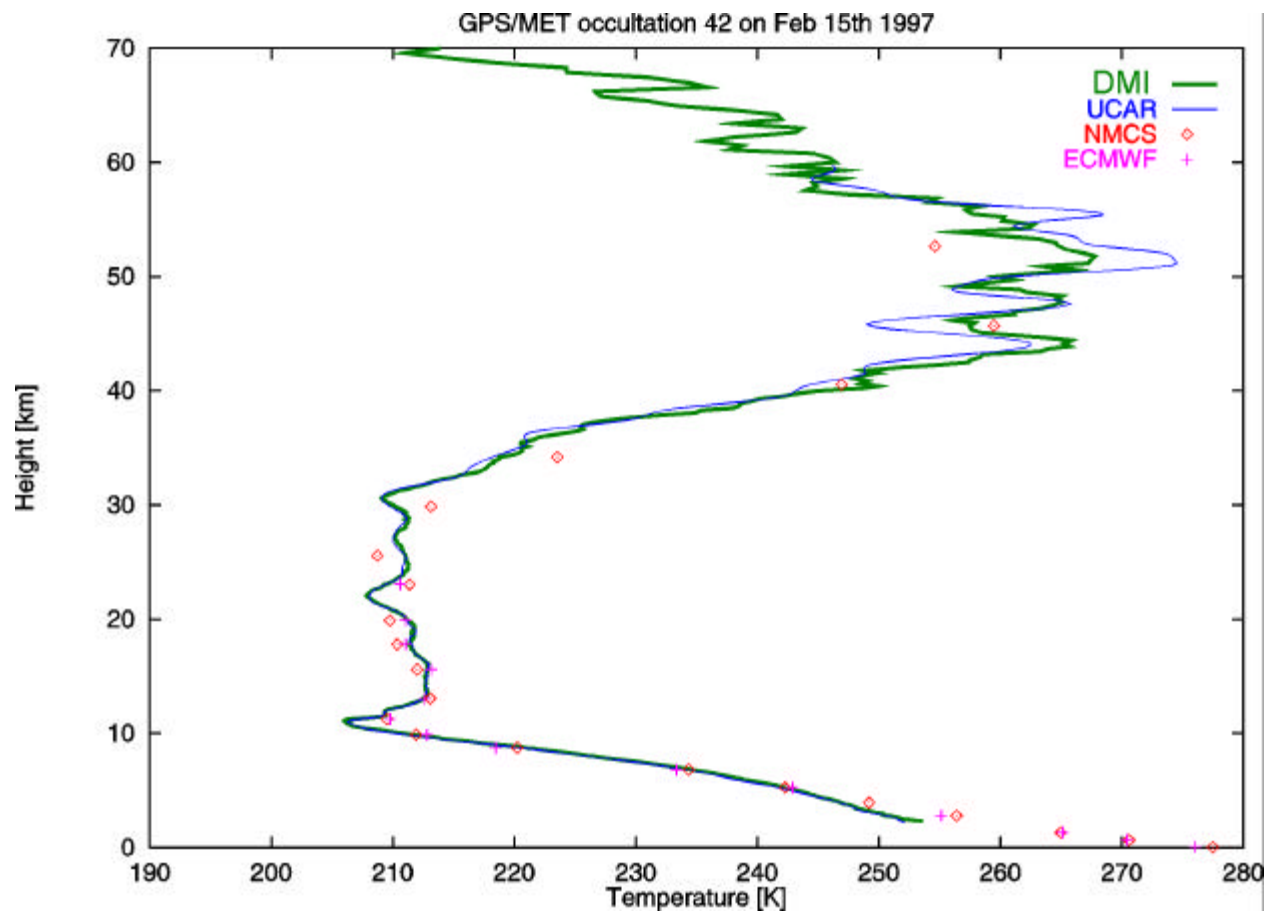
Processing Orbit N

Processing Orbit N+1

EUMETSAT SAF Techincal Coordination Meeting June 1999

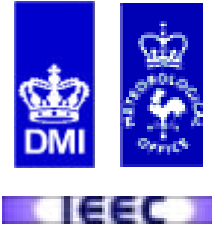2nd Seminar