OMPS LP Detection of Rocket Plumes for Stratospheric Dynamics

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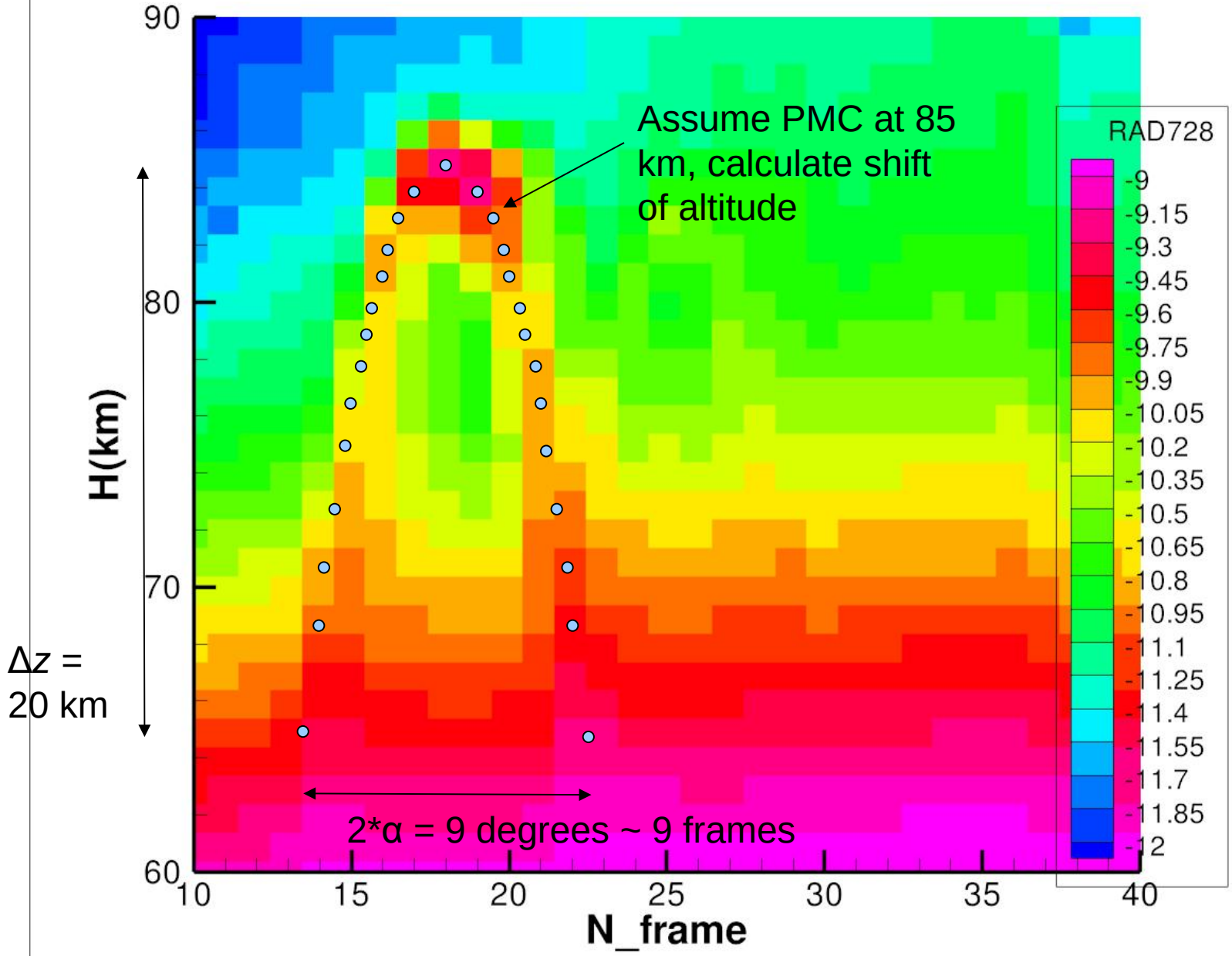
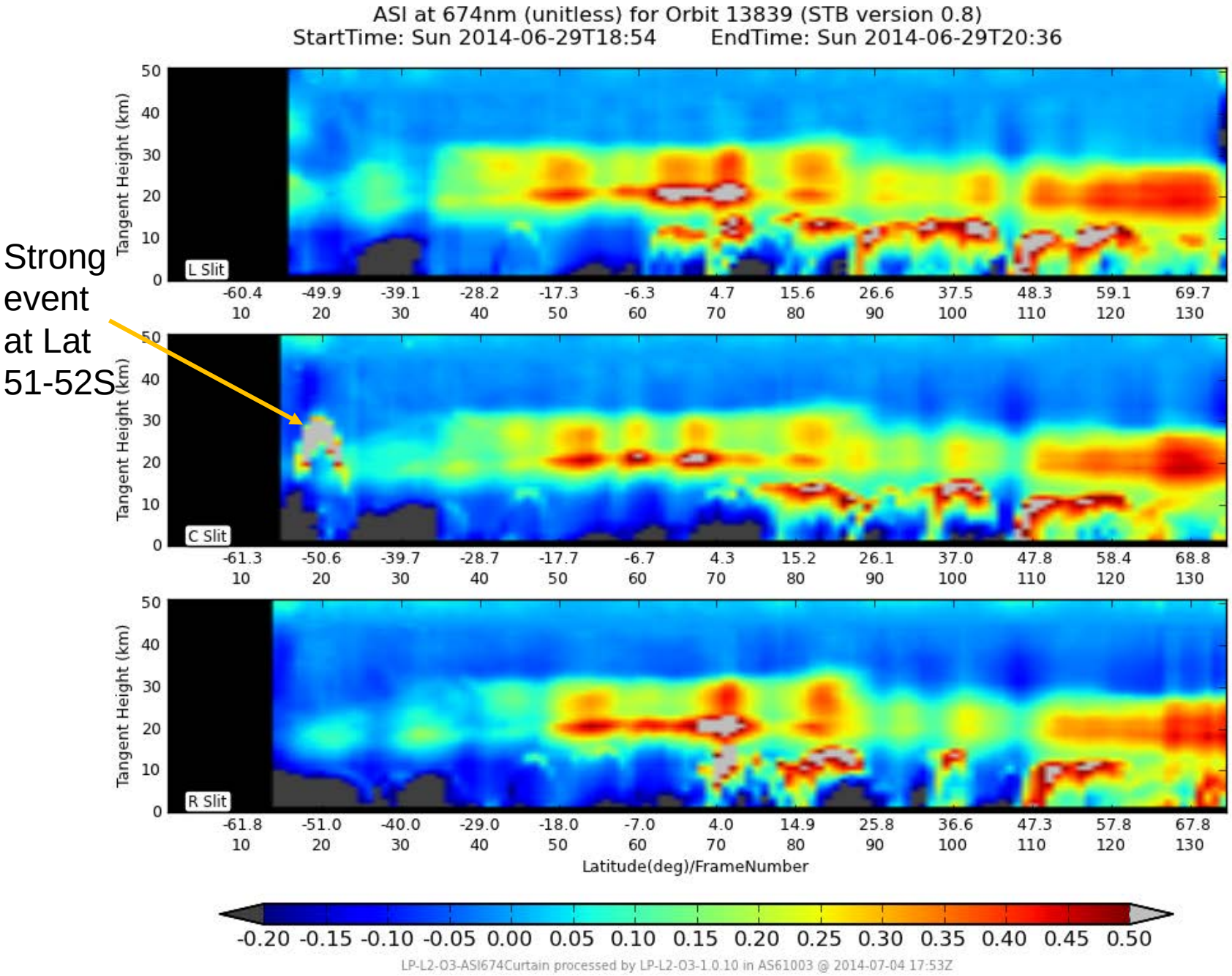
Vertical Layers in LP Measurements

