

Ionospheric Perturbations and Their Impact on GNSS - Investigated by DLRs High-Rate Receiver Chain

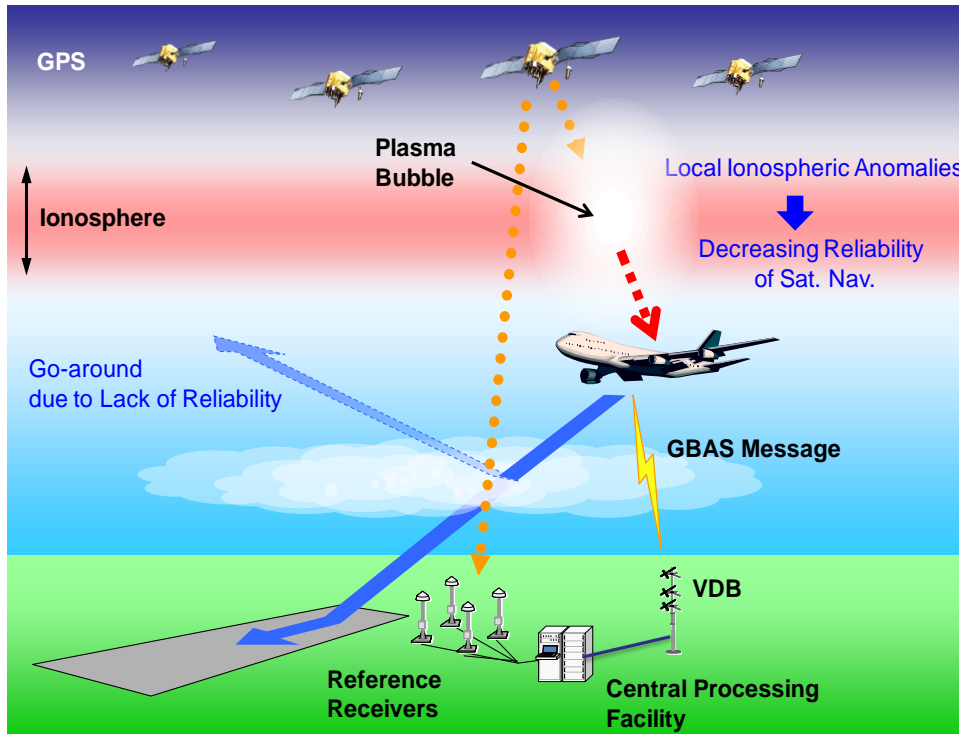
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Institute of Communications and Navigation,
German Aerospace Center

