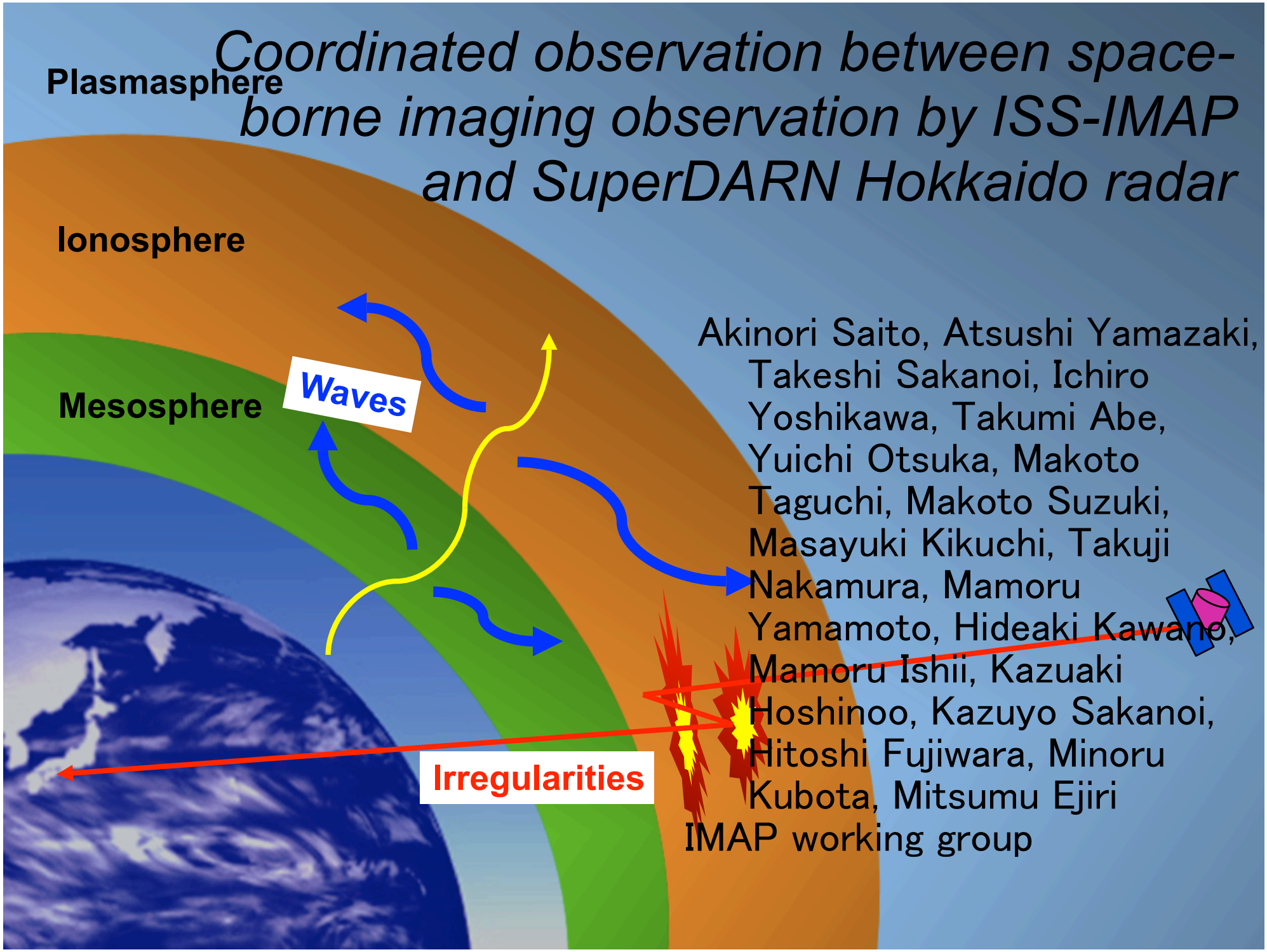
Coordinated observation between space-borne imaging observation by ISS-IMAP and SuperDARN Hokkaido radar



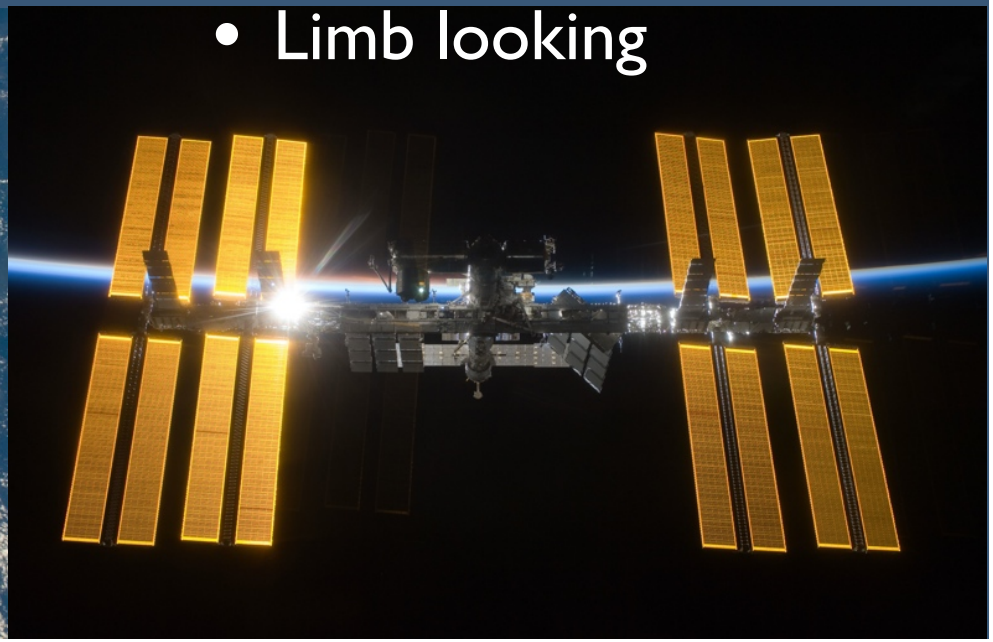
Akinori Saito, Atsushi Yamazaki, Takeshi Sakanoi, Ichiro Yoshikawa, Takumi Abe, Yuichi Otsuka, Makoto Taguchi, Makoto Suzuki, Masayuki Kikuchi, Takuji Nakamura, Mamoru Yamamoto, Hideaki Kawano, Mamoru Ishii, Kazuaki Hoshinoo, Kazuyo Sakanoi, Hitoshi Fujiwara, Minoru Kubota, Mitsumu Ejiri
IMAP working group

