



The GALILEA Project: new ideas on added value real/near real time GNSS services from regional networks.

The Galilea Team

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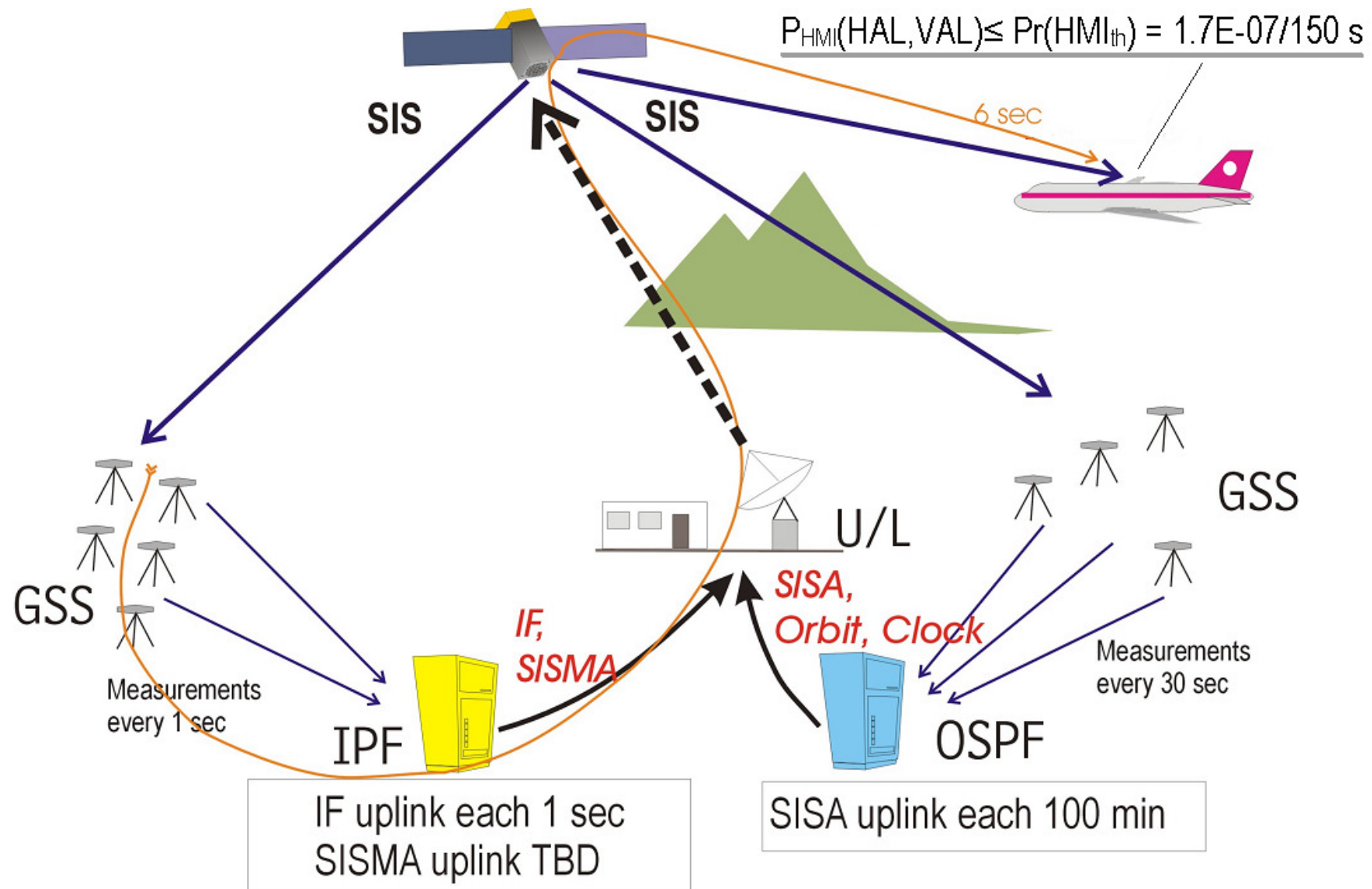
Space Engineering S.p.A.

