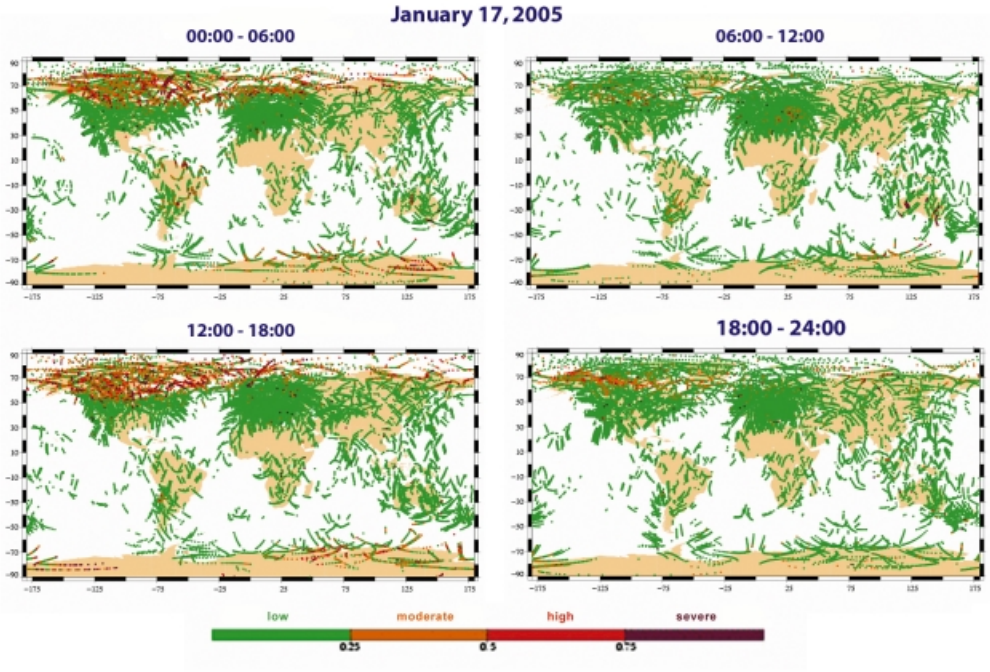
Ionospheric Scintillations

CLS, as part of the ESA Space Weather Pilot Project, has developed a prototype service for monitoring Ionospheric scintillations at a global scale in near real time.
This service provides perturbation analysis of GPS signals continuously provided by the IGS worldwide network.

It is composed of more than 300 stations among them about 50 are hourly stations.
Scintillations are rapid and very local changes in the concentration of electrons in the ionosphere.

Space Weather European Network

Mid-January 2005 big storm

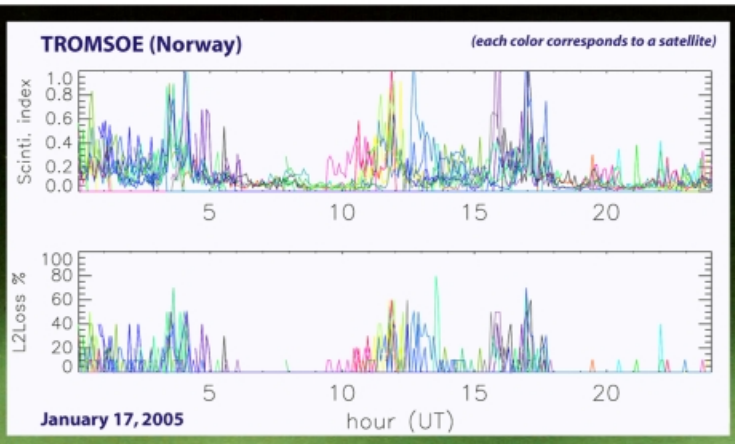


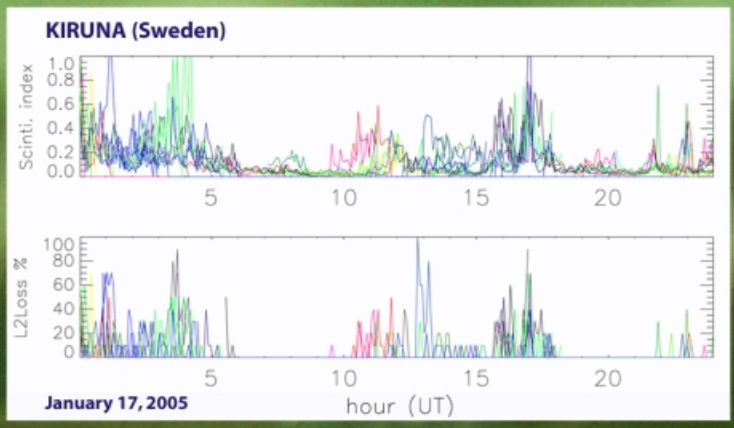
Both high latitude and equatorial regions are mainly affected by the scintillations. During a magnetic storm, electrons driven by the solar wind precipitate in the auroral zone.

During mid-January 2005, flares and coronal mass ejections occurred on the Sun surface releasing a high quantity of energy and particles. Crossing the geostationnary orbit, they cause several damages such as Intelsat's IS-804 satellite total loss due to an electrical anomaly on the spacecraft.
The electrons driven by the solar wind precipitate in the auroral zone and generate scintillations in the ionosphere.
The opposite maps show, at the altitude of 400 km, the expansion of the scintillations monitored over a 24 hour period on 17/02/2005.
Radio-signals have been corrupted causing possible and/or might cause inaccurate real time GPS positions (red and violet points).

GPS failures

Scintillations cause absorption of GPS signals up to complete loss. Monitoring such events is critical particularly for planning offshore geodetic survey operations or for airplane navigation during airport approach.





The calibration of the index is provided thanks to Ionospheric Scintillation Monitors.
A specific equipment will be installed shortly in Kourou (French Guyana).

http:// scintillations.cls.fr

www.cls.fr