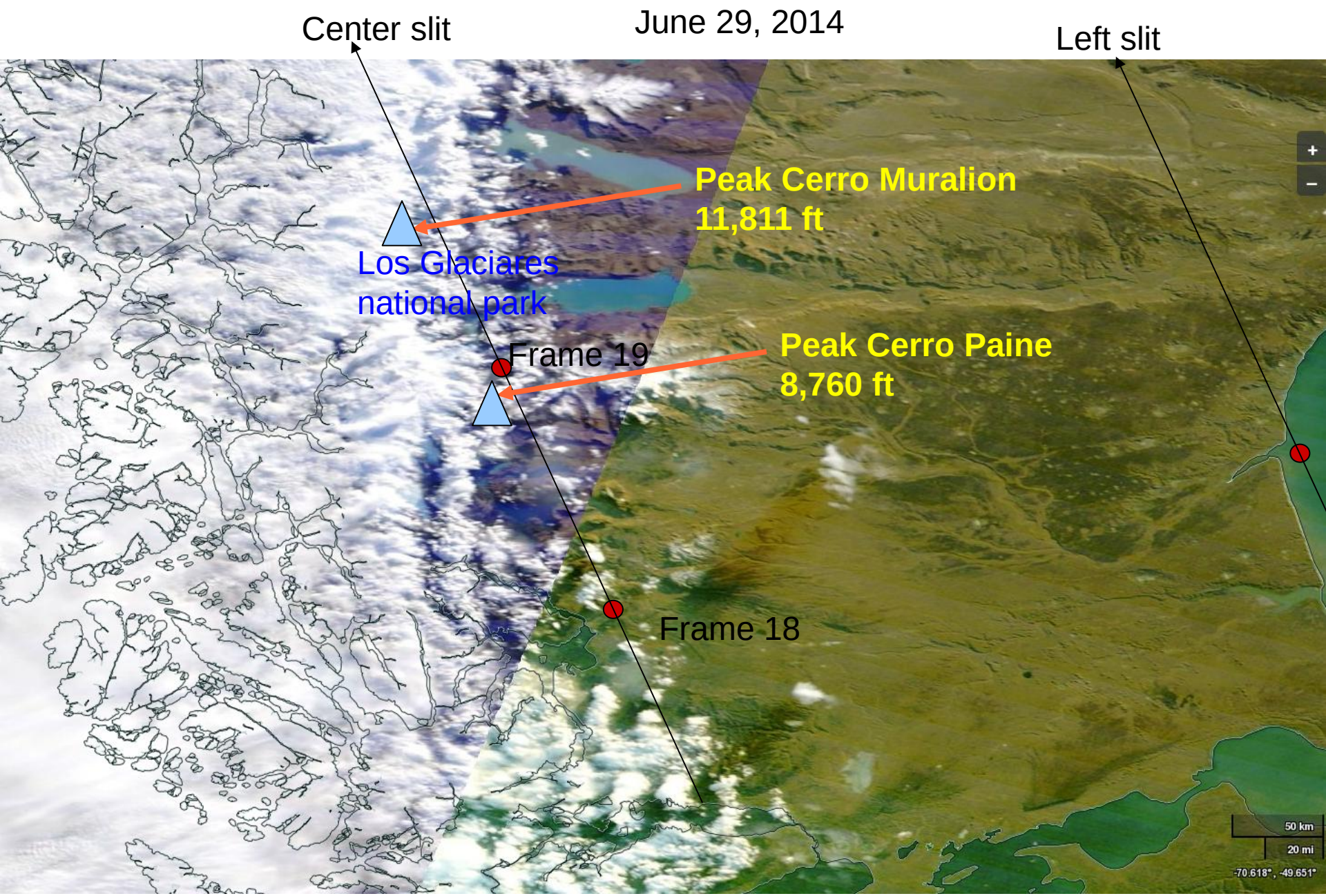
- LP viewing geometry produces characteristic "arc" signature for objects with narrow vertical extent.
- PMCs and PSCs are observed with this behavior in both hemispheres, with "tails" extending up to Δz = 50 km below the altitude of the object.
- Trails from bolides many times smaller than the Chelyabinsk event are also observed.