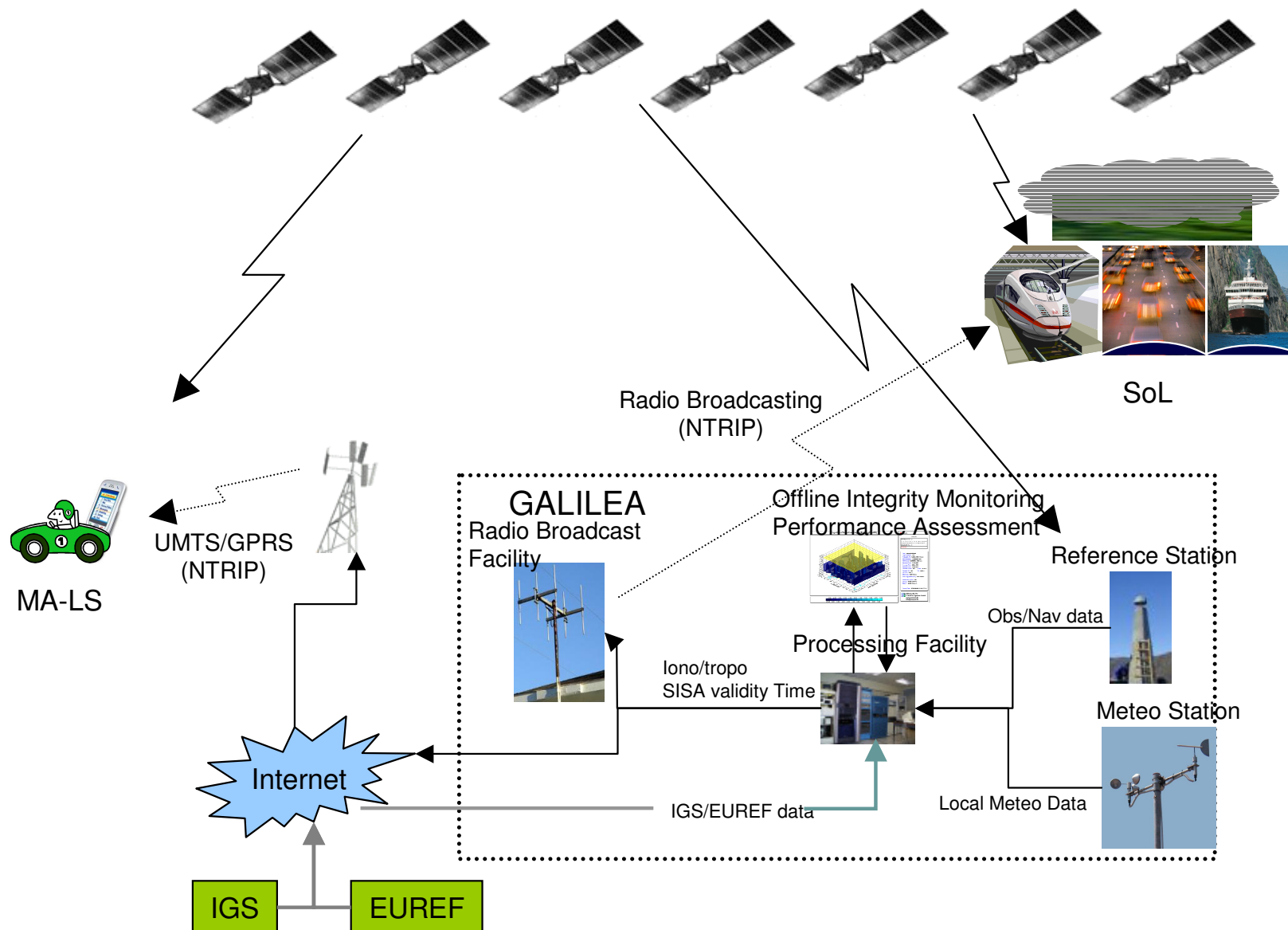
Space Engineering

The GALILEA project

- The Galileo Call 2423, “Innovation by SME”, solicited the Development of the Galileo Local Integrity Concept and Local Augmentations.
- The GALILEA (Galileo Local Elements Augmentation) project focuses on new methods and algorithms to locally predict, monitor and possibly improve in near real time the service performance. Specifically, it deals with:
 - SISE prediction
 - User position dependent iono/tropo corrections
 - Integrity monitoring
 - Data transmission

GALILEO Global Integrity Risk Concept

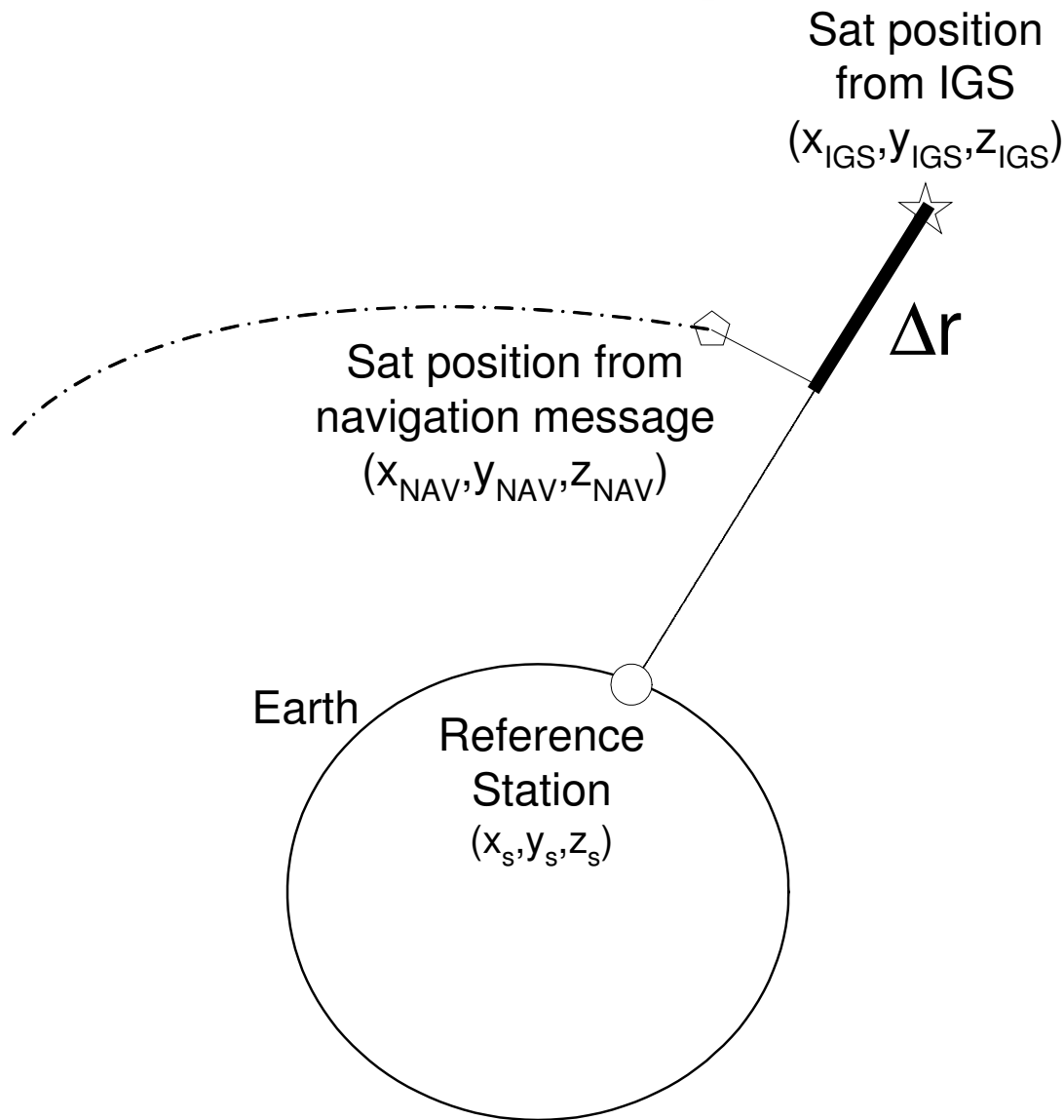






➤ Objective:

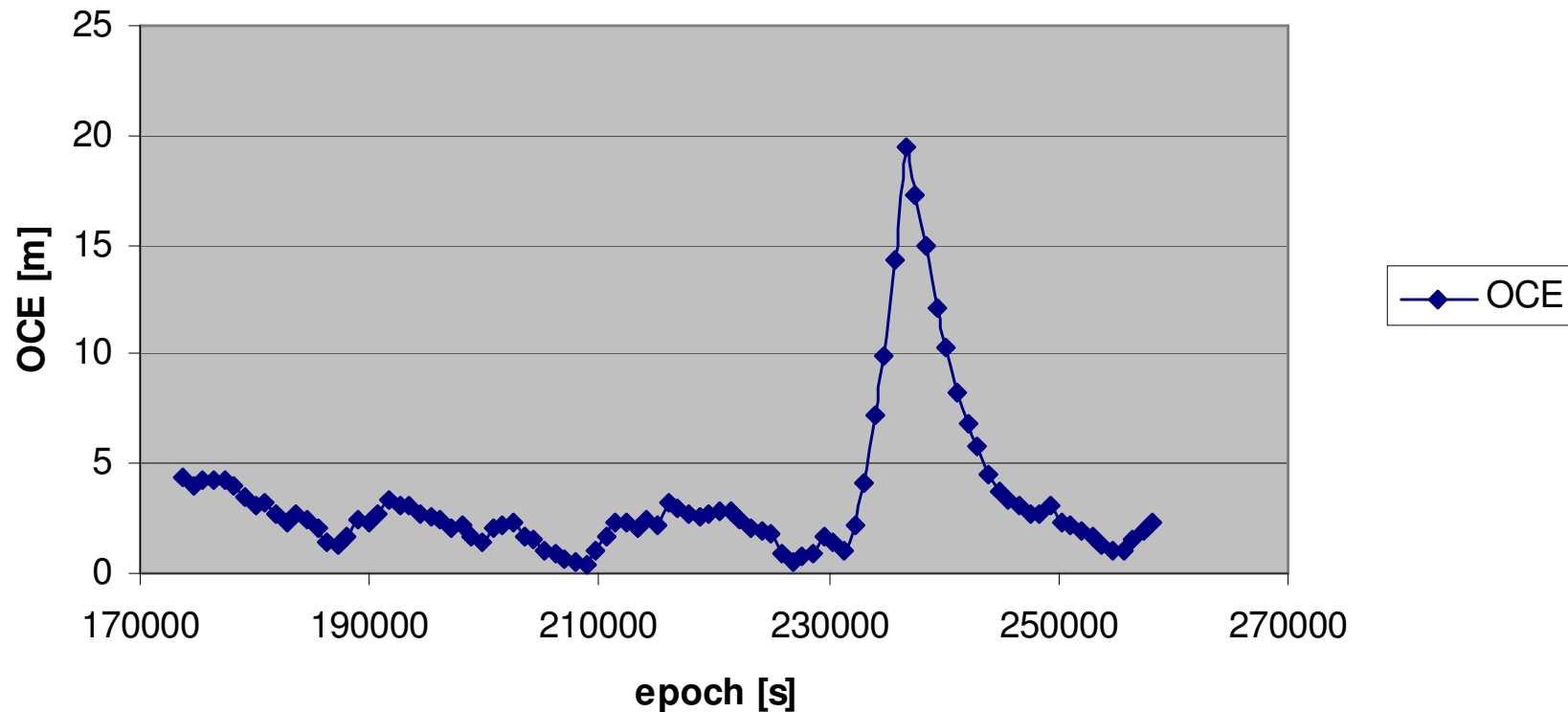
The task of the IGS module is the comparison between the IGS ephemeris (sp3 files) and the navigation data in order to compute the **Orbital and Clock Error (OCE)** as an index of the **Signal In Space Error (SISE)**