Mogese Wassae, Baylie Damtie
Bahir Dar University,
Ethiopia

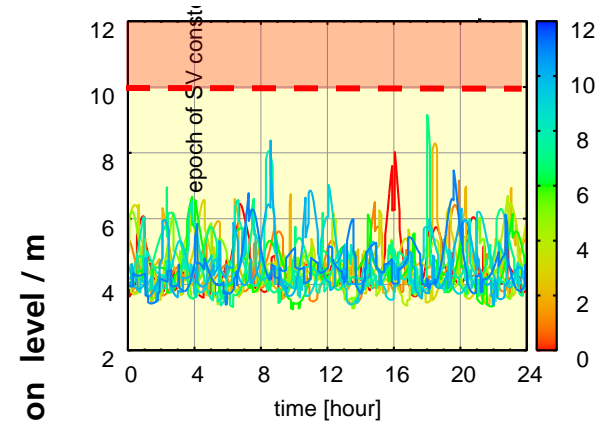
Wissen für Morgen



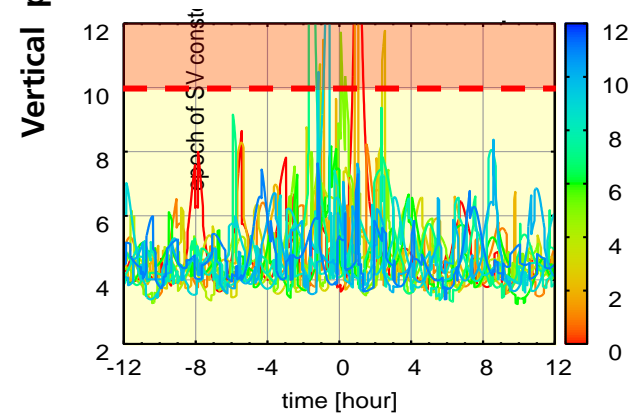
Aircraft Precision Approach



Plasma Bubble degrades availability of GNSS



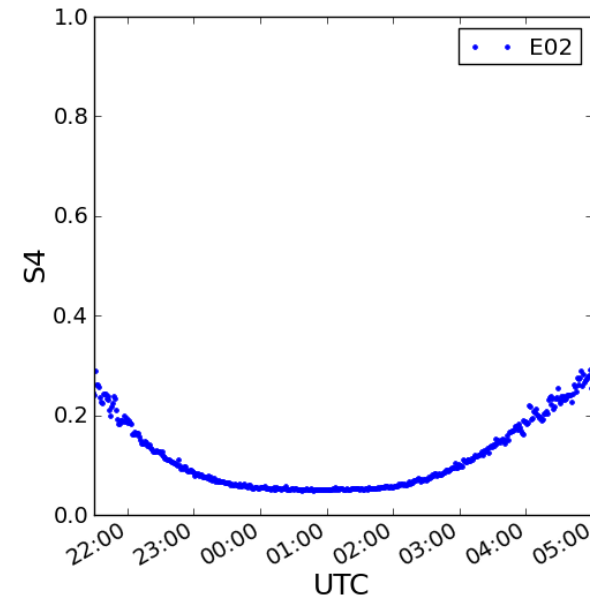
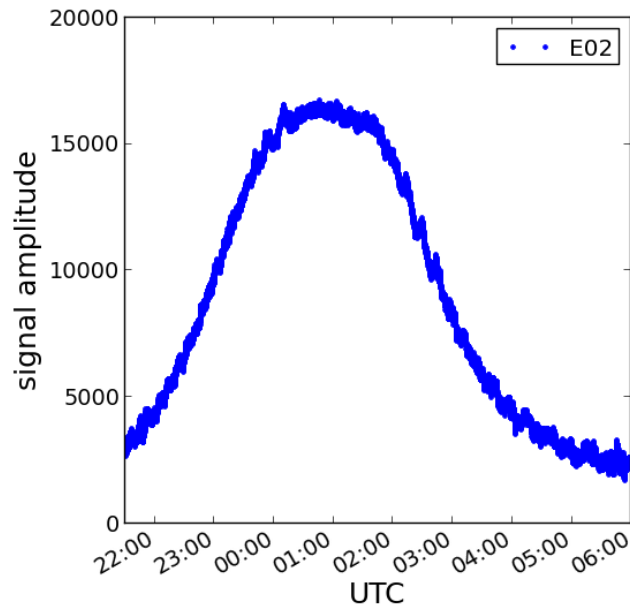
Simulated Availability (100%)



Approach Unavailable due to Bubbles



Normal amplitude data



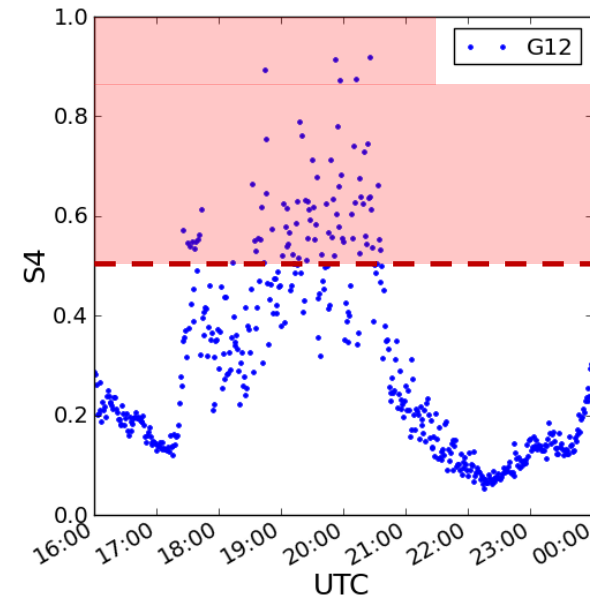
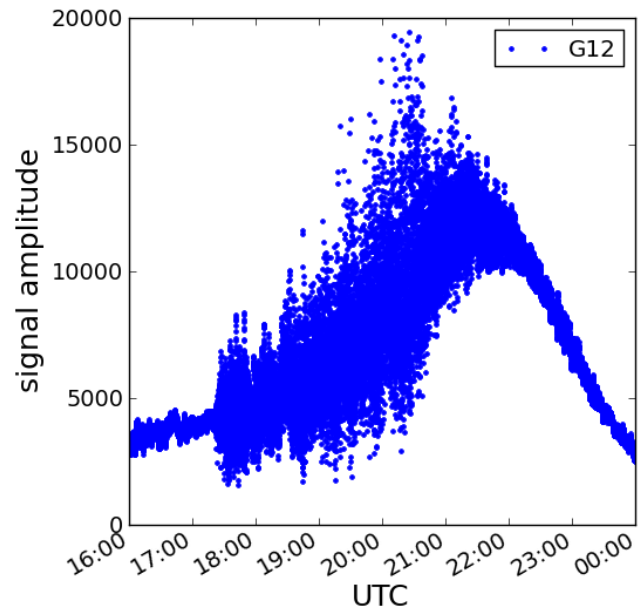
Bahir Dar/ Ethiopia