LP Radiance at 728 nm – Orbit 11916



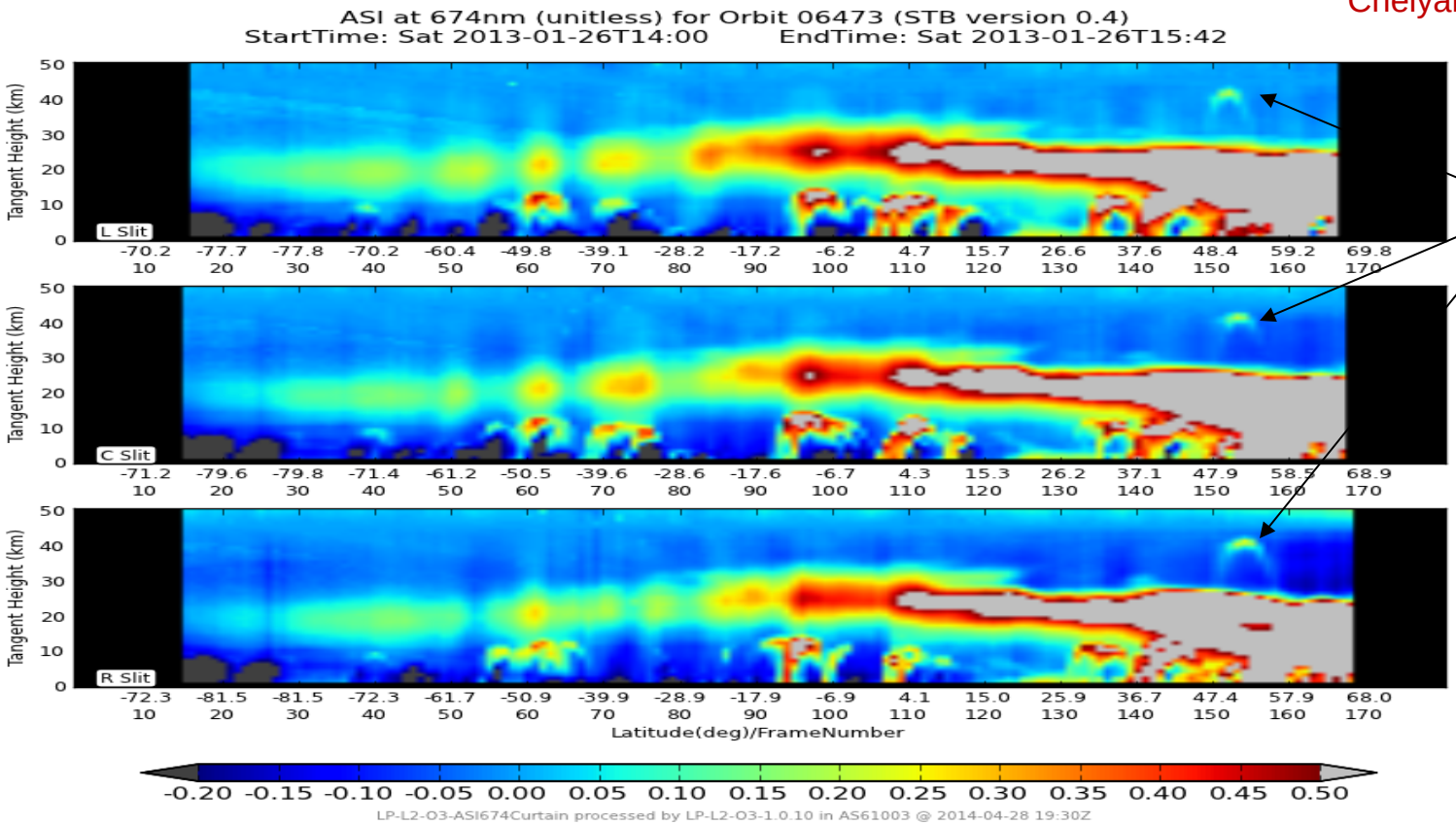
Very local and strong event! Other slits do not see it.



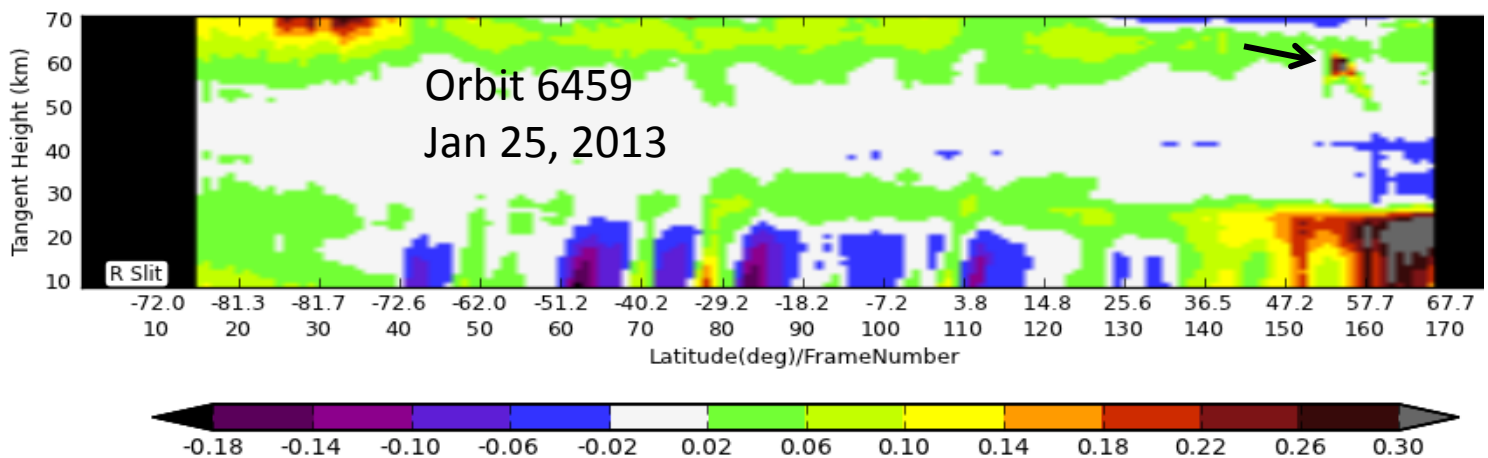

Center slit
June 29, 2014
Left slit
Peak Cerro Muralion
11,811 ft
Los Glaciares
national park
Frame 19
Peak Cerro Paine
8,760 ft
Frame 18
50 km
20 mi
-70.618°, -49.651°