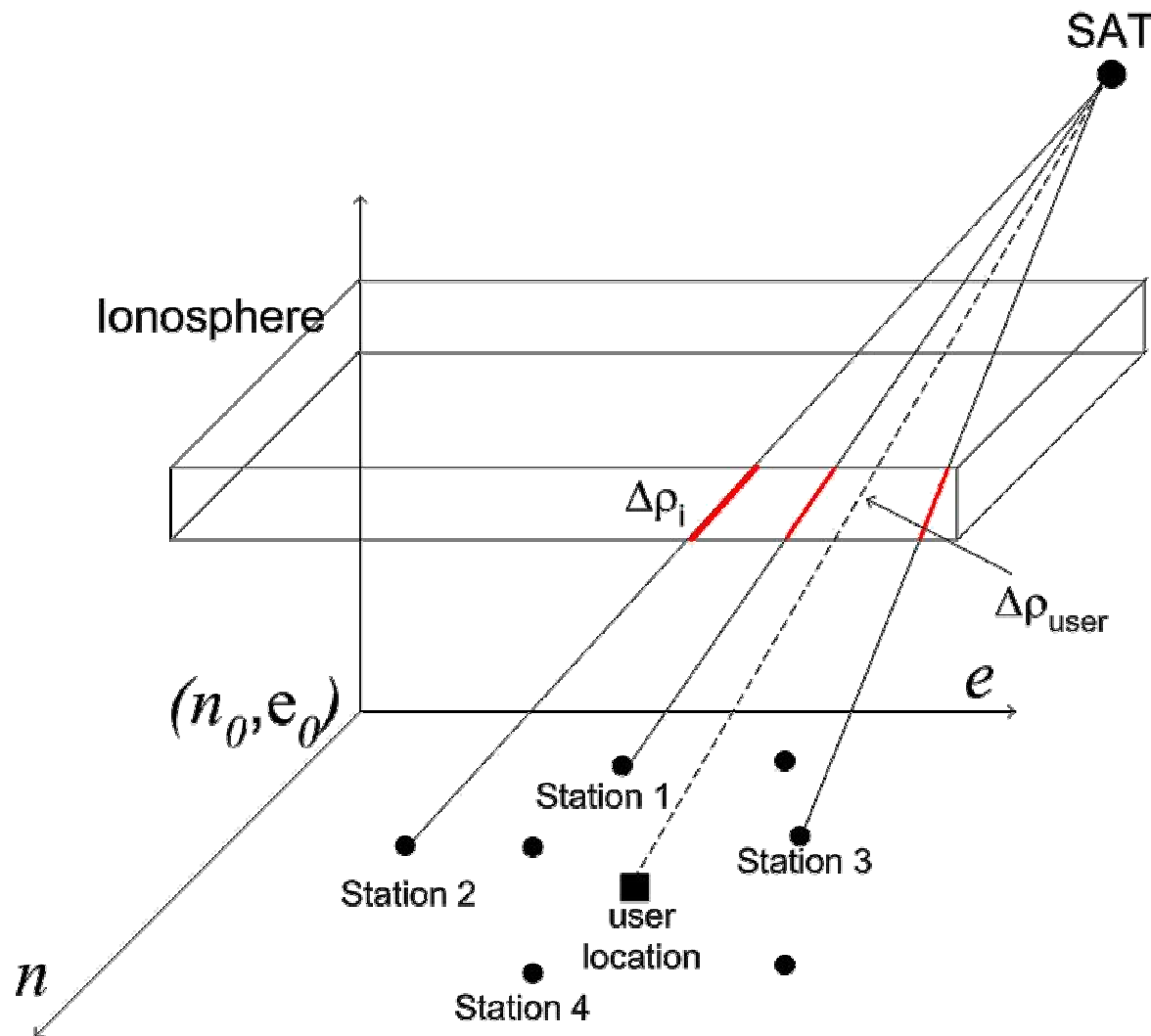


➤ Objective:

OCE, SV1




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data in
compute
and
(OCE)
as an index of the
Signal In Space
Error (SISE)



- merging of different satellites data to compute the iono/tropo coefficients
- interpolation of zenith delays to grid nodes or to a location nearest to the user
- Pack into a message and broadcast via Ntrip

NTRIP v2 Caster for GALILEA

- Sourcetable, meta data***



```

SOURCETABLE 200 OK
Server: NTRIP Caster 2.0.0
Date: 23/Mar/2007:15:33:30 GMT
Content-Type: text/plain
Content-Length: 1181

CAS;141.74.33.11;2111;TEST_NTRIP20;BKG;0;DEU;50.12;8.69;Trial Broadcaster
CAS;rtcm-ntrip.org;2101;NtripInfoCaster;BKG;0;DEU;50.12;8.69;http://www.rtcn-ntrip.org/home
NET;EUREF;EUREF;B;N;http://www.epncb.oma.be/euref_IP;http://www.epncb.oma.be/euref_IP;http://www.epncb.oma.be/projects/euref_IP
NET;IGS;BKG;B;N;http://igsb.jpl.nasa.gov//none;http://igs.ifag.de/root_ftp/software/NtripRegister.doc;none
STR;TEST0;Ephemerides;SP3;ASCII(1);0;GPS;Test;DEU;50.10;8.70;0;1;RTNET;none;N;N;9600;http://www.gps-solutions.com
STR;TEST1;Onsala;RTCM 2.3;1(1),3(10),18(1),19(1),22(10),31(1);2;GPS+GLO;IGS;SWE;57.40;11.93;0;0;JPS E_GGD;none;B;N;6000;SWEPOS
STR;TEST2;Frankfurt;RTCM 2.3;3(13),16(59),18(1),19(1),22(13),23(11),24(11);2;GPS+GLO;Test;DEU;50.09;8.66;0;0;GPSNet;none;N;N;28
STR;TEST3;Frankfurt;RTCM 3.0;1004(1),1006(10),1007(10),1012(1);2;GPS+GLO;Test;DEU;50.09;8.66;0;0;Javad E_GGD_2;none;N;N;1200;De
STR;TROPO;GalileaTropo;TropoCorr;ASCII(1);0;GPS;Test;DEU;50.09;8.66;0;0;EPCM;none;N;N;8000;http://www.galilea.navpos.de
STR;SISE;GalileaSISE;SISE;ASCII(1);0;GPS;Test;DEU;50.09;8.66;0;0;EPCM;none;N;N;7000;http://www.galilea.navpos.de
ENDSOURCETABLE
  
```


GALILEA SISE & Tropo Dissemination

■ *Client Access, SISE & Tropo Meta Data*

Stream Details

Previous Next Select Cancel

Broadcaster Details
Broadcaster: TEST_NTRIP20

Stream Details
Stream: GalileaTropo, Stream No: 5 of 6
Mountpoint: TROPD
Authentication: None
Format: TropoCorr
Format-Details: ASCII(1)
Carrier: No
Client must send NMEA-GGA: No
System: GPS
Country: DEU
Latitude: 50.09 deg North
Longitude: 8.66 deg East
Generator: EPCM
Solution: Single Base
Compression: none
Bitrate: 1200 bits per sec
Charges: No
Miscellaneous: <http://http://www.galilea.navpos.de>

Network Details
Network: Test
Operator:
Details:
Registration:

Stream Details

Previous Next Select Cancel

Broadcaster Details
Broadcaster: TEST_NTRIP20

Stream Details
Stream: GalileaSISE, Stream No: 6 of 6
Mountpoint: SISE
Authentication: None
Format: SISE
Format-Details: ASCII(1)
Carrier: No
Client must send NMEA-GGA: No
System: GPS
Country: DEU
Latitude: 50.09 deg North
Longitude: 8.66 deg East
Generator: EPCM
Solution: Single Base
Compression: none
Bitrate: 1200 bits per sec
Charges: No
Miscellaneous: <http://http://www.galilea.navpos.de>

Network Details
Network: Test
Operator:
Details:
Registration:

GNSS Internet Radio 1.4.10

Broadcaster Settings

START STOP Stream Details

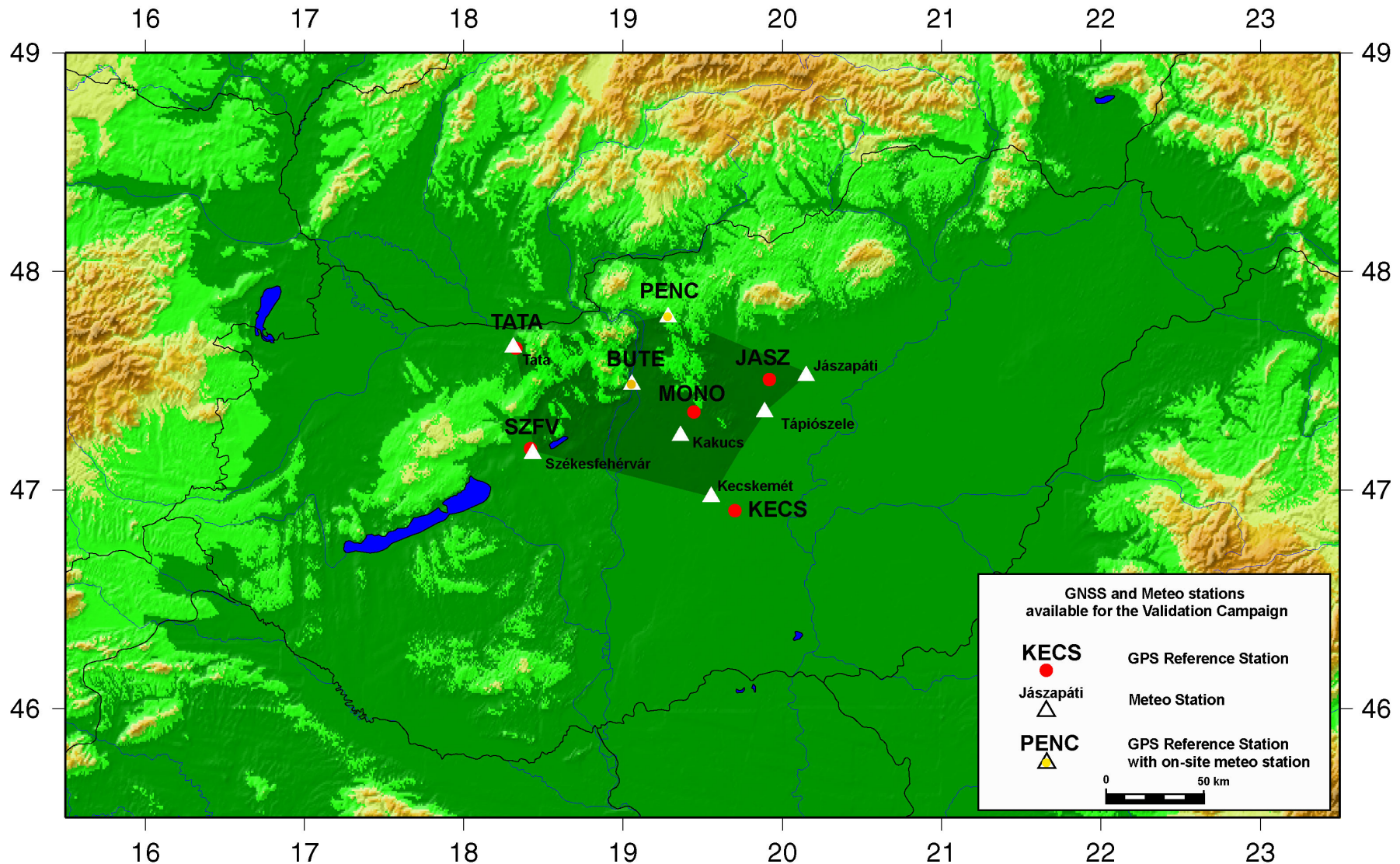
Bytes: 33,256

Select Network:
All

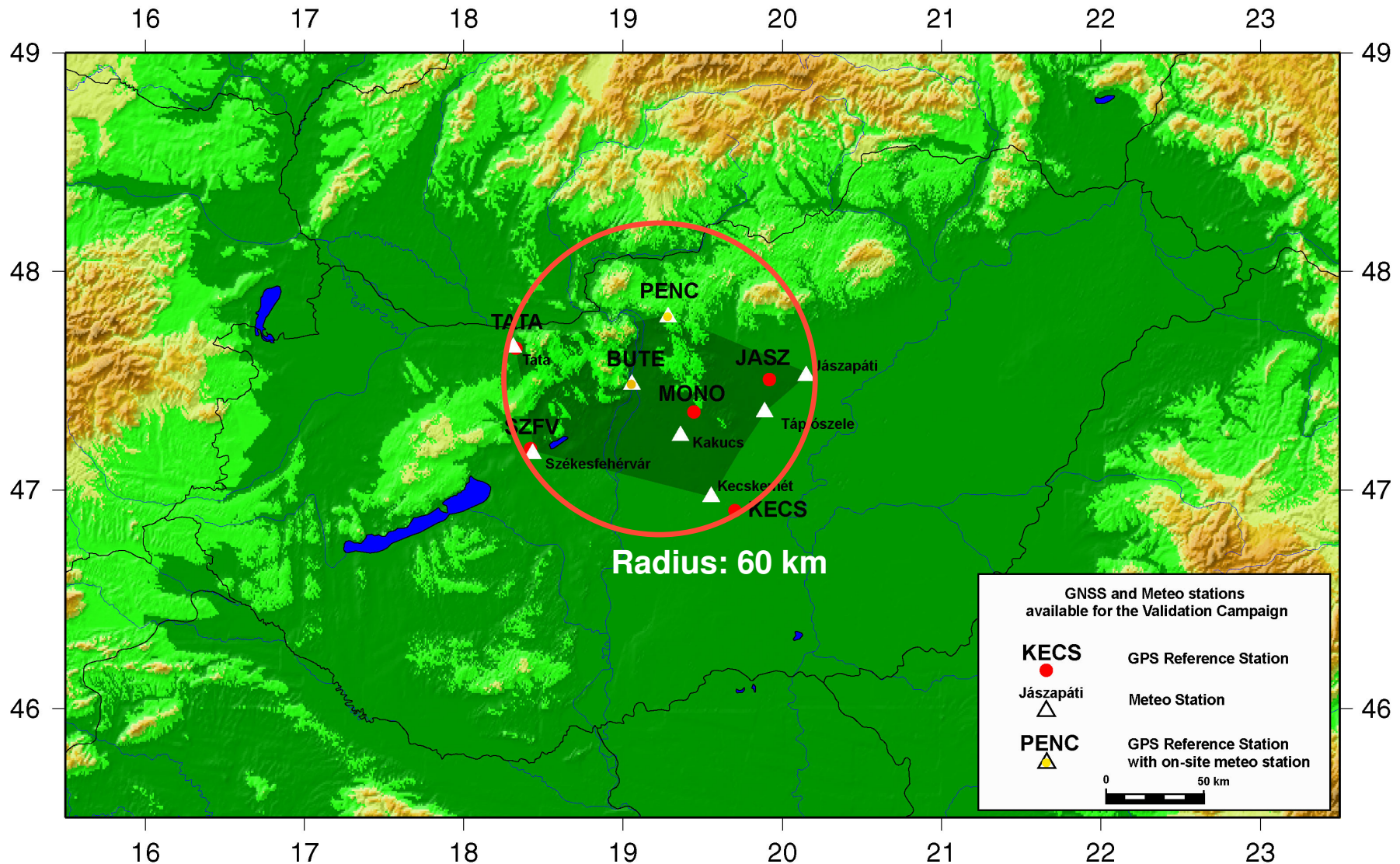
Select Stream or Update:
GalileaTropo/TropoCorr/GPS/Test