Outline of the ISS-IMAP mission

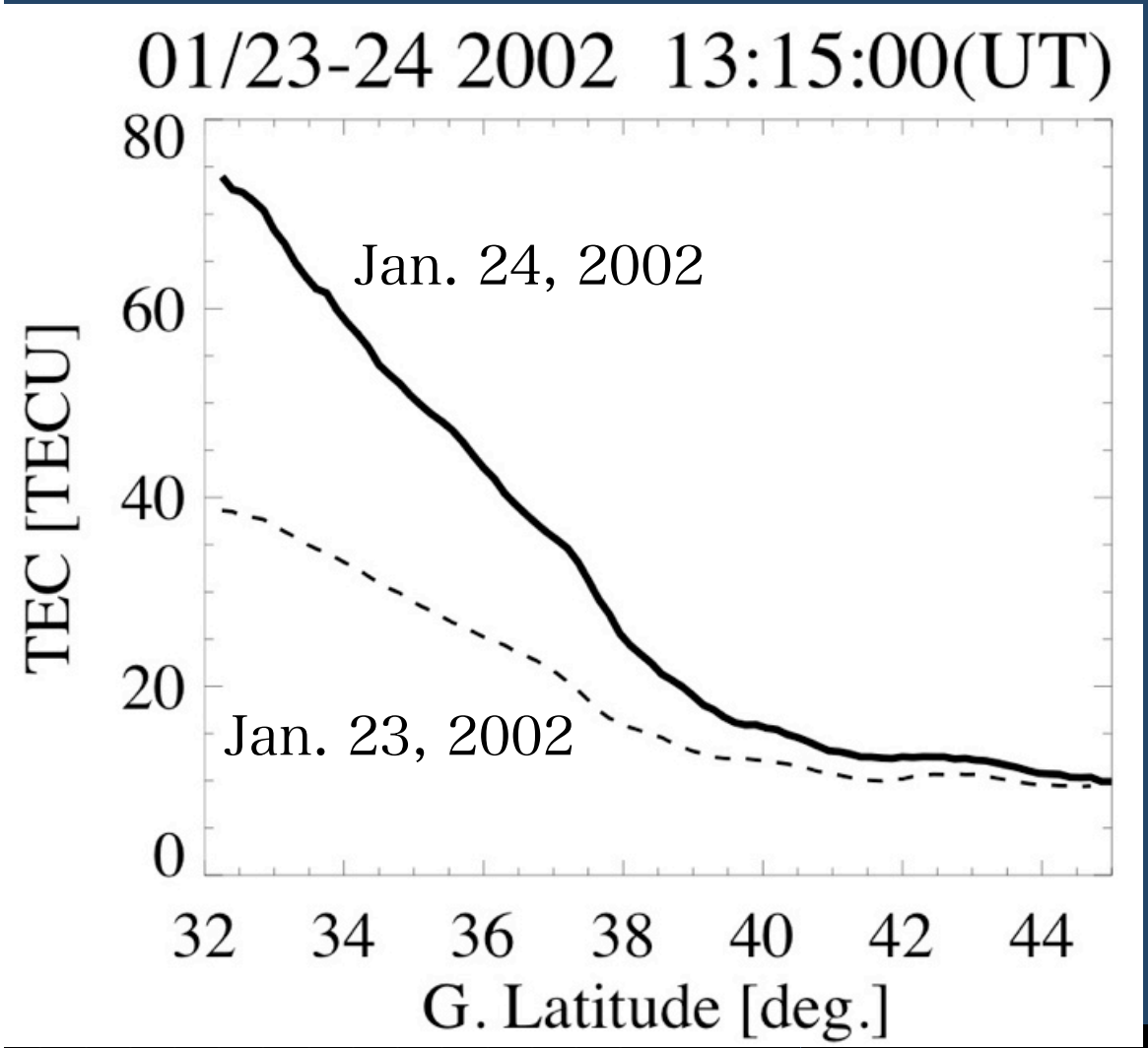
- Observation is scheduled to start in 2012.
- 2 set of imagers on International Space Station (ISS)

1. VISI for airglow in visible-light and infrared
   - Nadir looking

2. EUVI for resonant scattering in extreme ultra violet
   - Limb looking



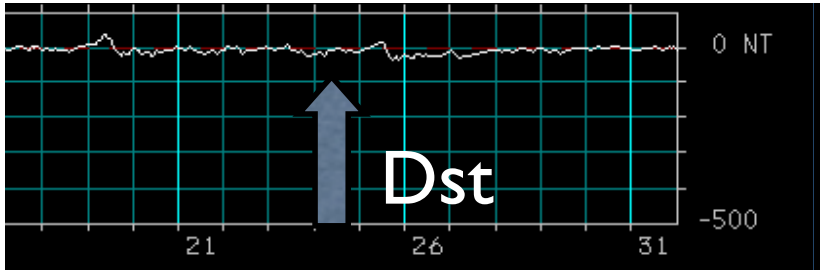
Background: Day-to-day variability of Total Electron Content