26/27.01.2012

S4	
< 0.3	low noise
0.3 to 0.5	enhanced
> 0.5	scintillation event



Scintillating amplitude data



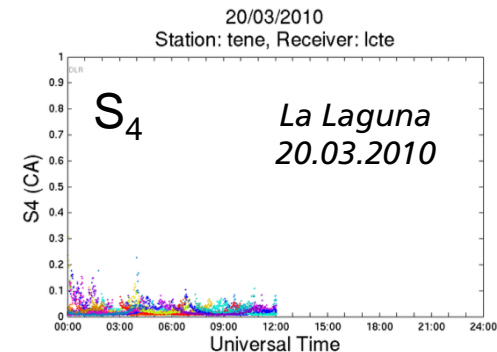
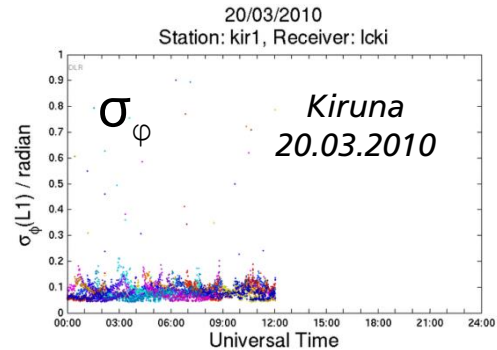
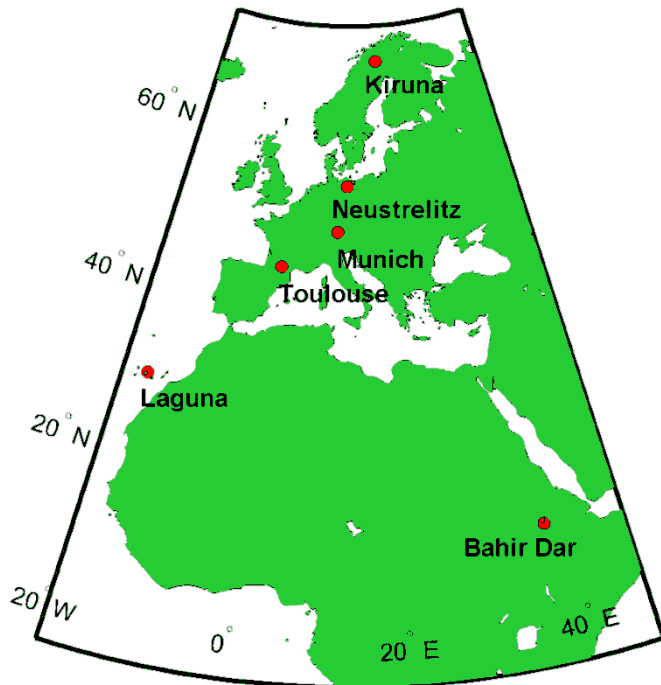
Bahir Dar/ Ethiopia

10/11.04.2012

S4	
< 0.3	low noise
0.3 to 0.5	enhanced
> 0.5	scintillation event



Scintillation Monitoring Network of DLR



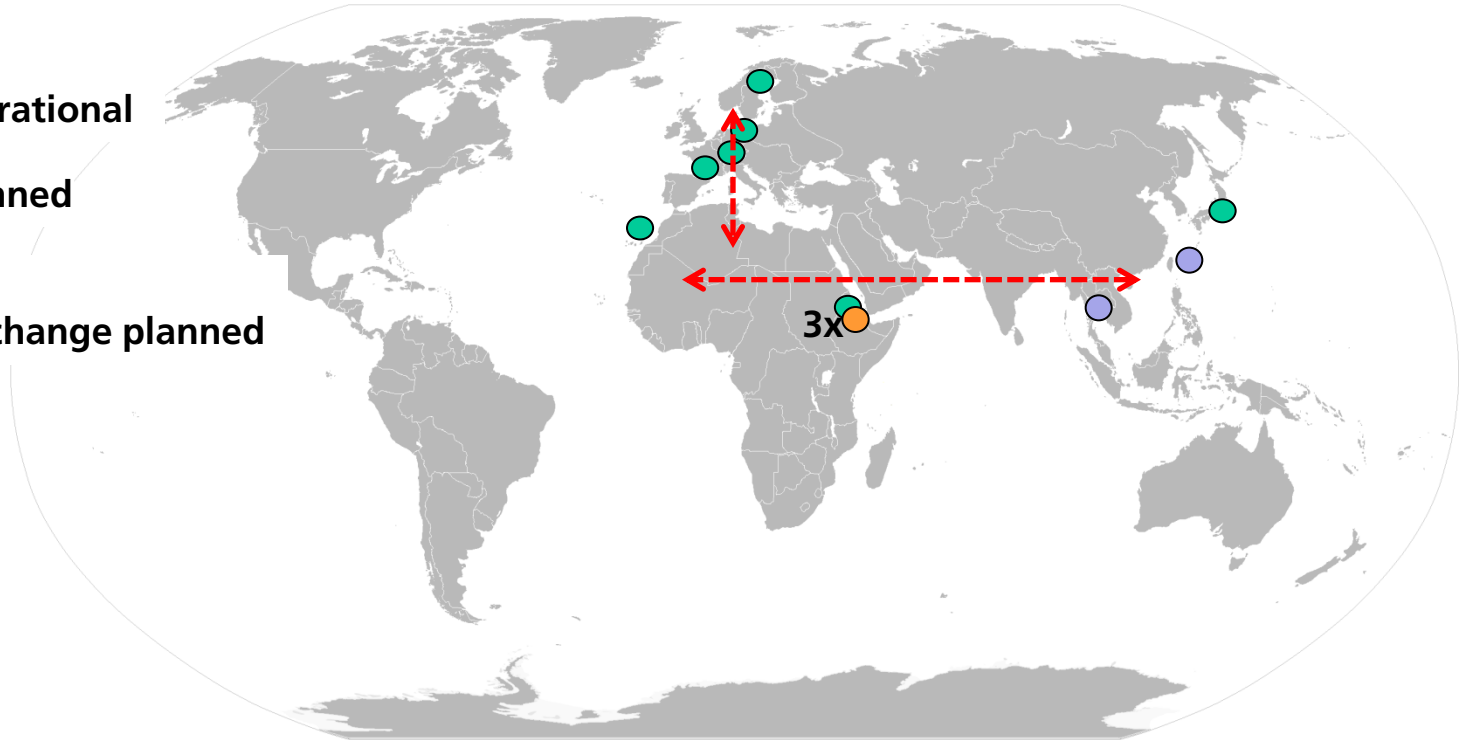
- Network of high rate dual frequency GPS receivers (20-50 Hz)
- Network provides actual scintillation data, distributed via SWACI