Writing data to 141.74.241.220:2101...

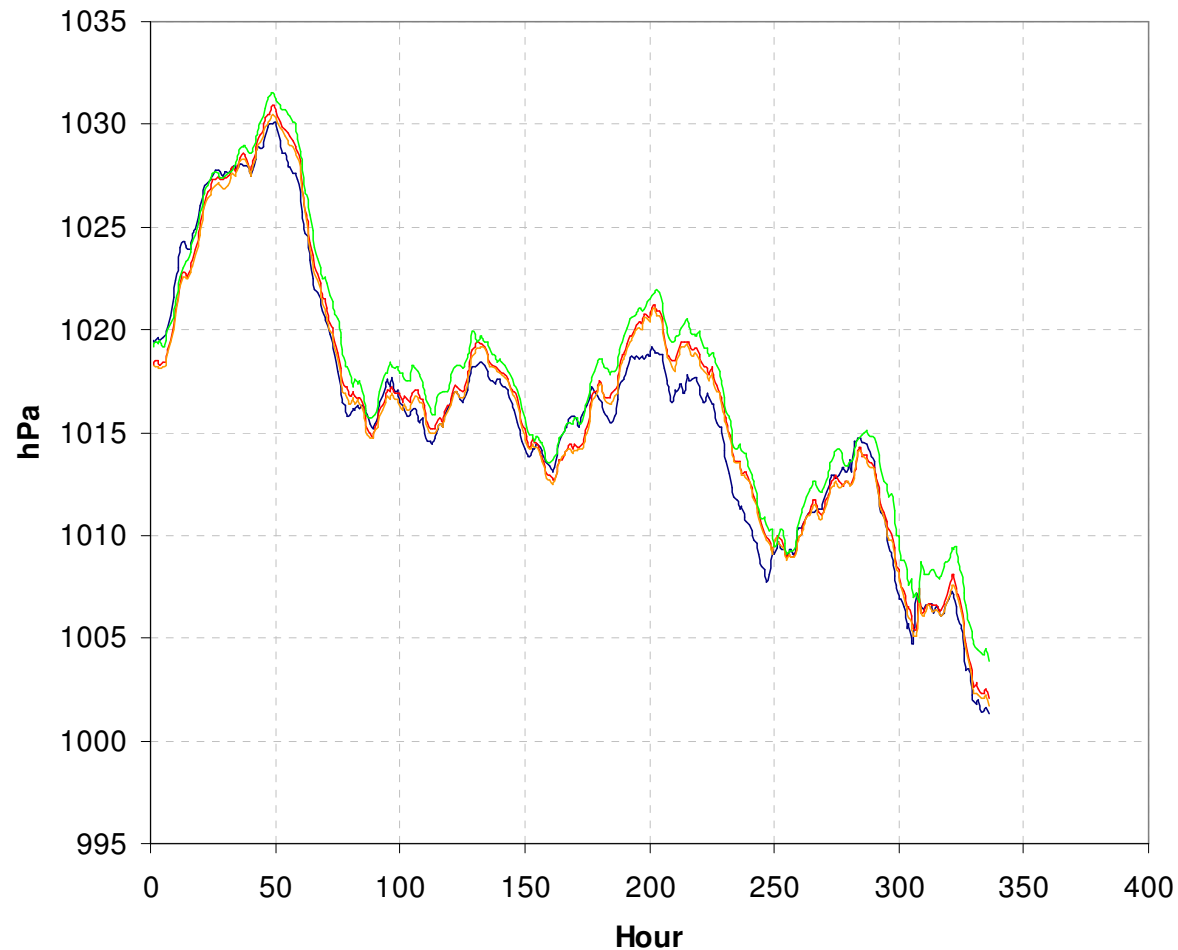
Validation with real data



Validation with real data



Acquisition of Meteo Data

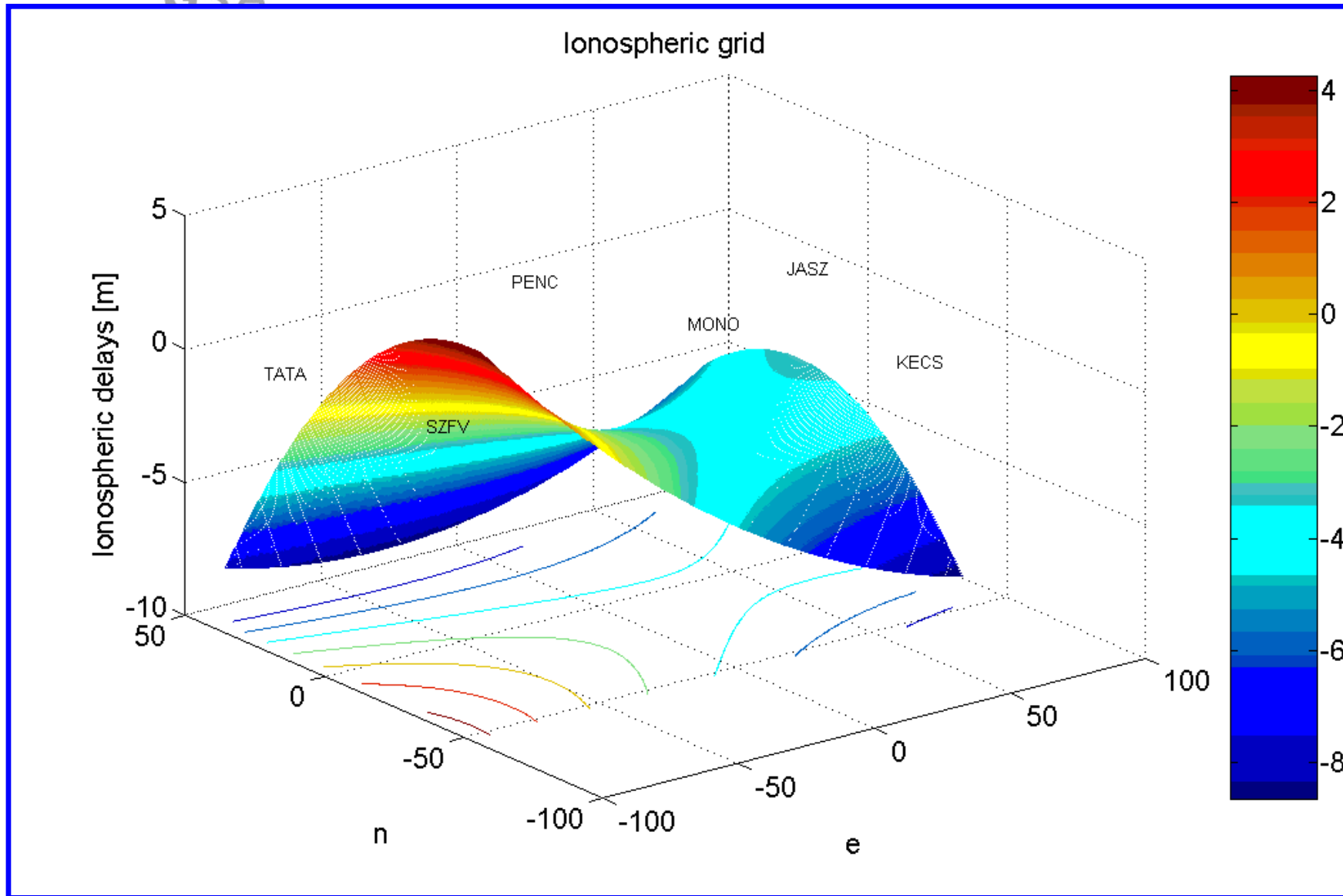


Max. diff. 7 hPa

**ca. 14 mm in tropo
delay**

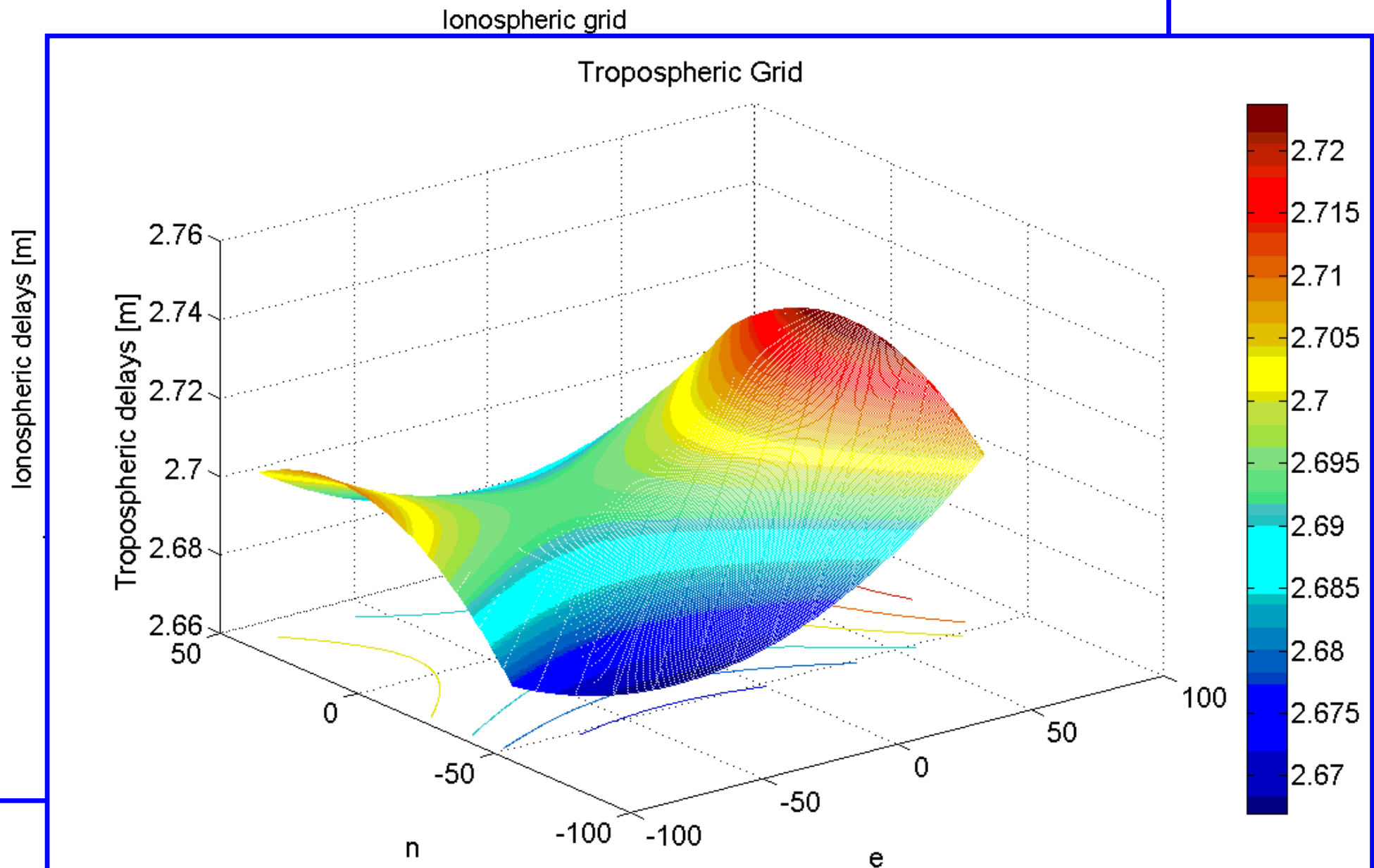


➤ Iono/tropo grid:



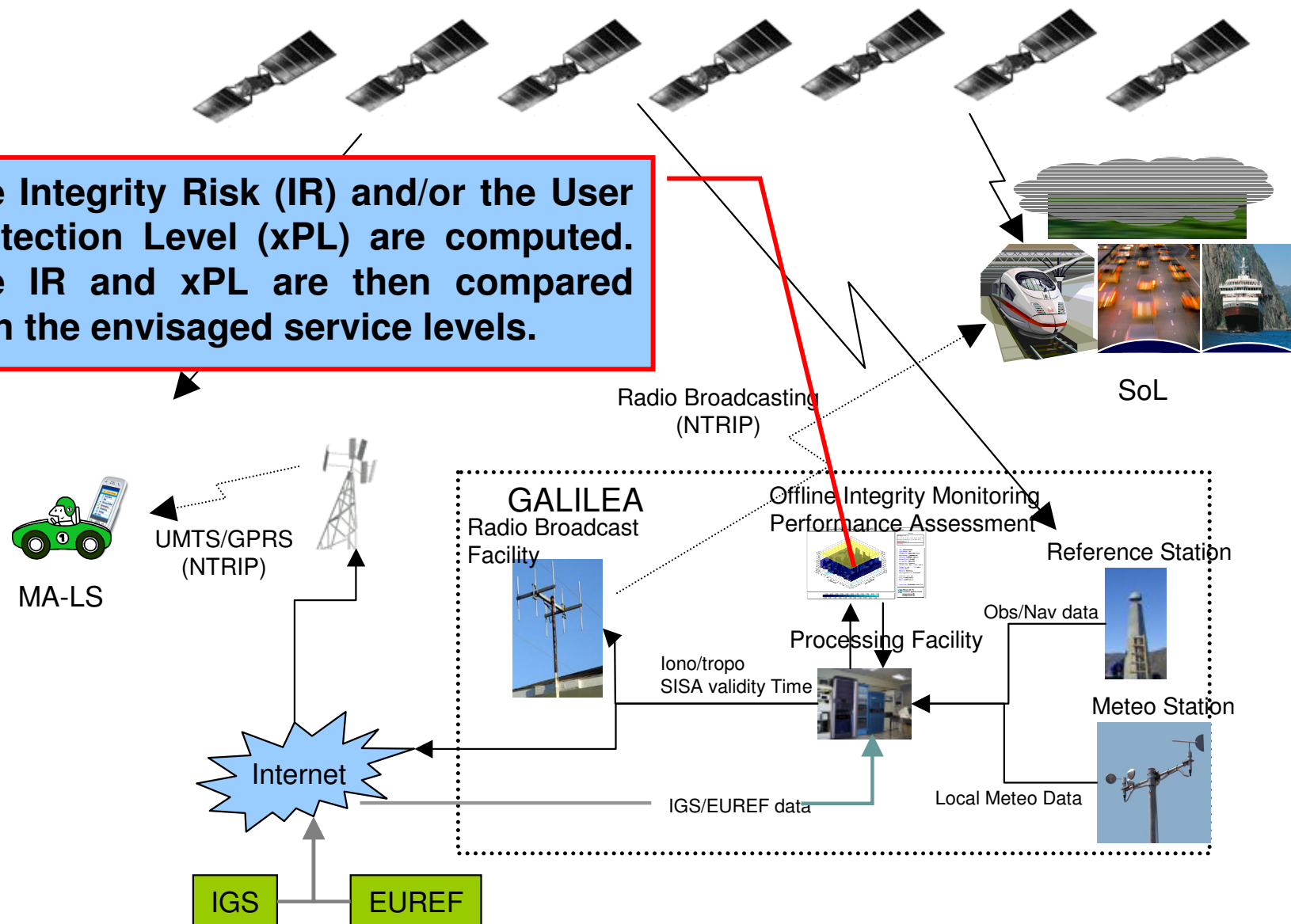


➤ Iono/tropo grid:



Study Objective: GALILEA Integrity Monitoring Module (IMM) Offline Performance Assessment 12

The Integrity Risk (IR) and/or the User Protection Level (xPL) are computed. The IR and xPL are then compared with the envisaged service levels.



EPCM - Conclusions

- The merge of global (IGS orbital and clock predictions) and local (observations) data in a single integrity information (SISE prediction) has proved to be a feasible concept.
- The interpolation of the iono/tropo corrections in the local area has shown the capability to improve the user position accuracy.
- Local Galileo adapted GBAS-like Concept does achieve CAT-I requirements with good Margin and has a high Potential to reach good CAT-II/III Integrity Monitoring performance. Availability could still be insufficient considering Critical Satellites and Degraded Modes.
- Real-time dissemination of GALILEA results SISE & Tropo up and running
- Work on new standard for real-time dissemination of SISE, Tropo etc.
- ToDo: Develop GALILEA software tools towards real-time capability