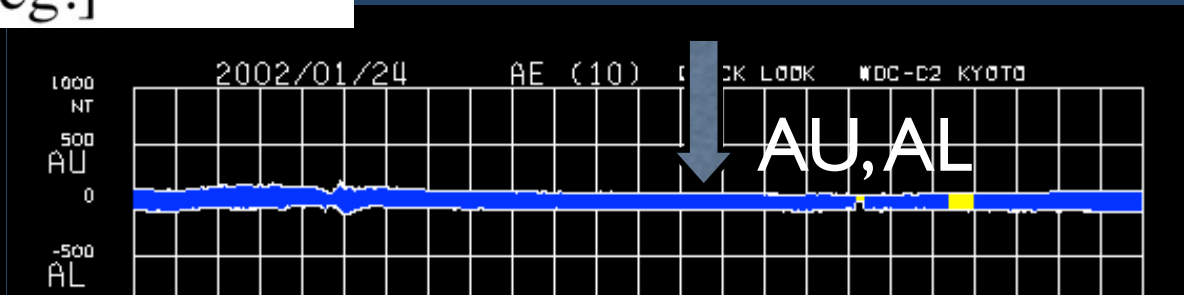


22:15 JST

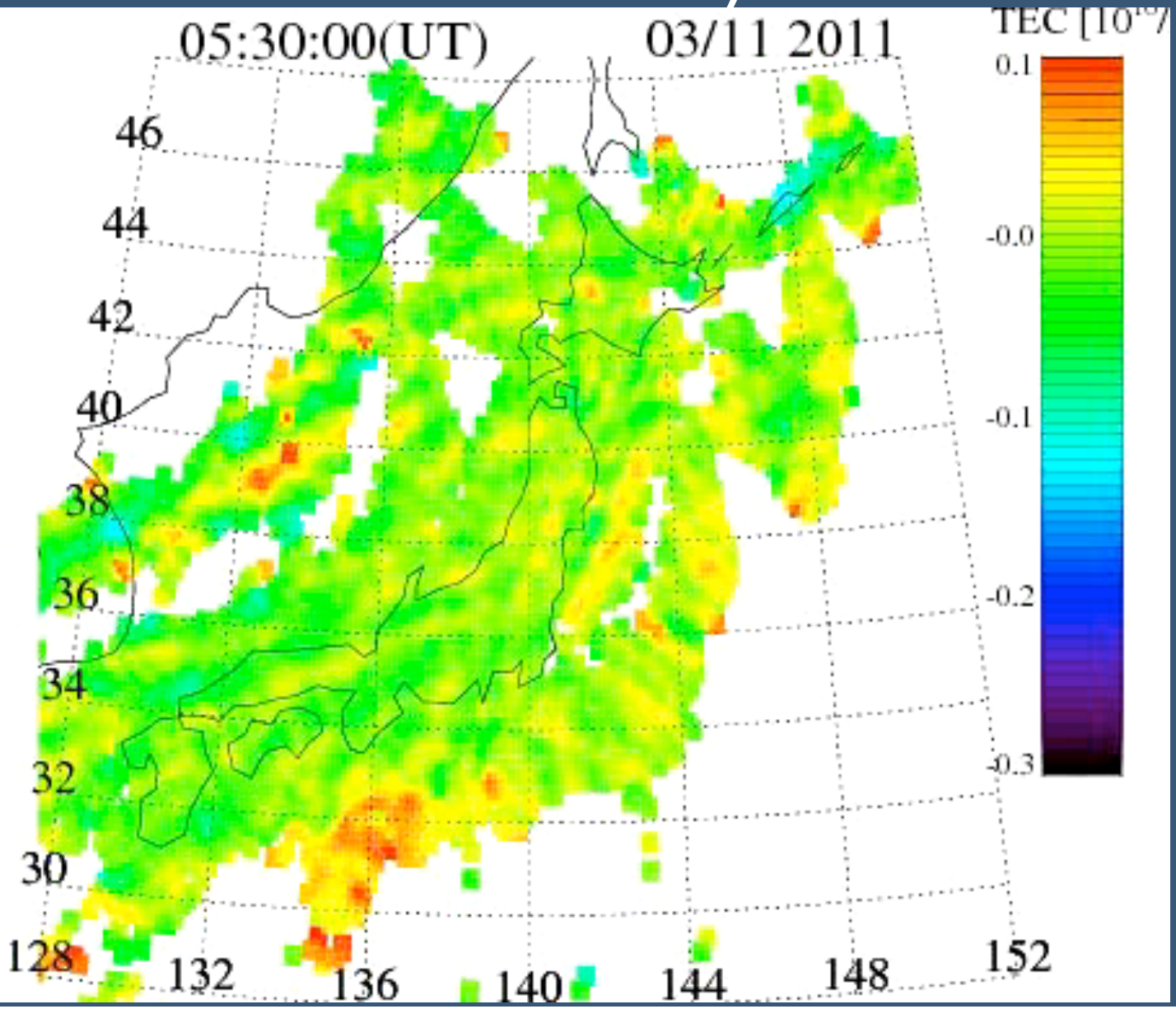
Drivers of the ionospheric variations:

1. Solar radiation
2. Magnetosphere
3. Lower atmosphere

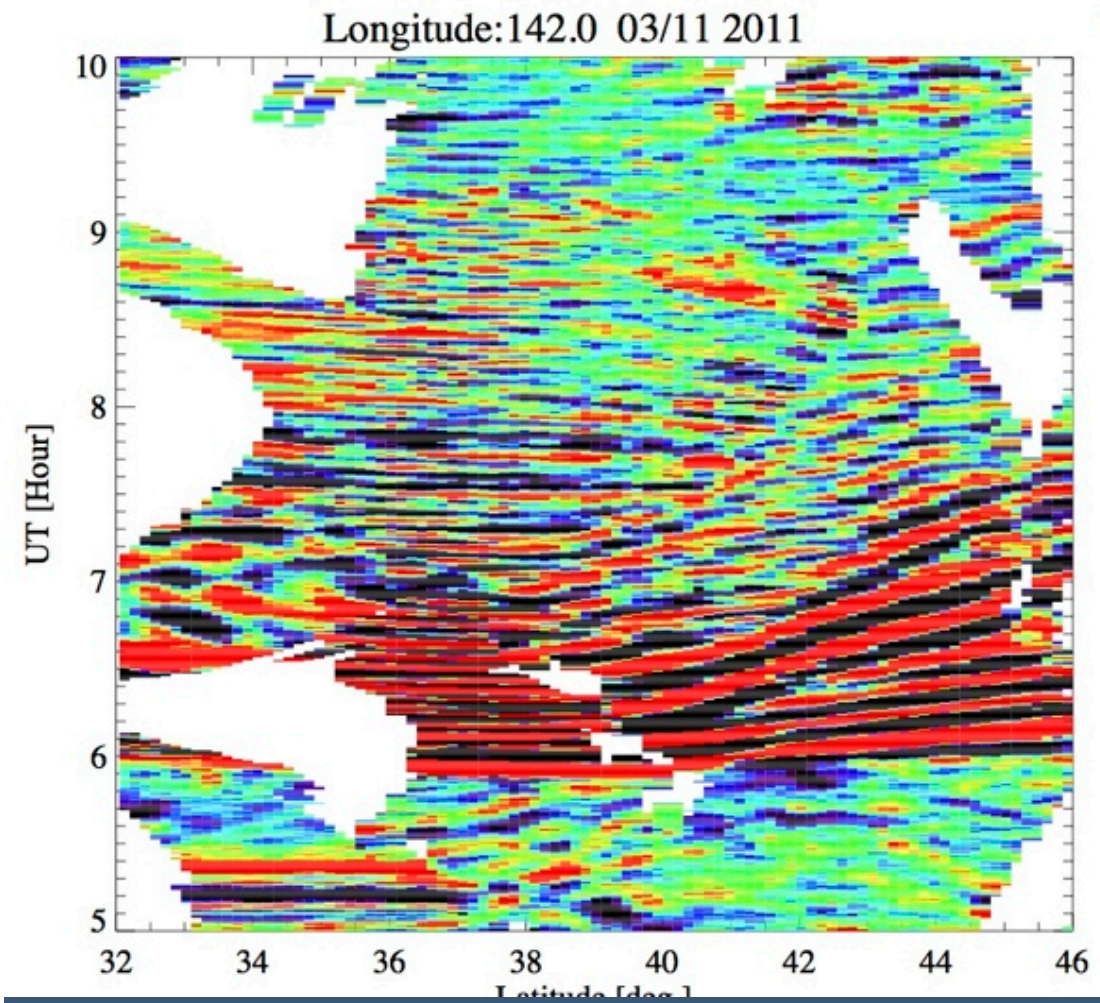


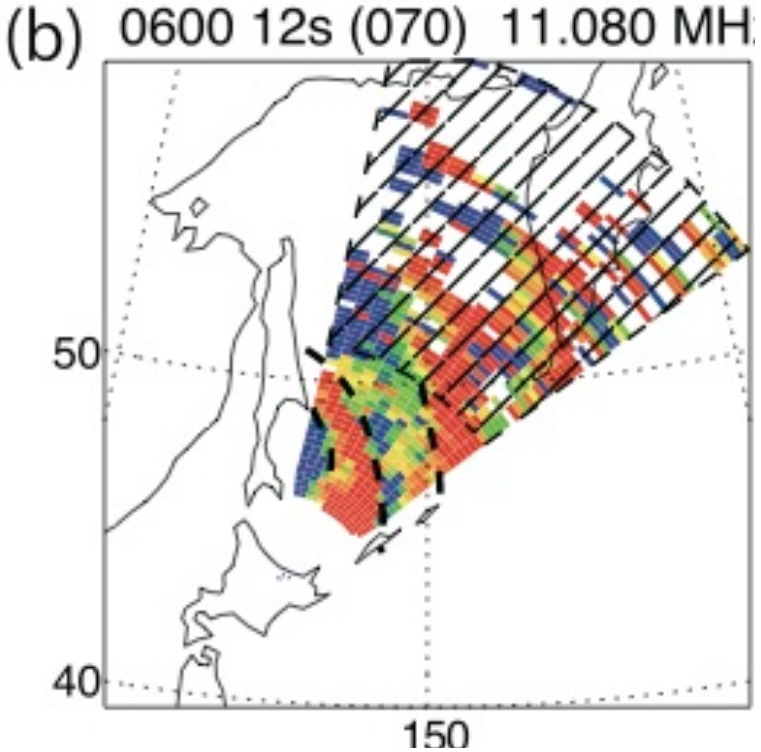


Ground-based imaging of ionospheric variations after the Tohoku Earthquake on March 11, 2011 observed by GPS receivers



A direct evidence of the energy input from the lower atmosphere to the upper atmosphere.



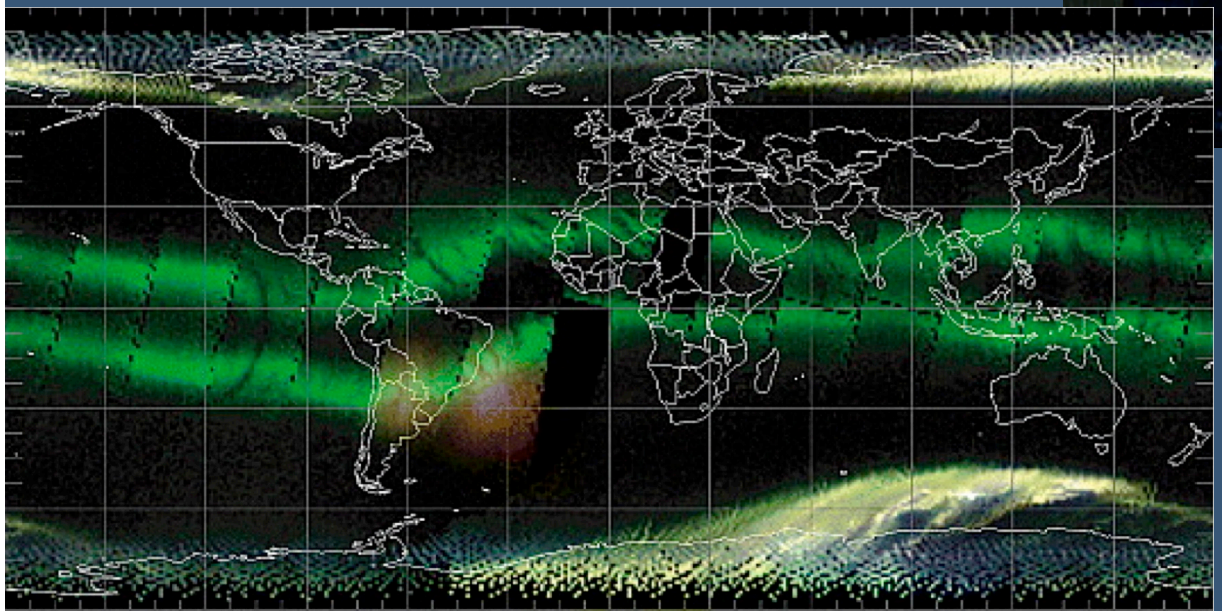


[Nishitani et al., 2011]

Previous space-borne imaging of the upper atmosphere by FUV

Far Ultraviolet (FUV) image of the Earth taken by Apollo 16 crew from the Moon in 1972

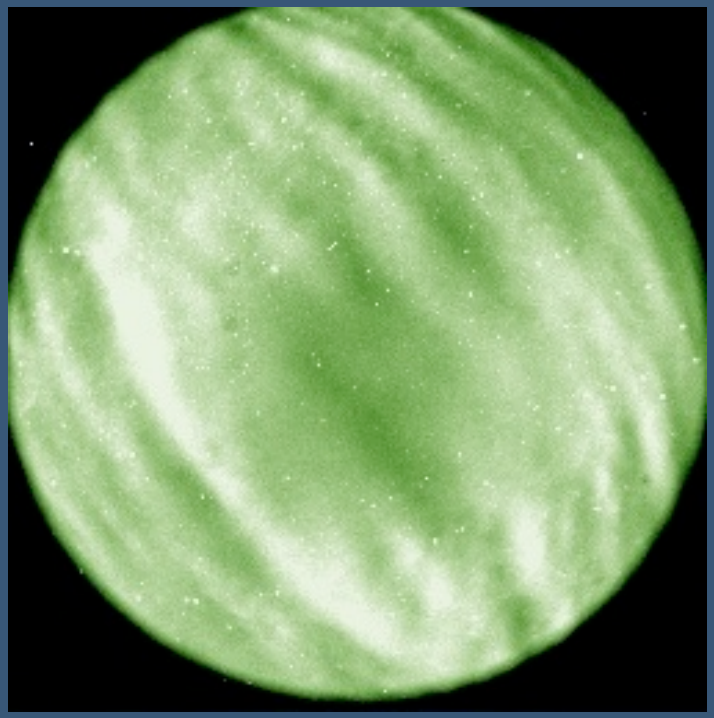
[http://www.nasa.gov/]