Bolide, January 25, 2013: NASA list: 60.3°N, 64.6°W, **6.9 kt**

~60 times smaller then Chelyabinsk bolide



Plume was visible ~ 5-7 days

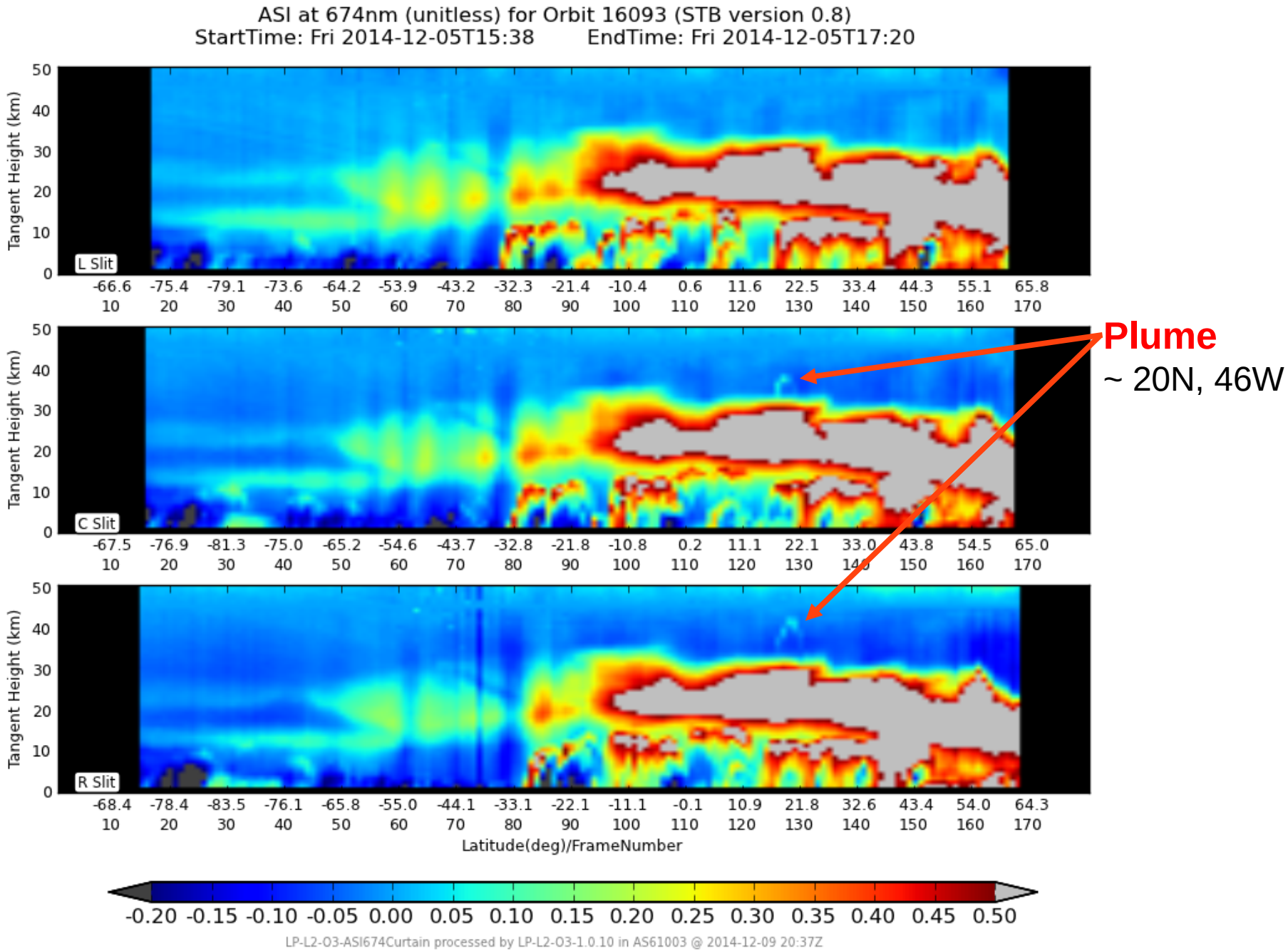


First observation in ASI353

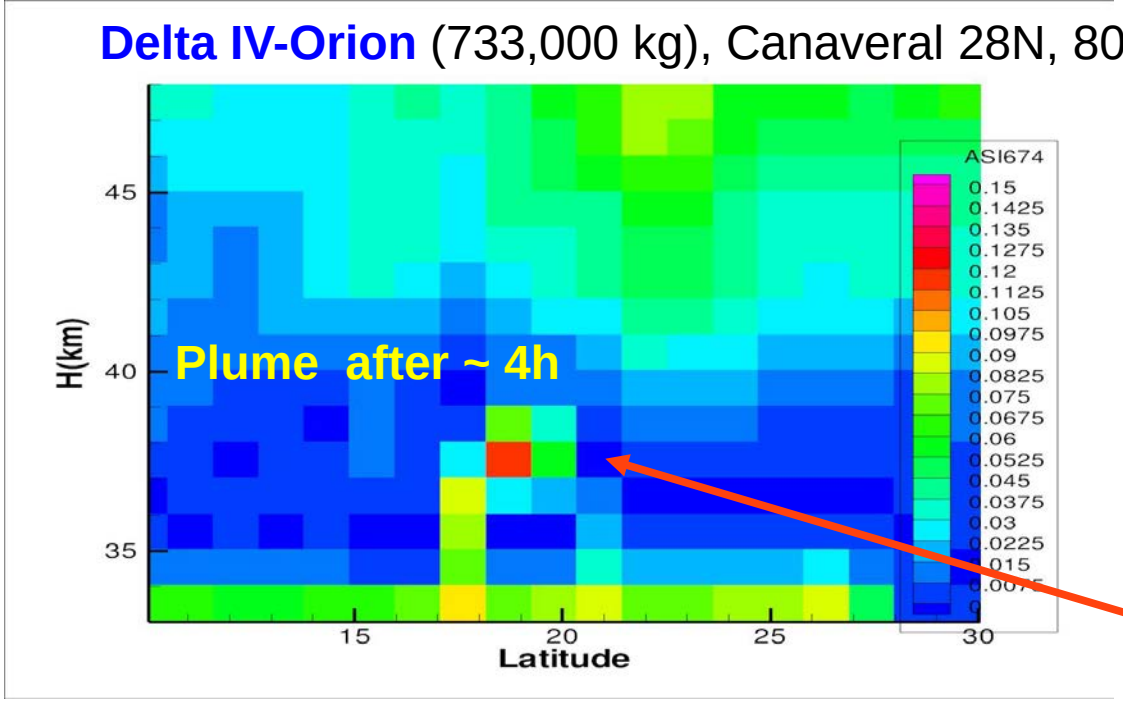
Observations of Rocket Plumes

- Standard orbital plots of radiance data also show plumes in stratosphere up to 30 hours after launch of large rockets.
- Initial conditions of rocket launches (location, time, inclination) are known.
- LP observations thus provide data for free "tracer experiment" to validate middle atmosphere wind models. Some events are seen in multiple slits during same orbit → additional geometric constraint.
- 10+ cases per year?