on Radio Occultation with GNSS, ESTEC, Noordwijk, 20-21 January 2000
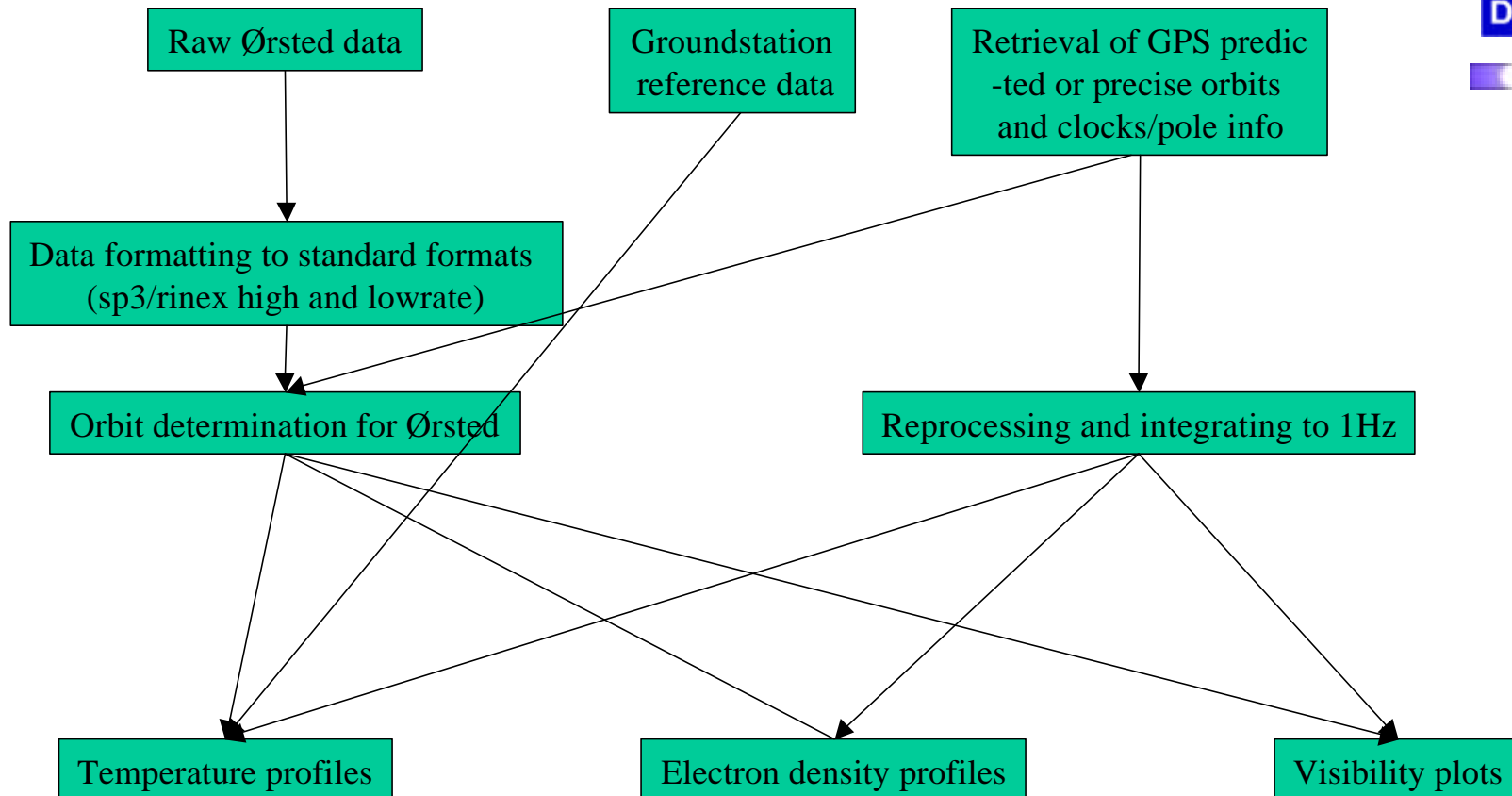
Temperature profile from GPS/MET
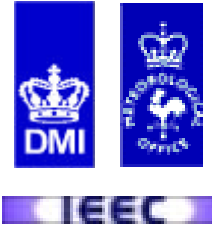