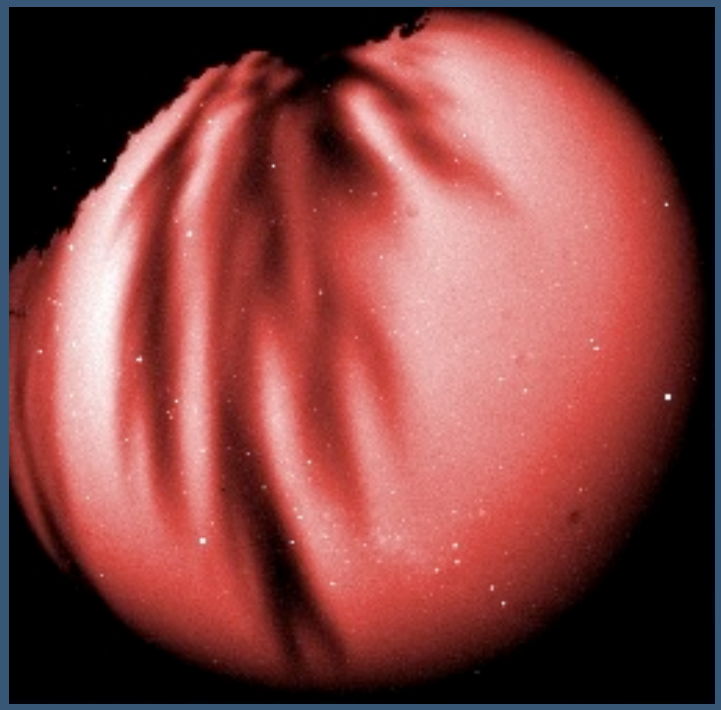
Composite image of TIMED/GUVI observation of FUV

[Christensen et al., 2003]

Ground-based imaging of the upper atmosphere by Visible light



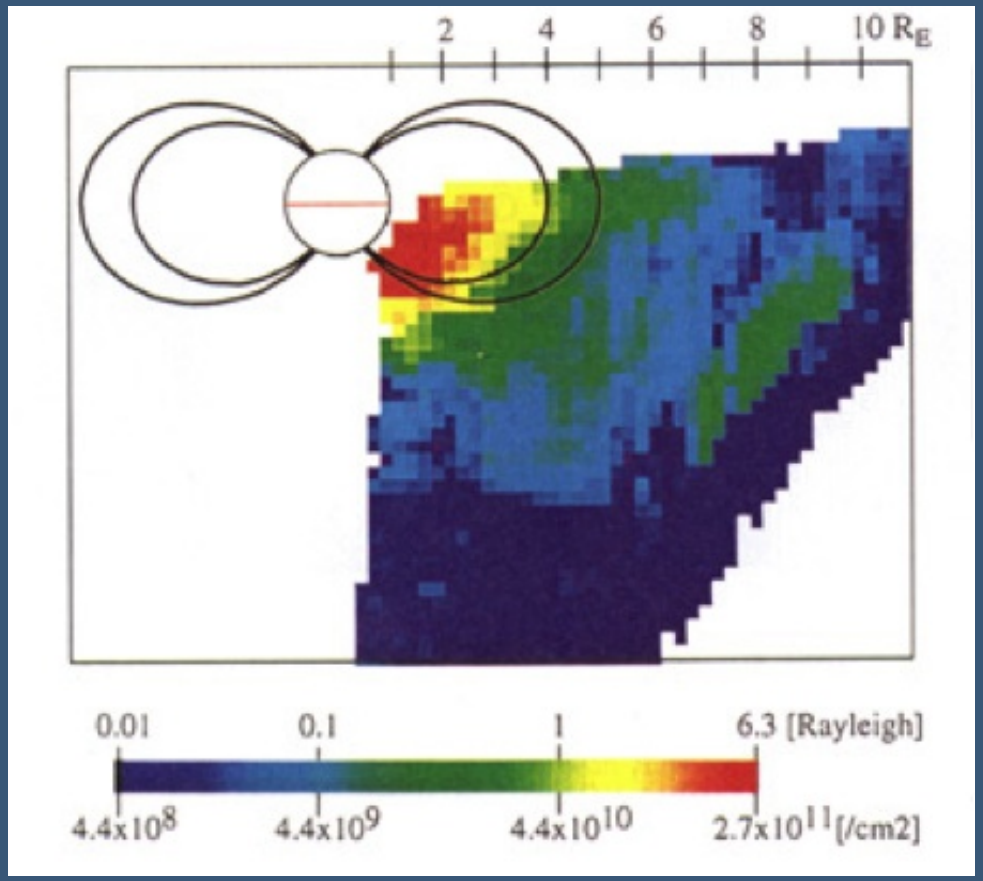
Mesosphere (Alt. 85-100km)



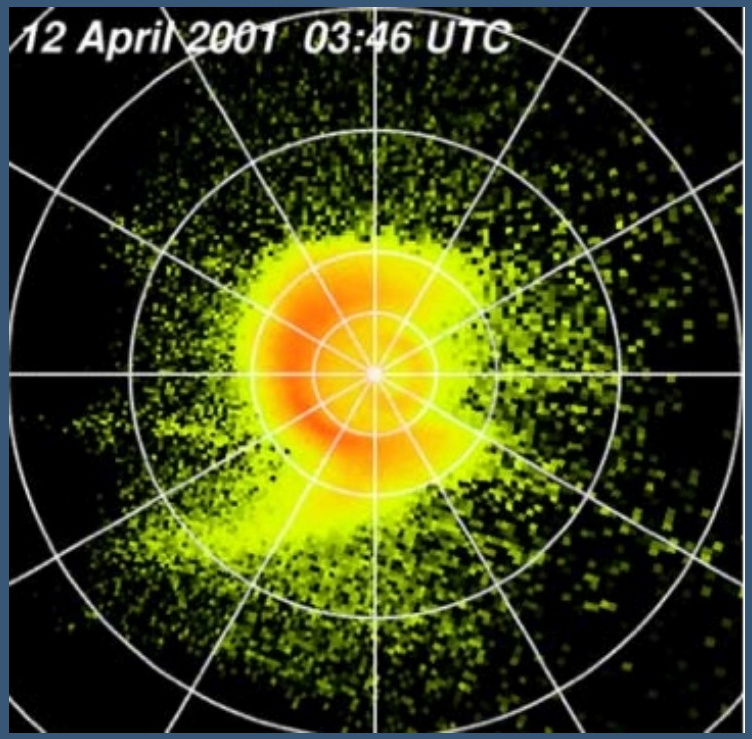
Ionosphere, 630nm(Alt. 250km)

[Courtesy of M. Taylor]

Space-borne imaging of the plasmasphere by EUV



EUV image by NOZOMI satellite [Yoshikawa et al., 2000]