Delta IV-Orion (733,000 kg), Canaveral 28N, 80W, 12/05/2014, 12:05

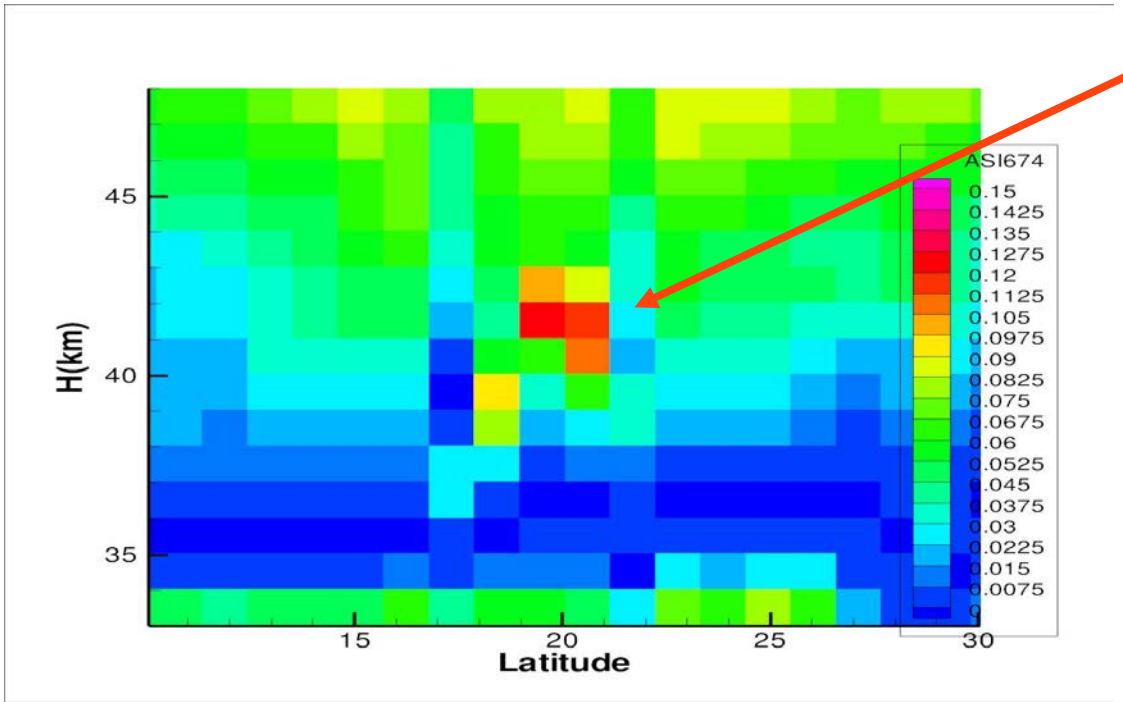


Delta IV-Orion (733,000 kg), Canaveral 28N, 80W, 12/05/2014, 12:05



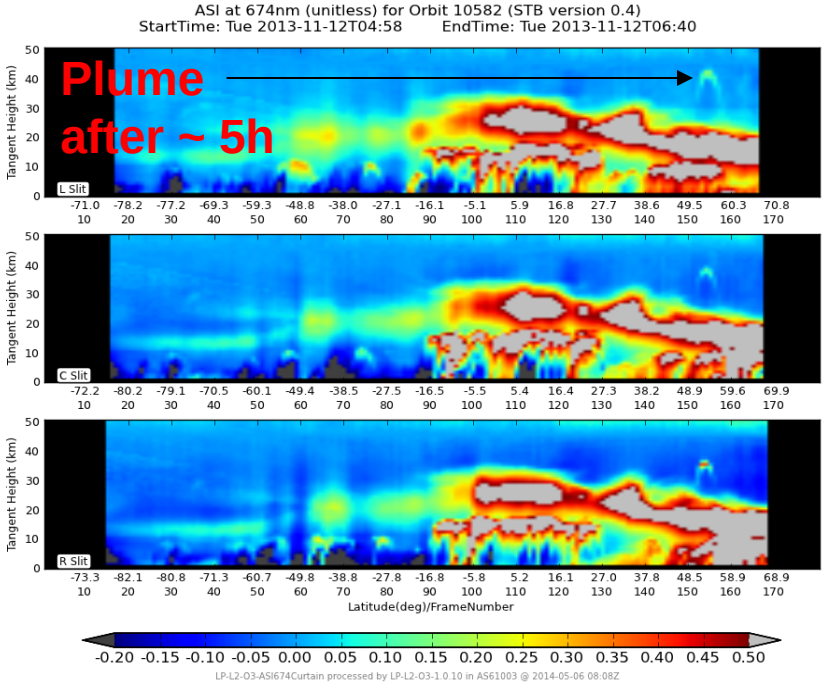
C-slit, 16093

Plumes
~ 20N, 46W

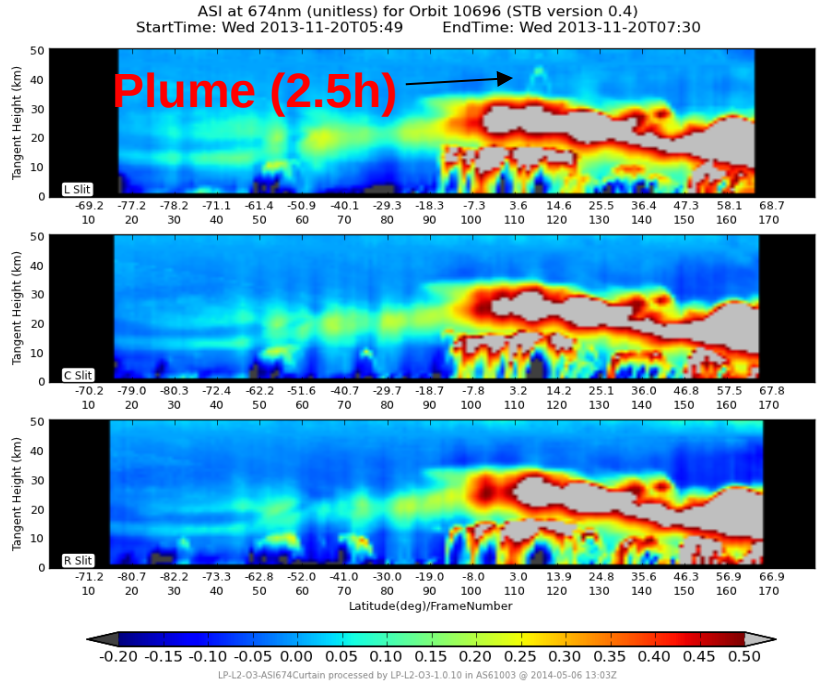


