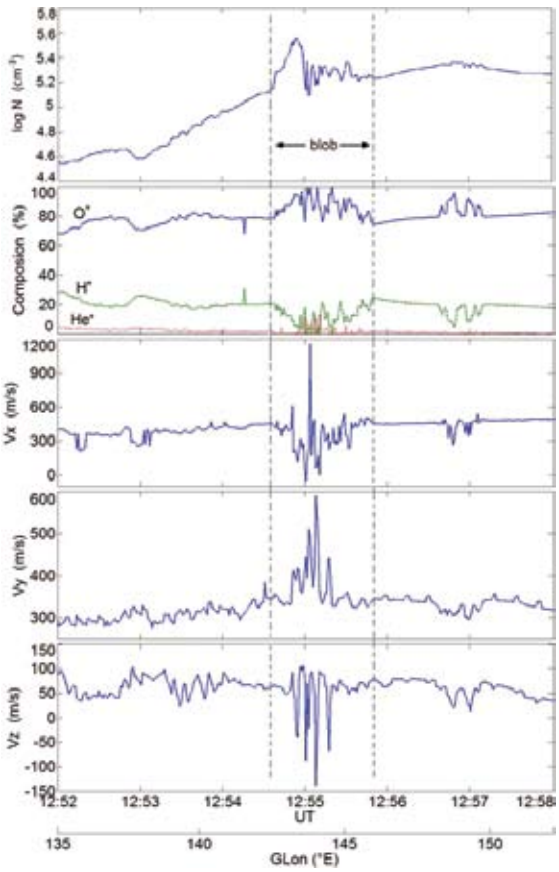
Basic Science

First Evidence of Scintillations Associated with Plasma Blobs in Low Latitude Ionosphere

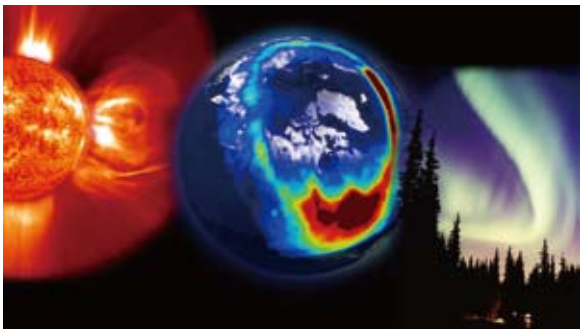
Combining scintillation data from low latitude stations and in-situ plasma density data from the ROCSAT-1 satellite, researchers with the State Key Laboratory of Space Weather, the National Space Science Center (NSSC) have provided the first evidence that scintillations can be associated with plasma blobs in the low-latitude ionosphere.

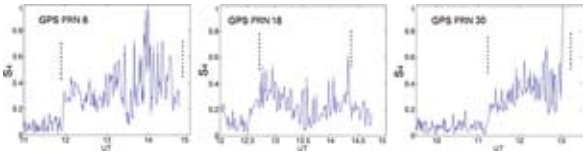
In general, ionospheric scintillation at low latitudes is considered as a signature of equatorial plasma bubbles. Previous studies suggested that scintillation in the low latitude ionosphere could also be generated by plasma blobs, but there was no in-situ measurement to confirm it.

With GPS amplitude scintillation measured at Vanimo and the in situ measurement data from the ROCSAT-1 satellite, researchers from NSSC conducted a case study on the concurrent observation of scintillations and a plasma blob observed in situ. For the first time, their study provided direct evidence for the argument that scintillations can be associated with plasma blobs in the low-latitude ionosphere. The blob measured in situ had a scale size of about 800 km in the F layer, and the ion density inside the blob was severely disturbed. The blob was mainly caused by O^+ ion activity and was upgoing.



The ion density, ion composition, and three components of ion drift velocity measured by ROCSAT. The dashed lines indicate the blob, whose density was twice as the background.





When the ROCSAT measured the blob, the ionospheric GPS scintillation monitor observed scintillations in three concerned GPS signals, providing evidence for the view that scintillations can be associated with plasma blobs in the low-latitude ionosphere.

They also analyzed the mechanism of scintillations produced by the plasma blob, and suggested that the eastward polarization electric field should be associated with the plasma blob and its associated density disturbance which then caused the ionospheric amplitude scintillations.

Their study will help scientists better understand the process of scintillations and the physical mechanisms and related phenomena of plasma bubbles and blobs in the low latitude ionosphere. It is also important to the study of scintillation-related phenomena and the improvement of scintillation forecast models.

The results have appeared in the *Geophysical Research Letters*, which is published by the American Geophysical Union.