GPS/MET occultation 42 on Feb 15th 1997

DMI
UCAR
NMCS
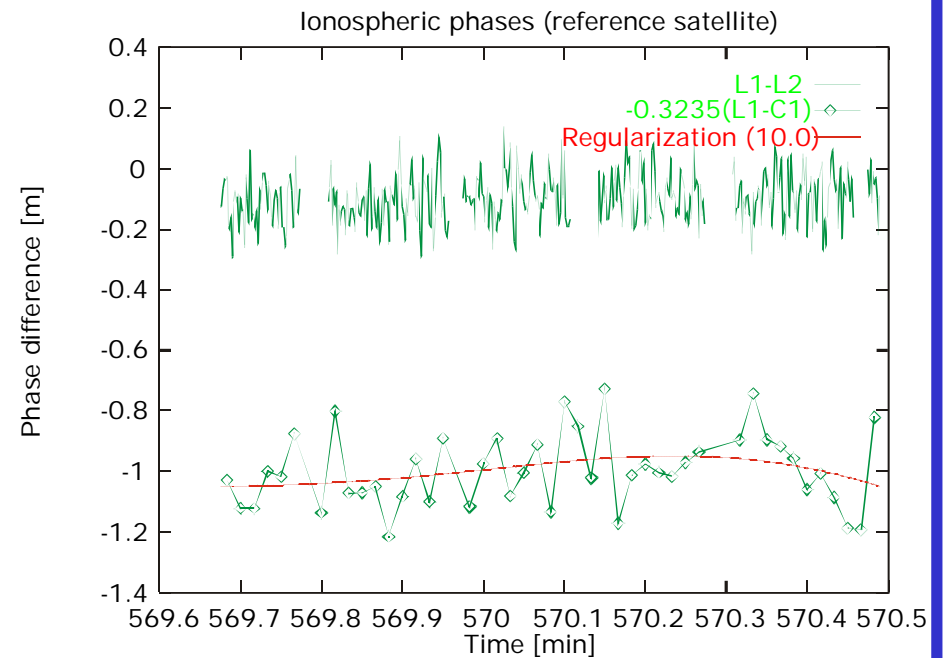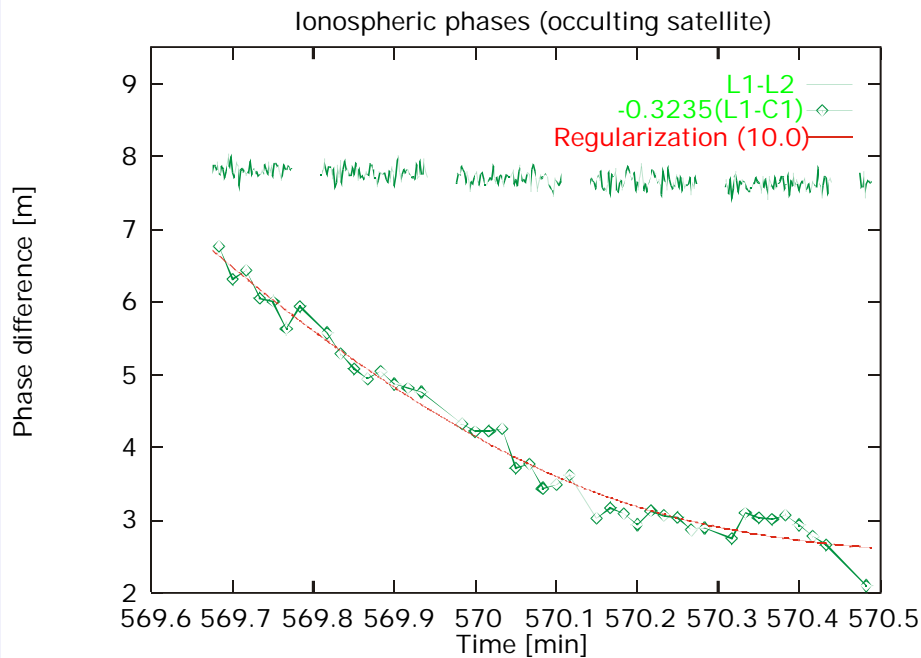ECMWF
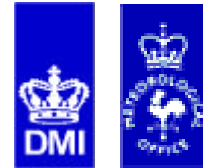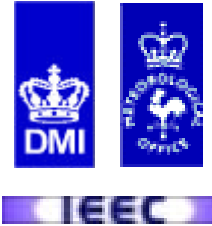
Retrieval of Ørsted profiles

- Preparation of Orsted observations
   Constructed L2 based on C1 - L1

- LEO and GPS orbit determination
- Interpolation of orbits to 10 Hz

- Doublediff based on LEO, groundstation and GPS satellites
- Bias correction of bending angels, based on MSISE90 model