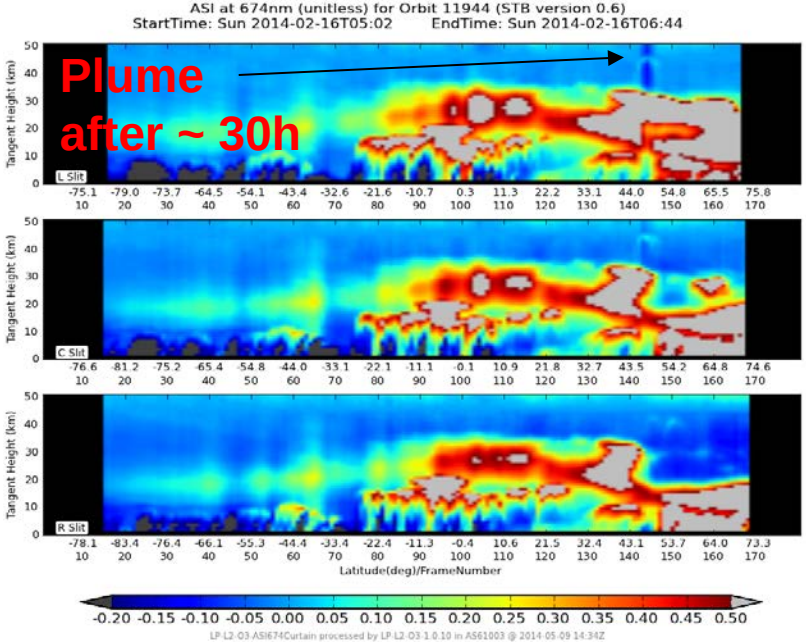
R-slit

Proton-M (712,000 kg), Baikonur 45N, 63E

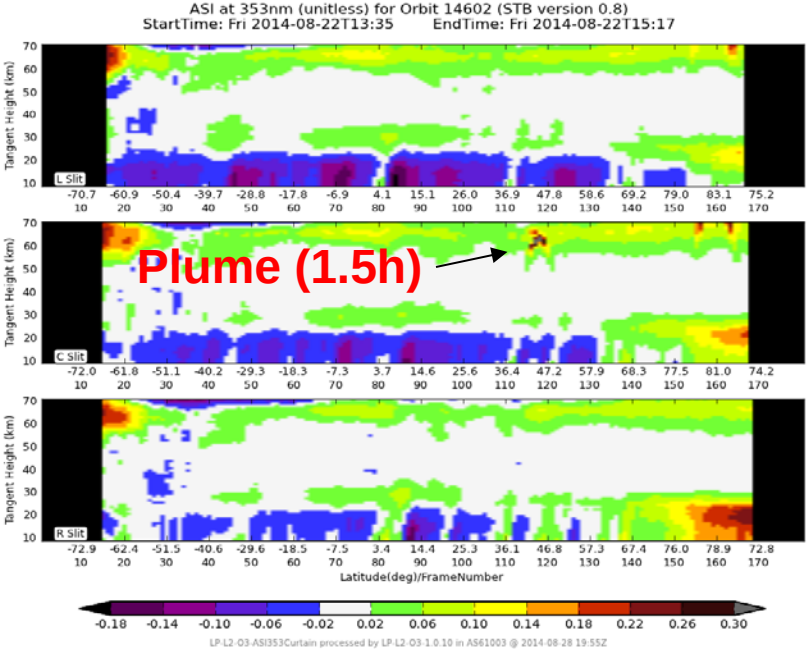


Long March-4C (250,000 kg), Taijuan 39N, 111E

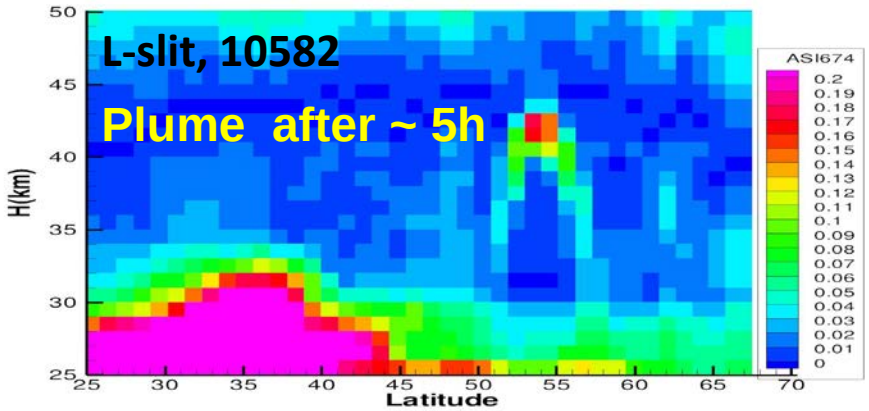


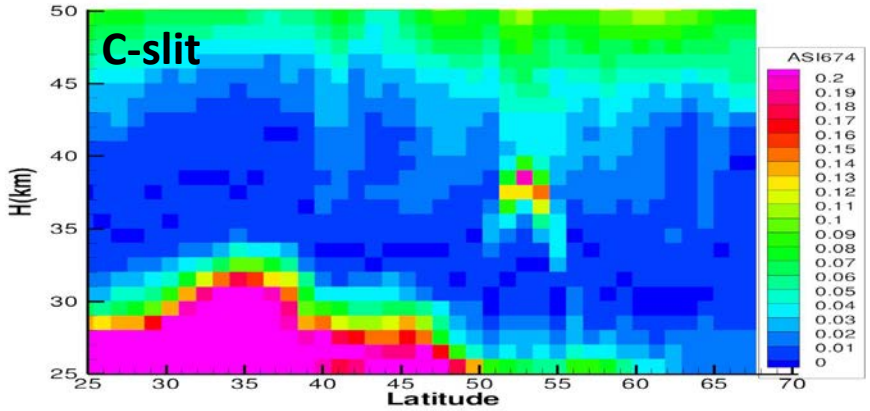


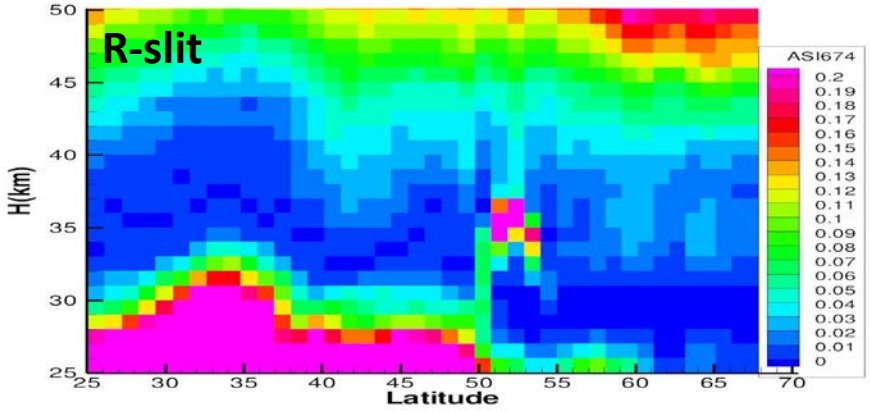