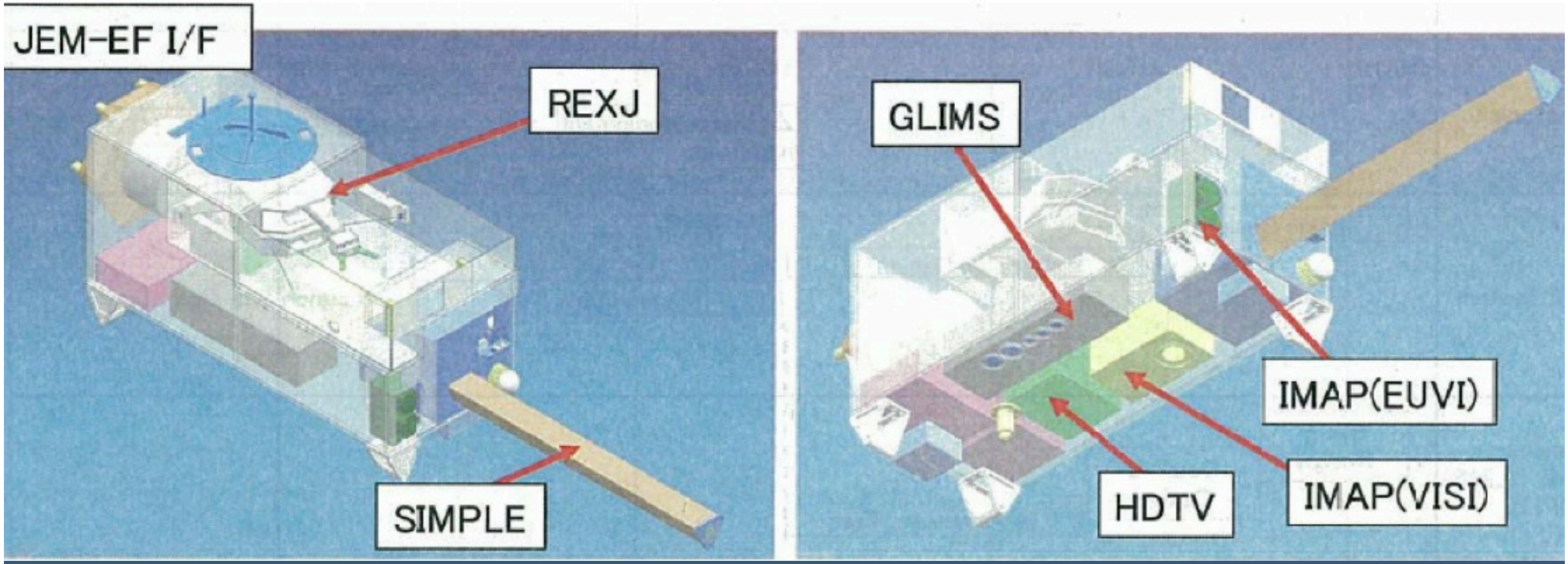


EUV image by IMAGE satellite [Foster et al., 2000]

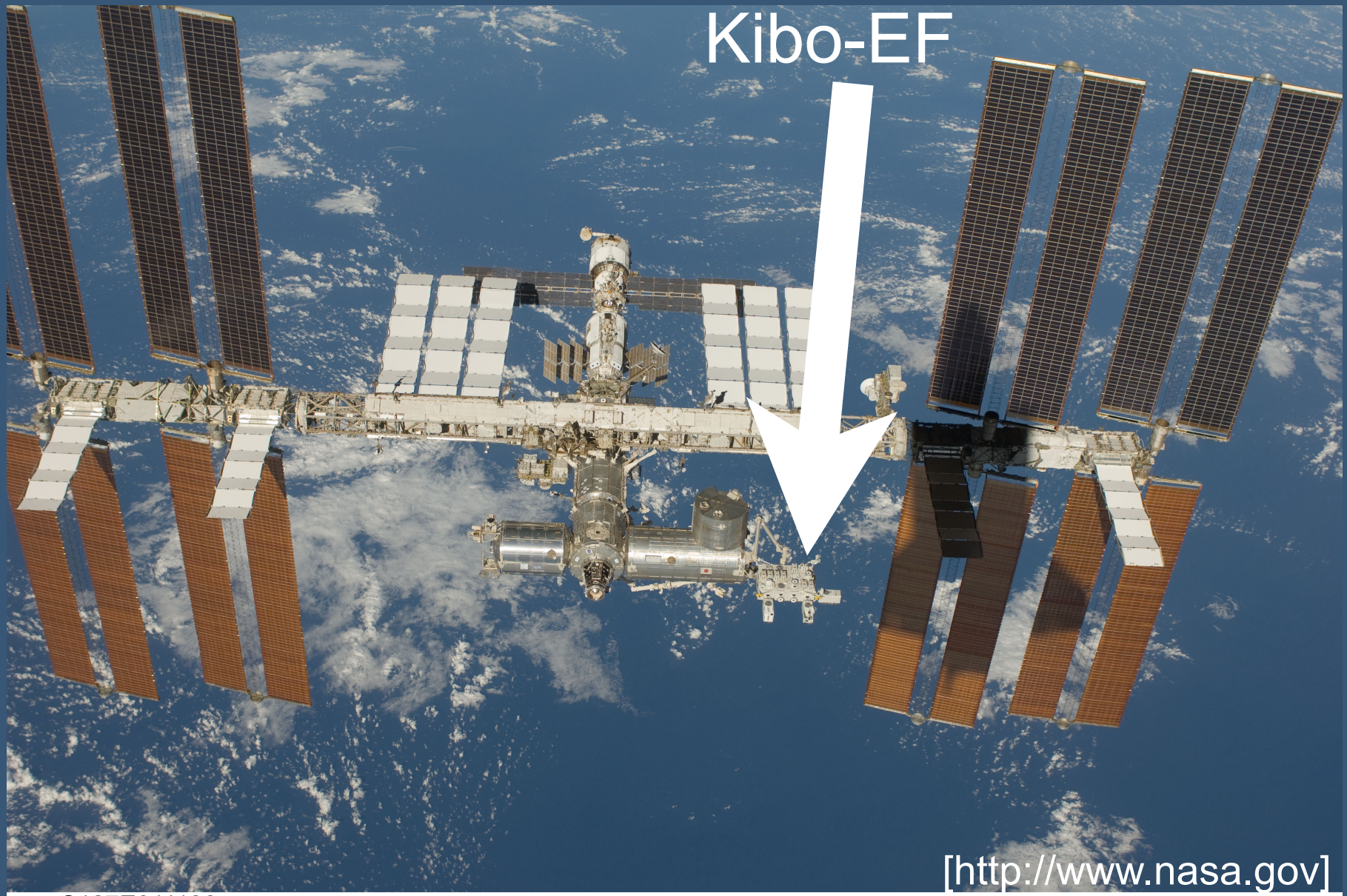
Outline of the ISS-Ionosphere, Mesosphere, upper Atmosphere, and Plasmasphere mapping mission

- Visible-light and EUV imagers on International Space Station (ISS) exposed facility of Japanese experiment module (Kibo).
- One of 5 missions of Multi mission Consolidated Equipment (MCE) for the Kibo-Exposure Facility 2nd phase utilization.
- Latitude < 51 deg.
- Observation is scheduled to start in 2012.