- Retrieval of temperature profile

Ørsted data processing flow

Raw Ørsted data

Groundstation reference data

Retrieval of GPS predic -ted or precise orbits and clocks/pole info

Data formatting to standard formats (sp3/rinex high and lowrate)

Orbit determination for Ørsted

Reprocessing and integrating to 1Hz

Temperature profiles

Electron density profiles

Visibility plots

Phase differences

Ionospheric phases (occulting satellite)

Ionospheric phases (reference satellite)

First temperature profile from Ørsted

First DMI temperature profile from Oersted (37S, 151W, Sep. 15 at 11:13 UTC)
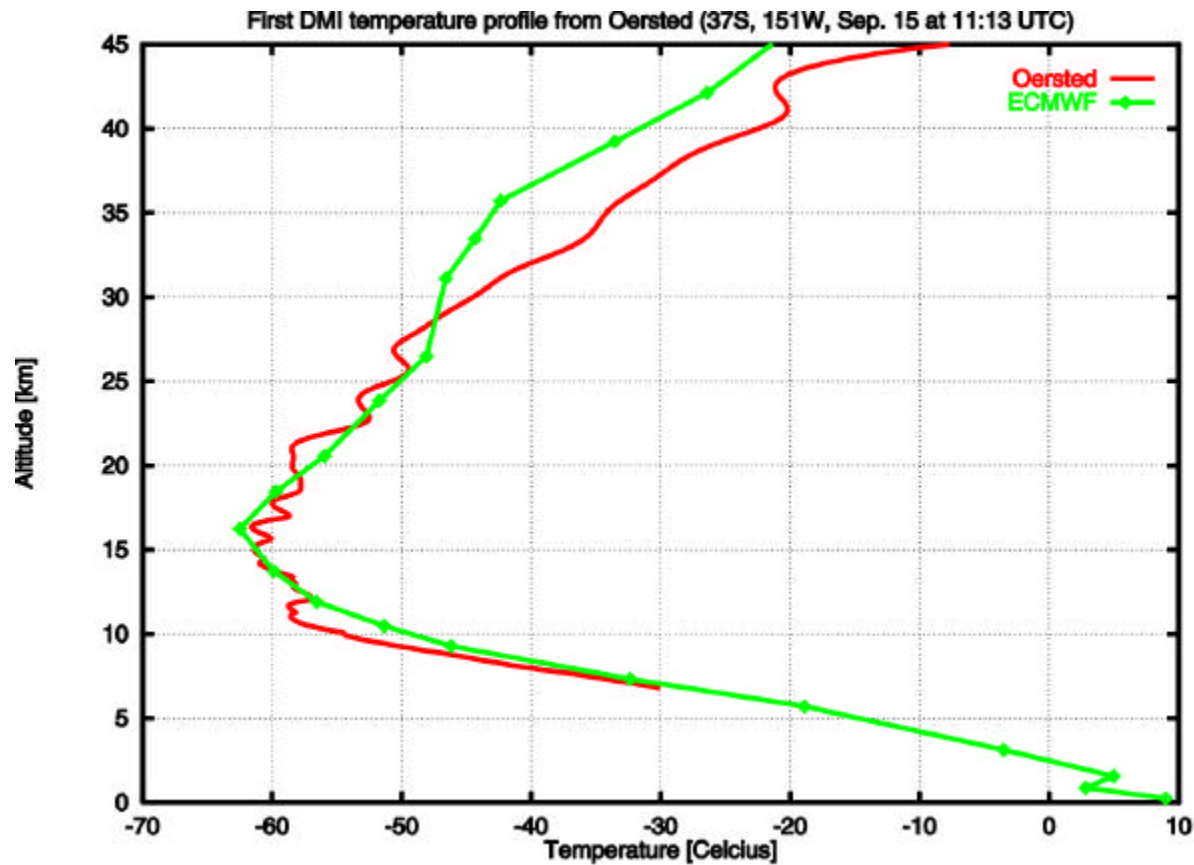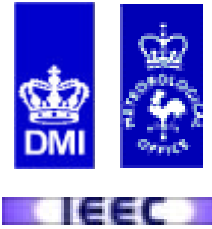
Martin B. Soerensen & Stig Syndergaard

Ørsted temperature profile compared with Radiosonde

Oersted temperature profile (66.5 N, 169.5 W) Sep. 15 14:05 UTC

Radiosonde (66.9 N, 162.6 W) 12:00 UTC
Oersted