Soyuz (305,000 kg) from Kourou 5N, 52W



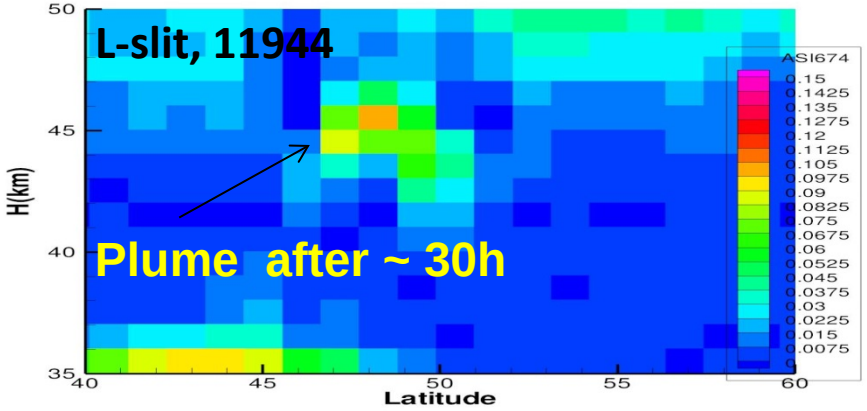
Proton-M , Baikonur 45N, 63E, 11/11/2013, 23:46 UT

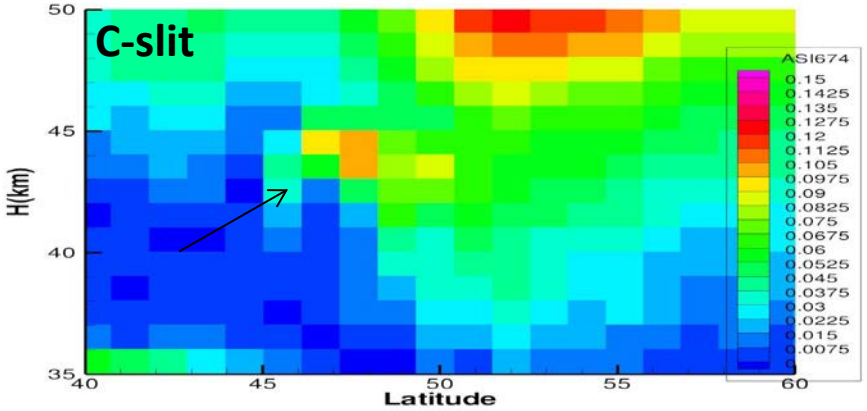


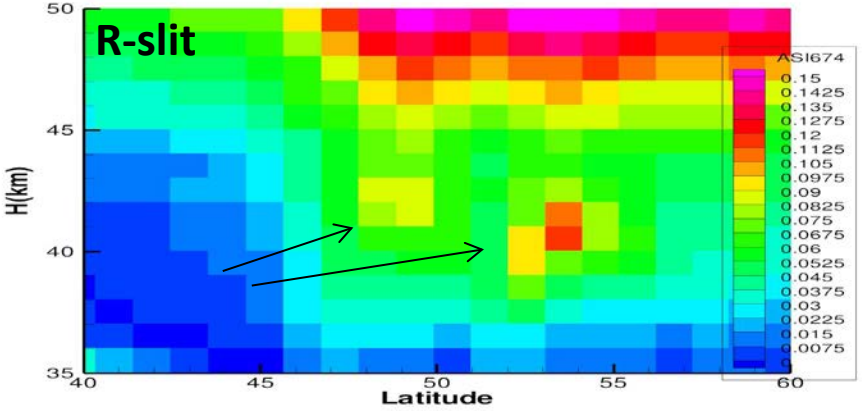




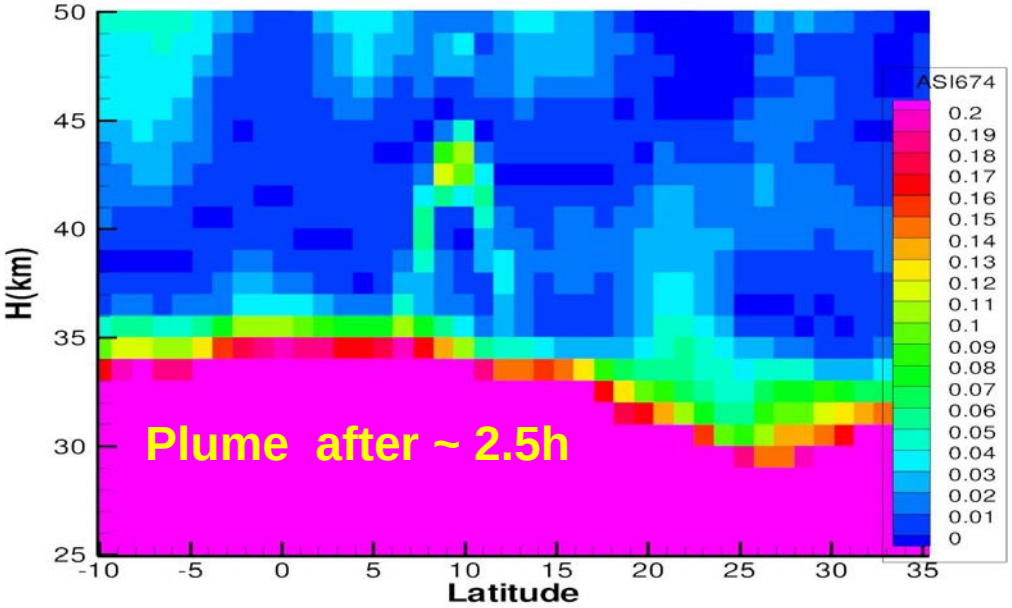
Proton-M, Baikonur, 02/14/2014, 21:09 UT