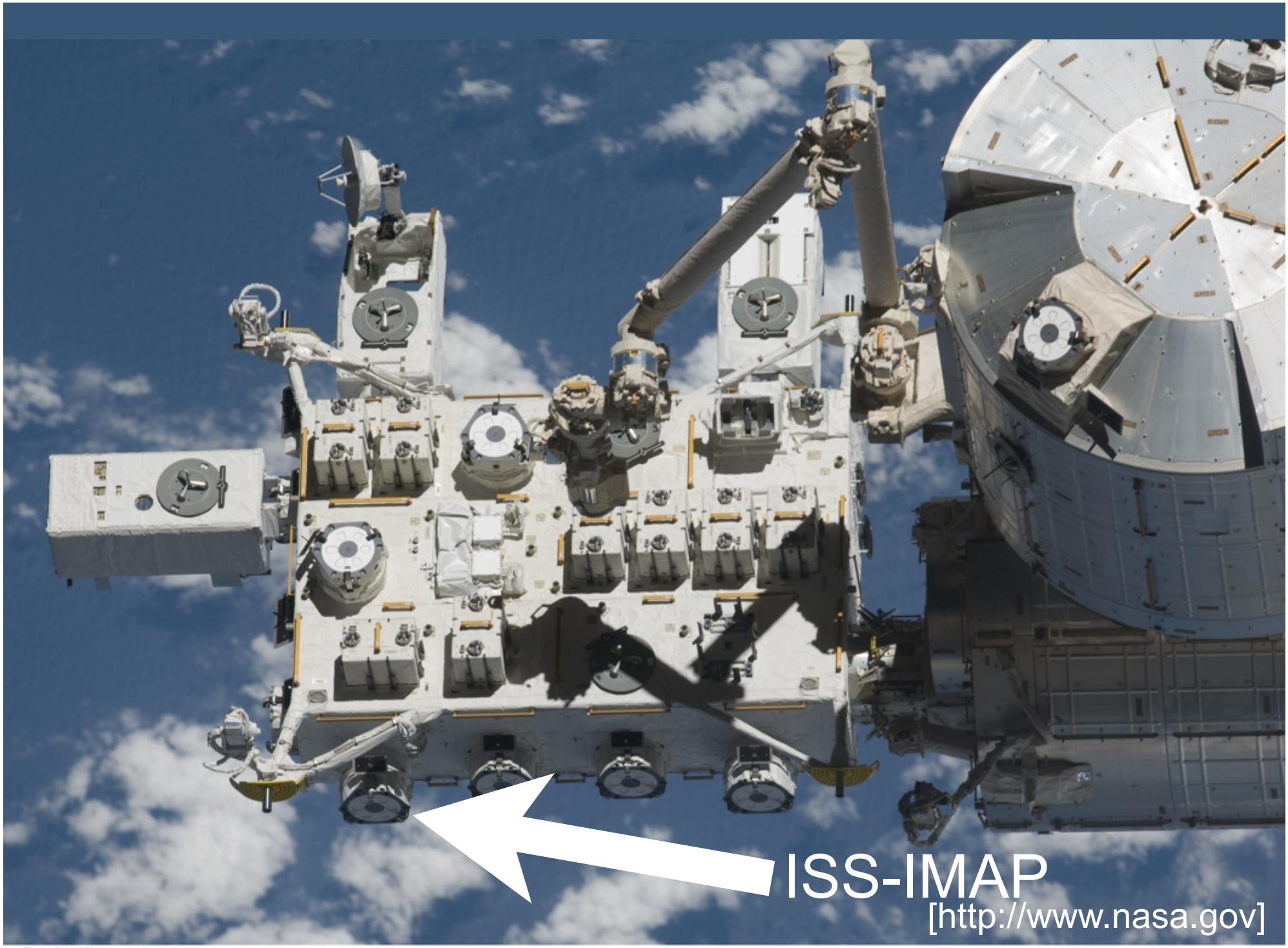
Multi mission Consolidated Equipment (MCE) Configuration



- GLIMS: Lightning observations (Optical and Radio)
- HDTV: High definition TV camera
- SIMPLE, REXJ: Engineering experiments



S127E011186



S127E009998

Targets of the observation

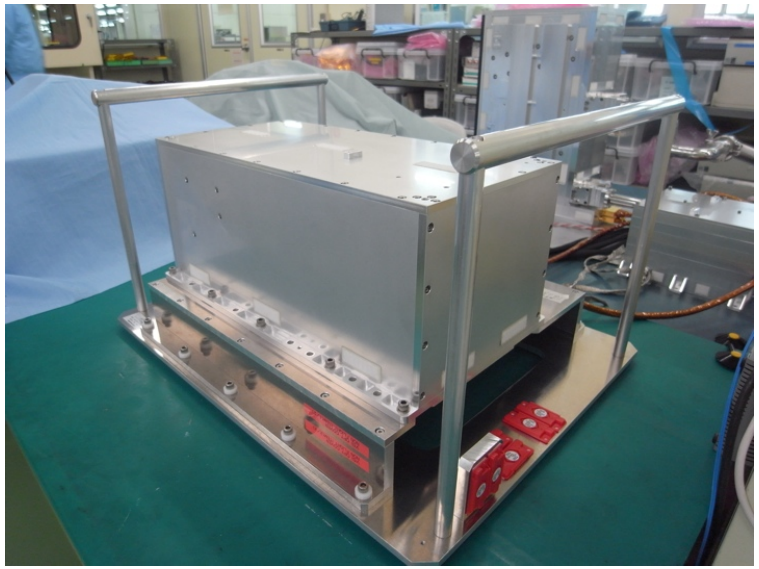
- Global distribution of 50-500km structures in the mesosphere and the ionosphere.
- Plasma structures from the bottom side of the ionosphere to the plasmasphere.

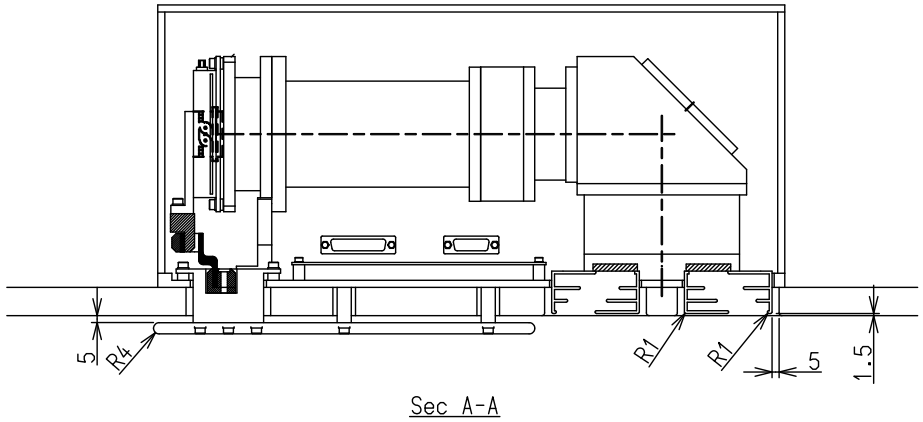
Detailed targets

- Distribution of the atmospheric gravity waves around the mesopause (87km Altitude) and the ionospheric E-region (95km Altitude)
- Distribution of the plasma density on the bottom side of the ionospheric F-region (250km Altitude)
- Distribution of O+ and He+ in the ionosphere and the plasmasphere (up to 20,000km Altitude)