<http://swaciweb.dlr.de>



Scintillation network sites

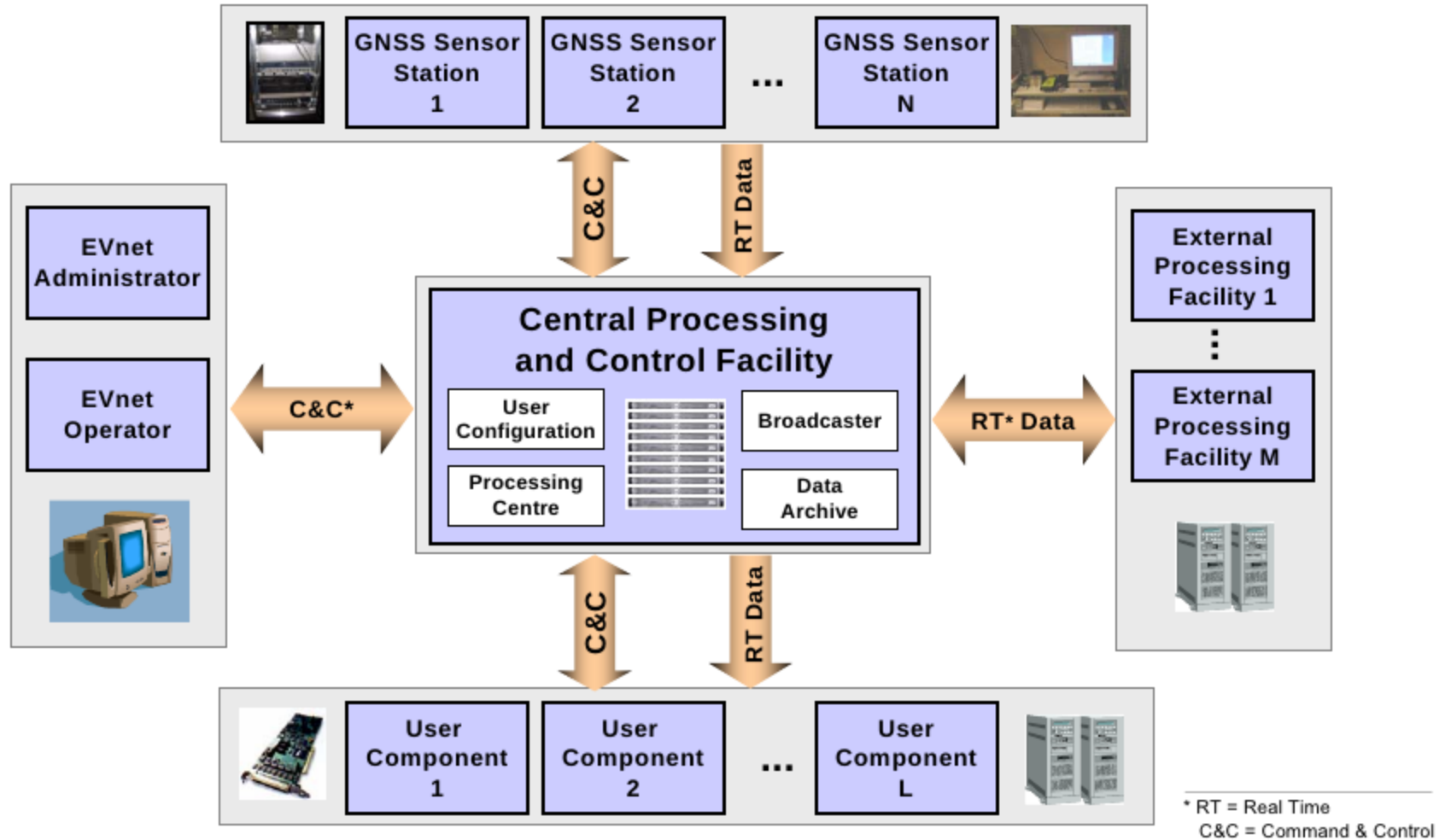
- DLR operational
- DLR planned
- JAXA –
Data exchange planned



- Network from high to low latitudes in European sector
- Coordinated measurements at European and Asian region



Setup of EVNet



EVNet cont'd

The screenshot shows the EVN administration interface with three callout boxes:

- Browser Tree:** Points to the left sidebar showing a hierarchical tree of sensor stations and users.
- Working Area:** Points to the main configuration area, including the 'Sensor Properties' dialog box for 'N_EGGD0131'.
- Information desk:** Points to the bottom log window showing system messages.