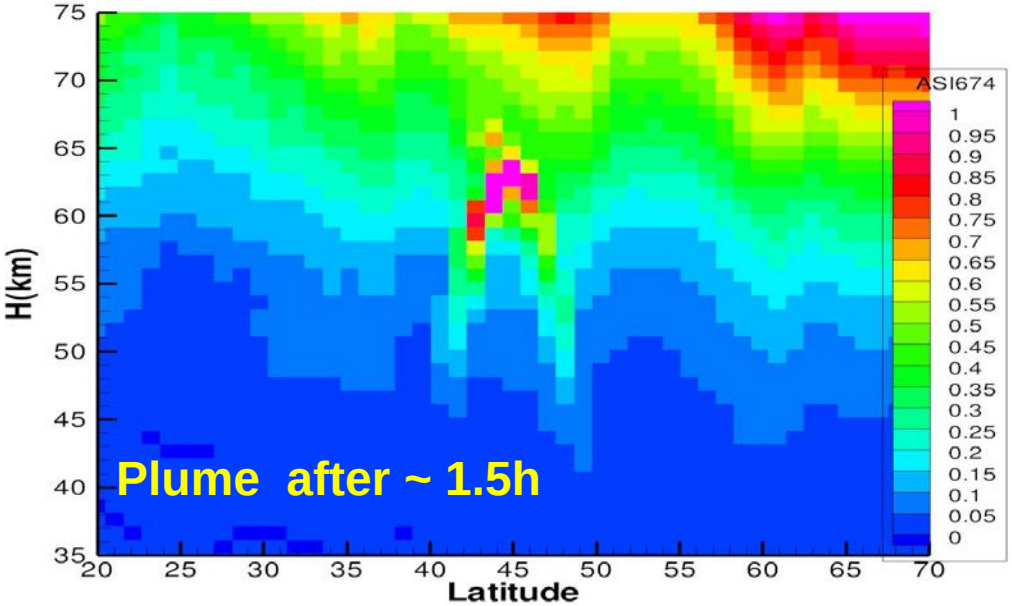


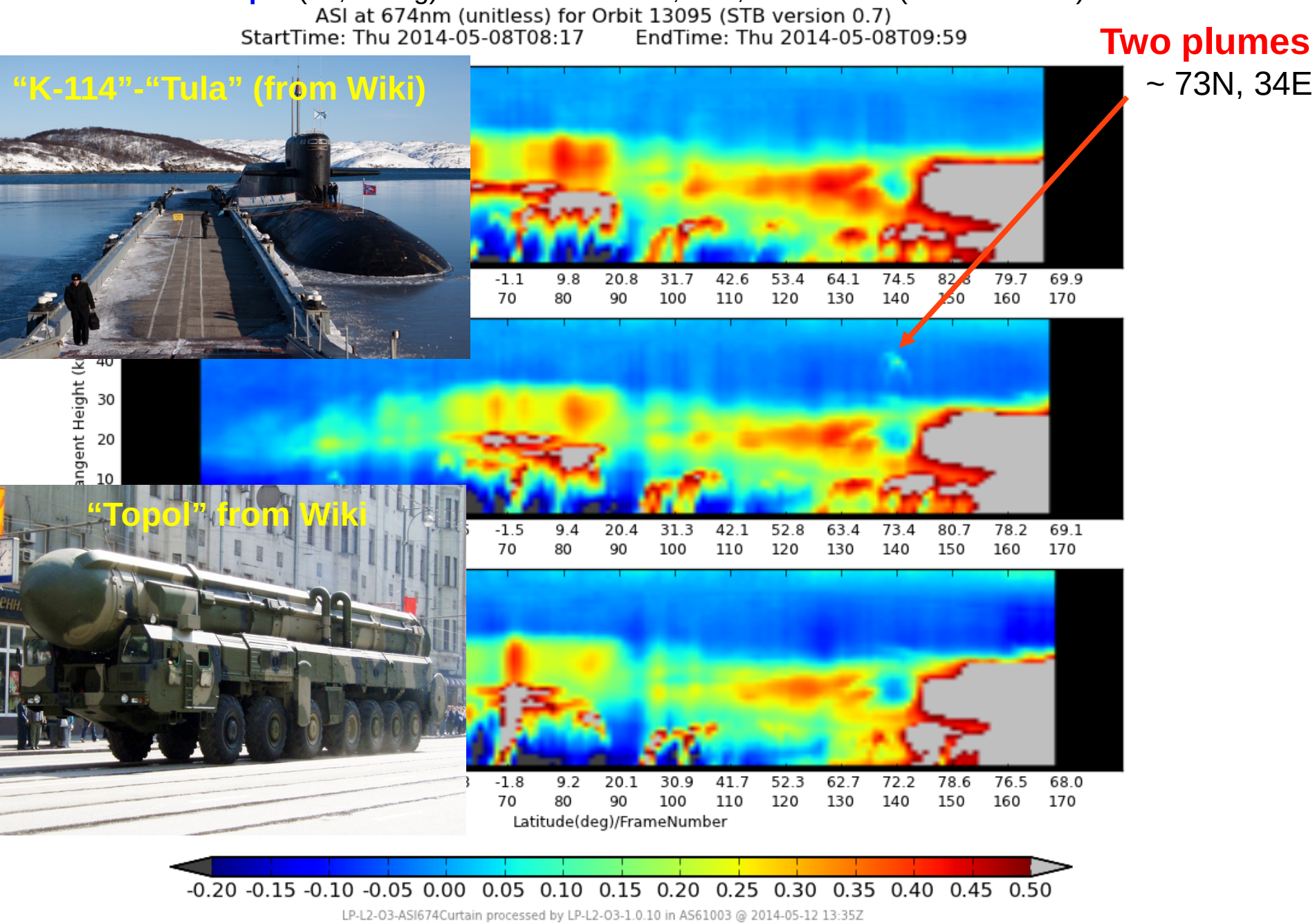
Long March-4C (250,000 kg), Taijuan 39N, 111E, 11/20/2013, 03:31 UT



10696, L-slit

Soyuz (305,000 kg) from Kourou 5N, 52W, 08/22/2014, 12:27



14602, C-slit

Sineva (40,000 kg), Submarine “K-114” (“Tula”), Barents Sea, 05/08/2014
and **Topol** (45,000 kg) from Plesetsk 63N, 41E, 05/08/2014 (info from Wiki)