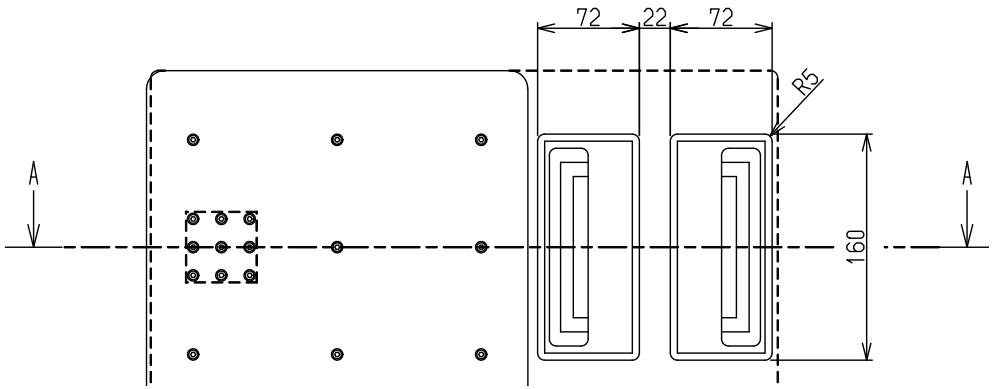
VISI:Visible-light and Infrared Spectral Imager

- Airglow
- 730nm (OH, Alt. 85km), 762nm (O2, Alt 95km), 630nm(O, Alt.250km)
- Nadir looking with forward and backward slits perpendicular to the ISS trajectory
- Spatial Resolution: 18km (OH and O2) and 25km(O)
- Exposure Time: 1 sec.-
- Weight 14.5kg
- Size 416 x 335 x 223mm



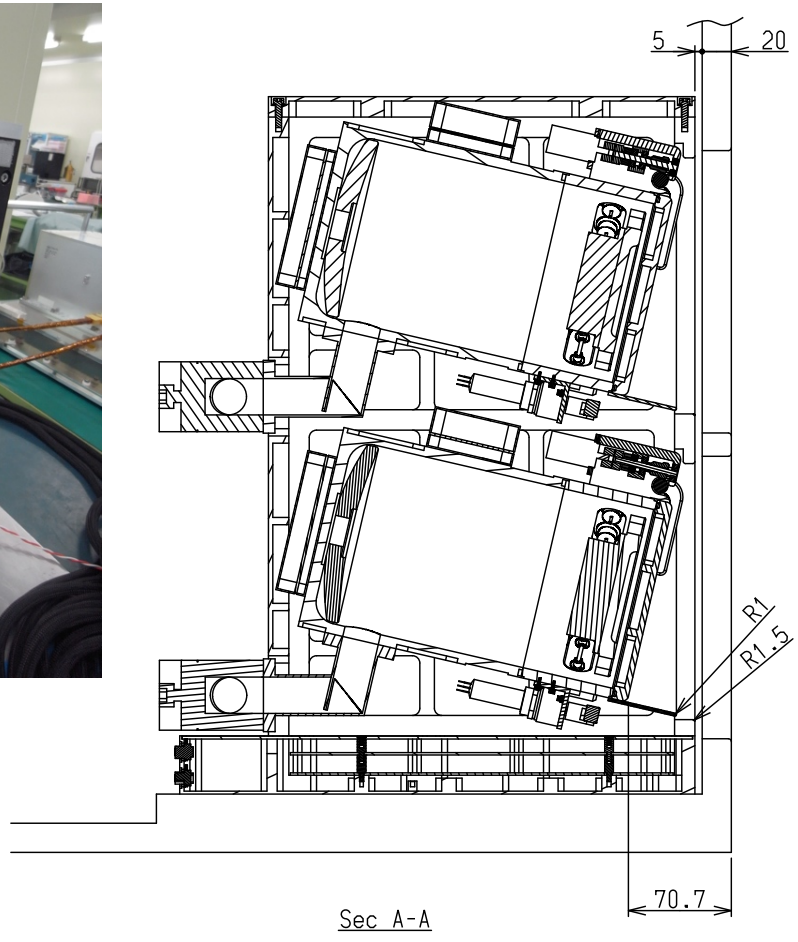


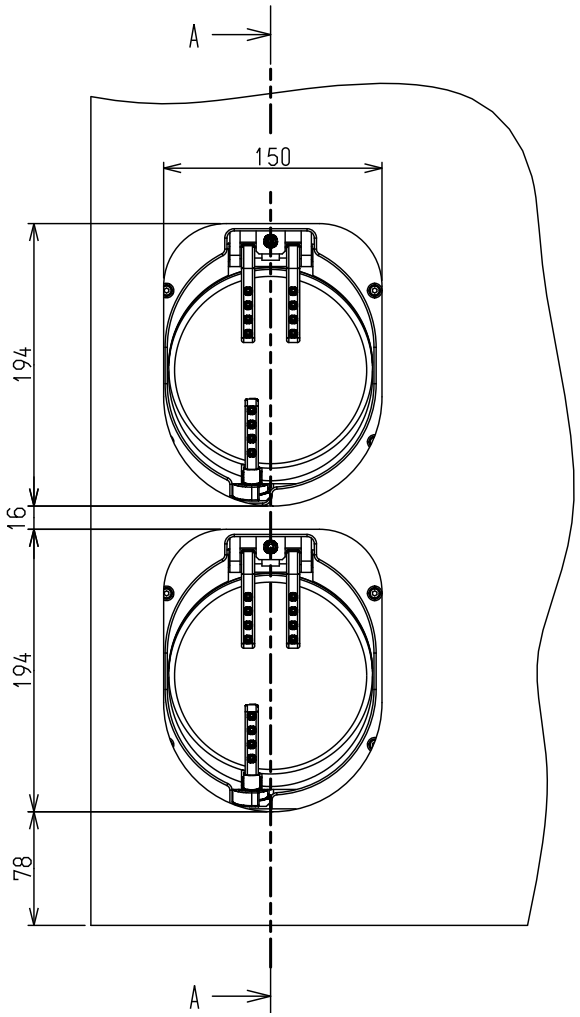
Sec A-A



EUVI: Extreme Ultra Violet Imager

- Resonant scattering from ions
- 83.4nm (O+), 30.4nm (He+)
- Backward Limb looking with 15 deg. Field-of-view.





Summary

- ISS-IMAP: Visible-light and EUV imagers on International Space Station (ISS)
- Global distribution of wave structures, and the ion structures in the topside ionosphere and the plasmasphre will be investigated.
- VISI: Airglow: 730nm (OH, Alt. 85km), 762nm (O2, Alt 95km), 630nm(O, Alt. 250km)
- EUVI: Resonant scattering: 83.4nm (O+), 30.4nm (He+)
- Observation is scheduled to start in 2012 and continue for three years.
- Coordinated observations with ground-based and space-borne observations are essential.
- Collaborations with models are also crucial.