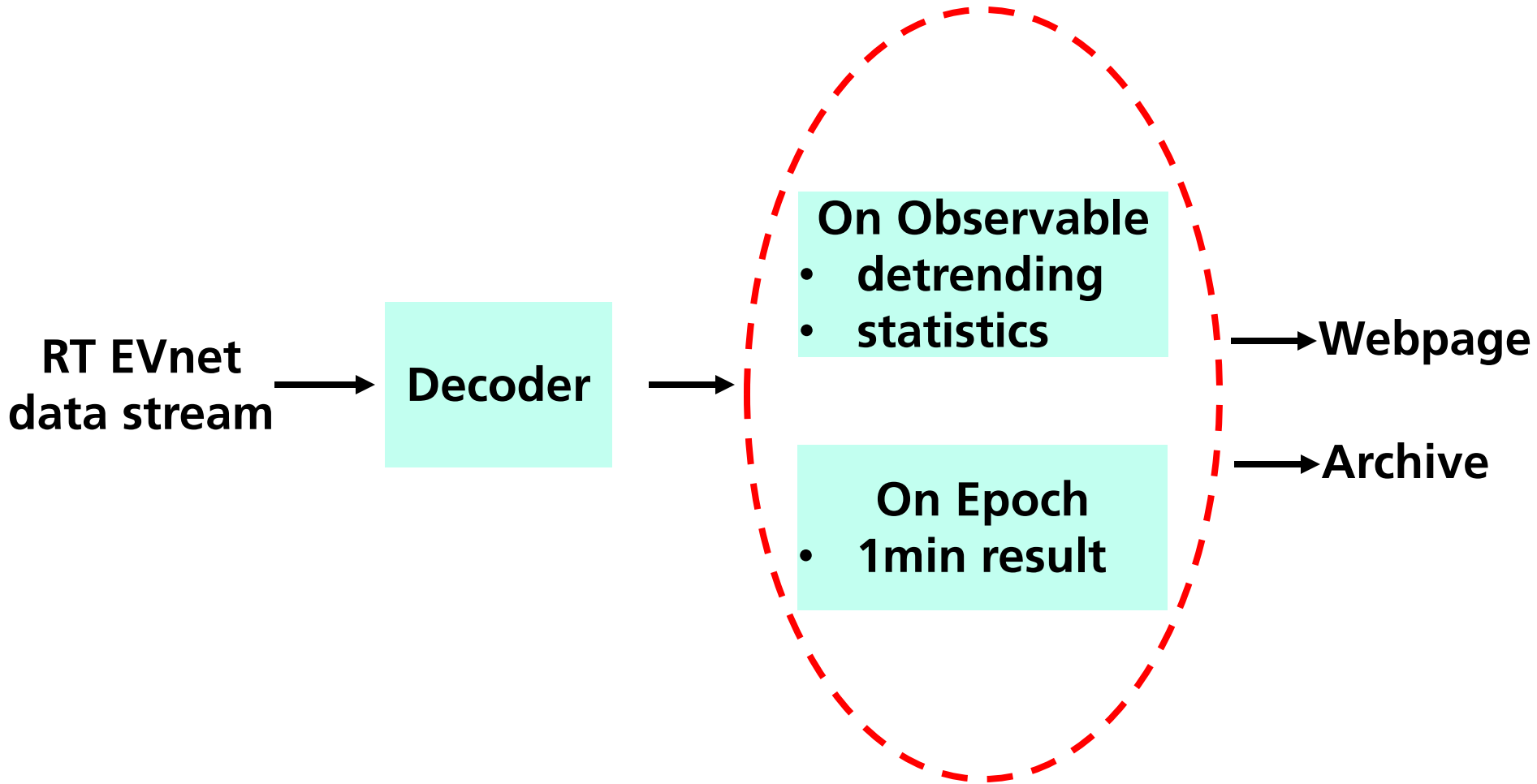
- CPCF Monitoring
- Sensor Station config.
- User configuration
- Processor config.
- Archive configuration

- Status information
- Sensor properties
- Sensor configuration
- Archive settings

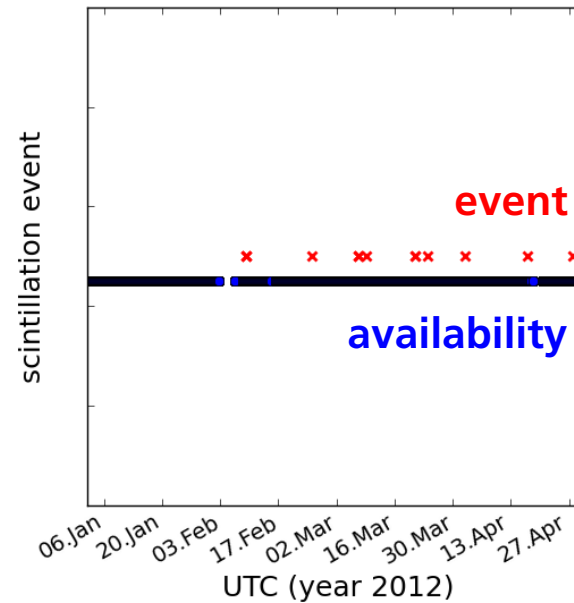
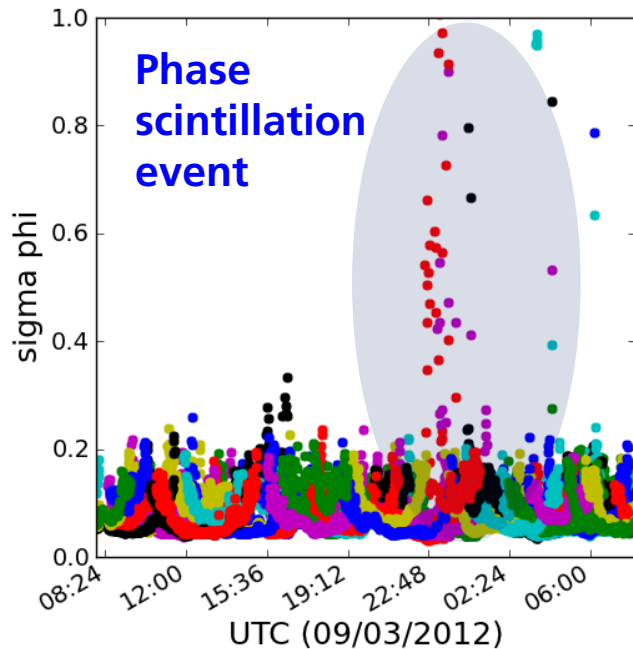
- Logging information
- Error detection
- Warnings



Scintillation Processor



Phase scintillation Sweden



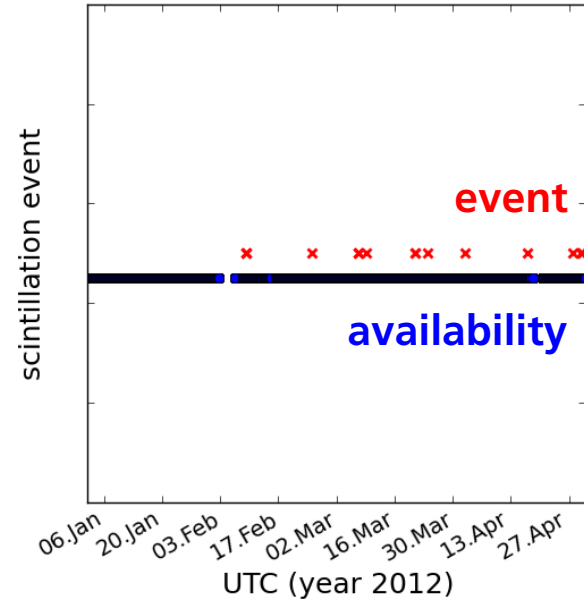
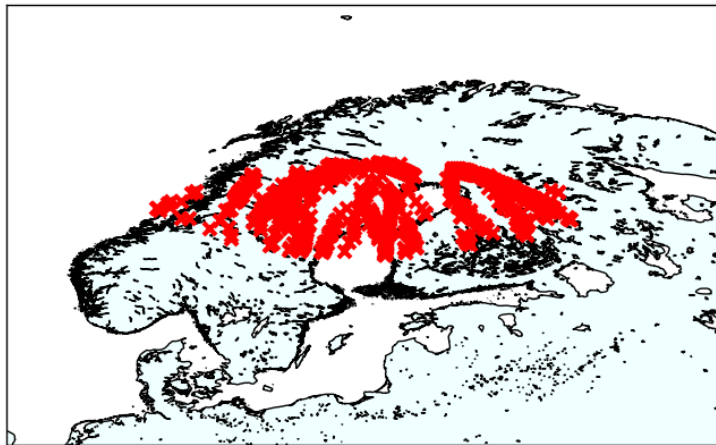
Kiruna / Sweden

09/10.03.2012

L1 σ_{ϕ}	Elevation
> 0.5	50 < x < 130



Phase scintillation Sweden cont'd



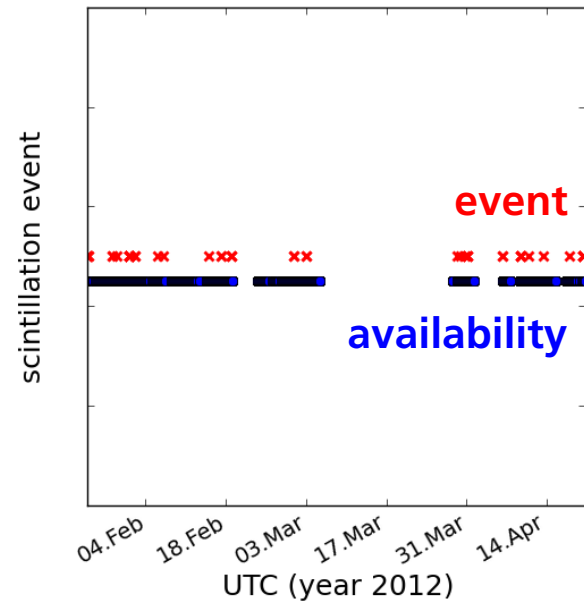
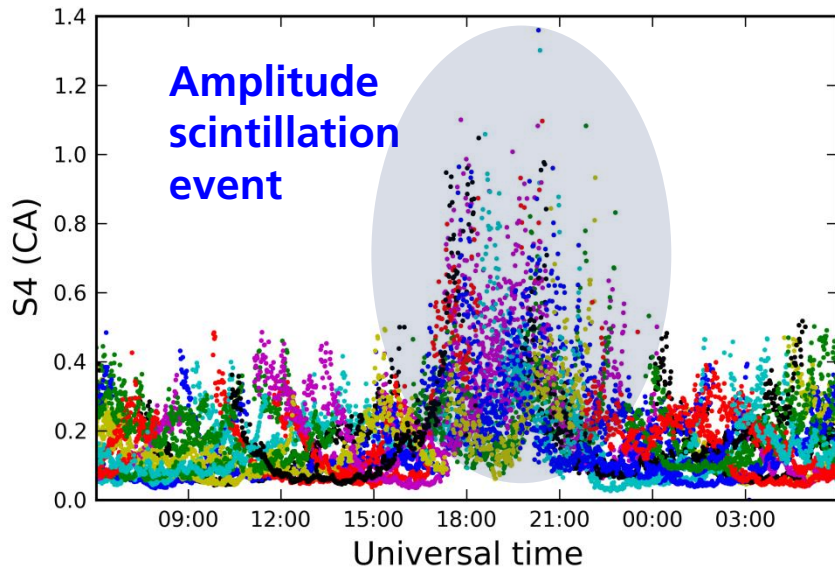
Kiruna / Sweden

Jan – Apr 2012

L1 $\sigma\phi$	Elevation
> 0.5	50 < x < 130



Amplitude scintillation Ethiopia



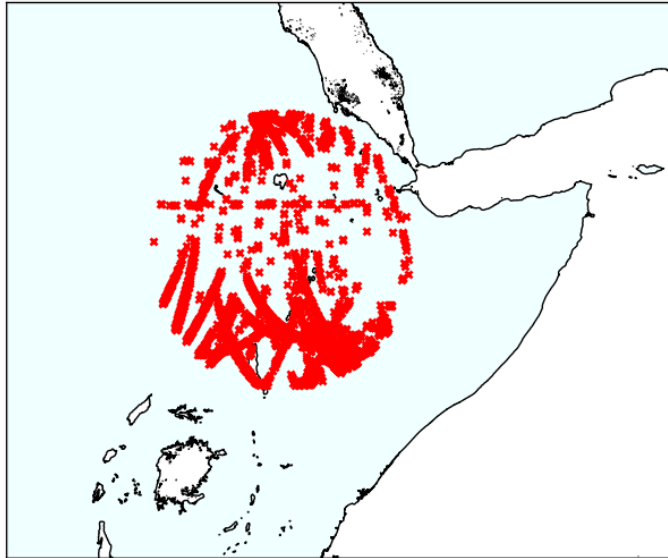
Bahir Dar/ Ethiopia

10/11.04.2012

L1 S4	Elevation
> 0.8	50 < x < 130

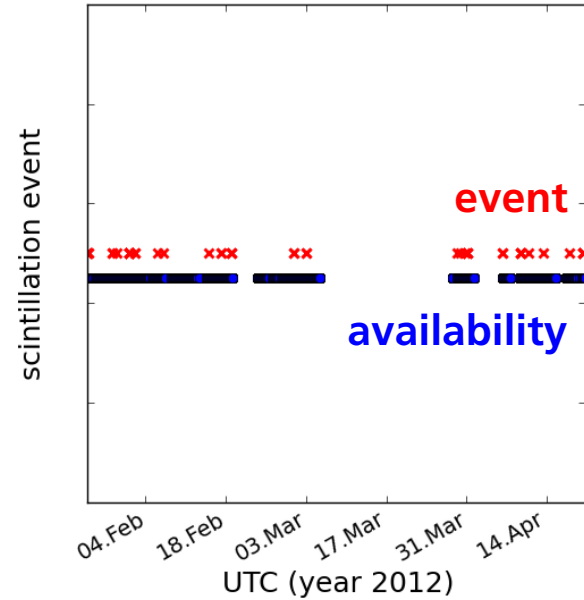


Amplitude scintillation Ethiopia cont'd



Bahir Dar/ Ethiopia

Jan – Apr 2012

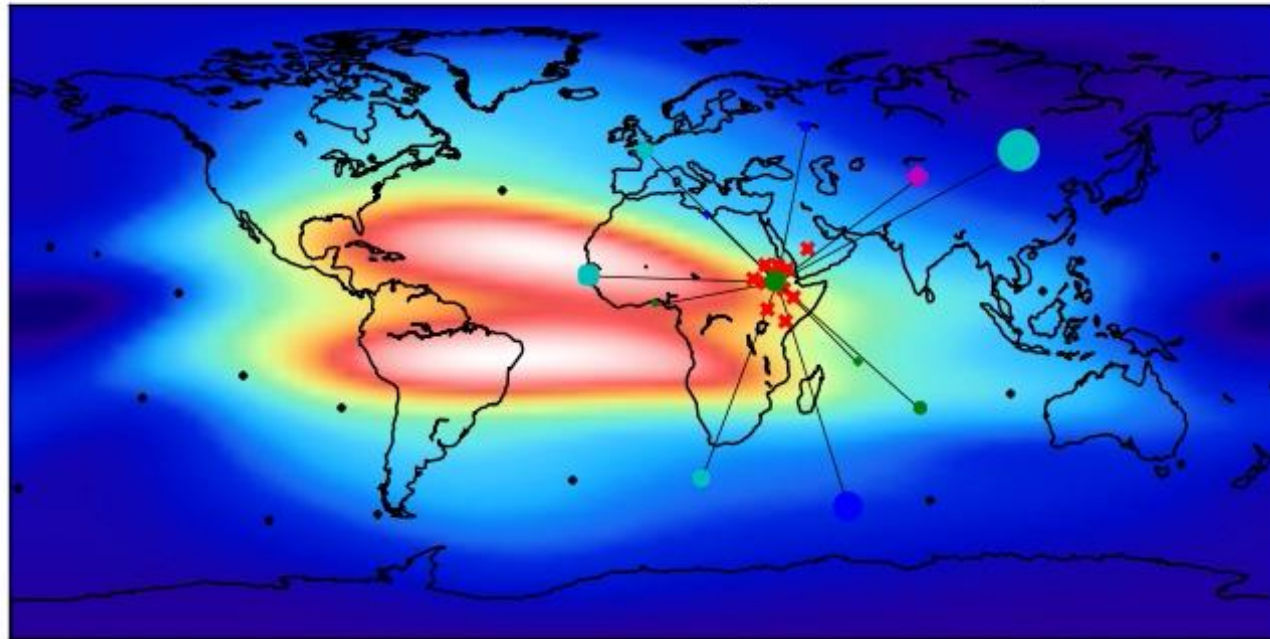


L1 S4	Elevation
> 0.8	50 < x < 130



Scintillation in Bahir Dar

Satellite Scintillation and global TEC map

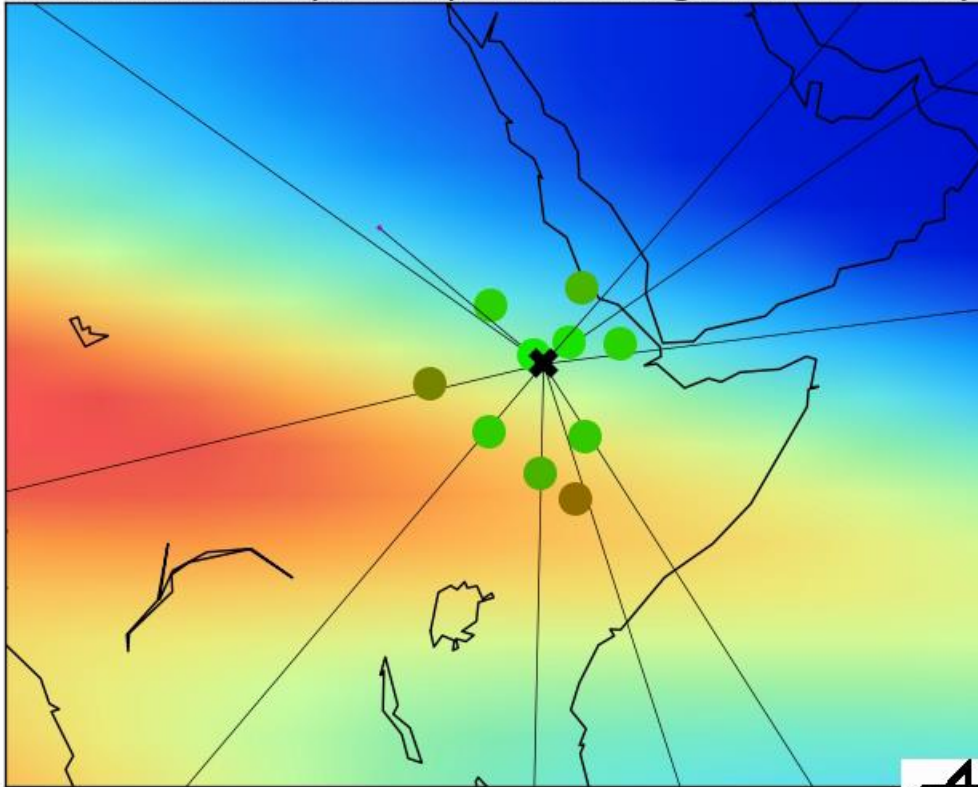


Time: 2012-01-26 16:00:00



Amplitude Scintillation in Bahir Dar

Scintillation at pierce points and global TEC map



Time: 2012-04-10 16:00:00



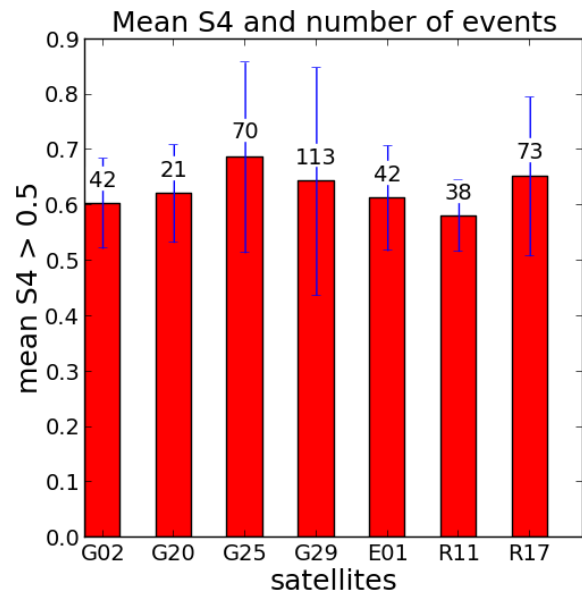
Ionospheric Pierce points

Color ~ S4

**Background:
Global TEC model**



New frequencies



Gxy: GPS satellites on different positions

E01: Galileo test satellite

Rxy: Glonass satellites



Planned new stations



● DLR prototype

● planned



Nov 2012



Summary - Outlook

- **Scintillations -> even with new signals non negligible**
- **Prototype system for real-time scintillation monitoring running**
<http://swaciweb.dlr.de>
- **Now begin developed to 24/7 service**
- **Expansion of system to Africa**

