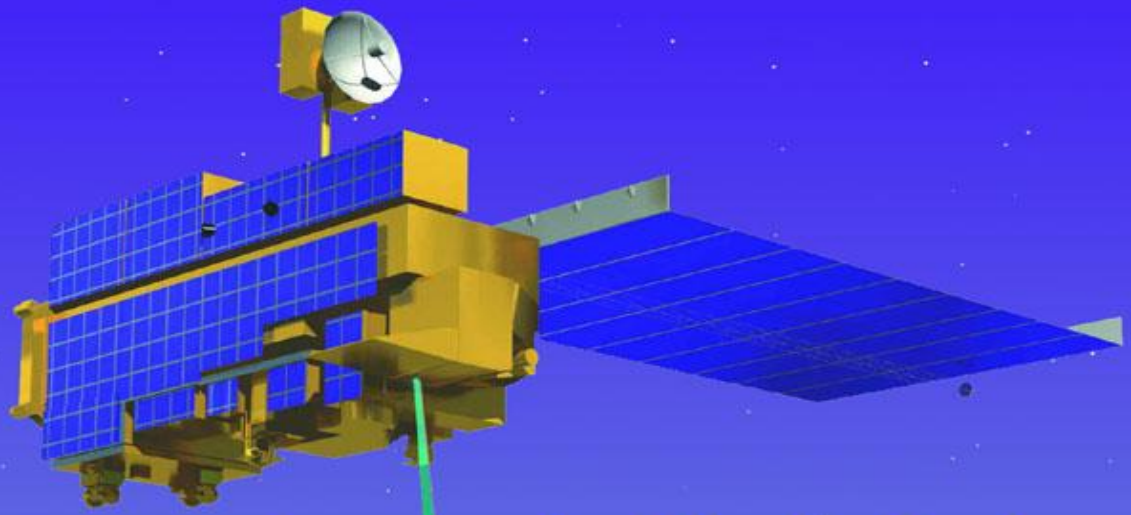
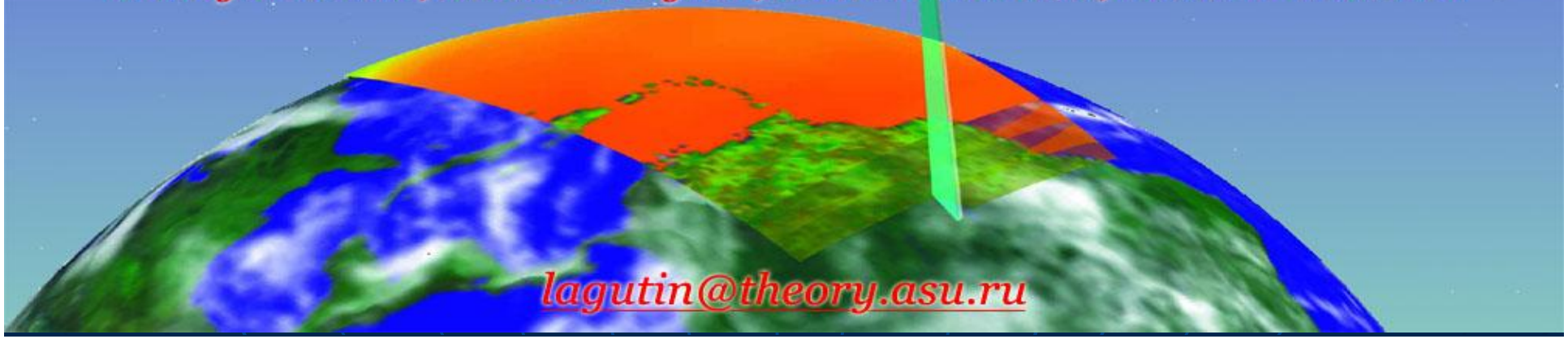
ALTAI STATE UNIVERSITY
Remote Sensing Center



Retrieval of surface parameters over the Siberian Region using MODIS data

Anatoly A. Lagutin, Yuri A. Nikulin, Ivan A. Shmakov,
Andrey P. Zhukov, Aleksei A. Lagutin, Anton N. Reznikov, Vladimir V. Sinitsin



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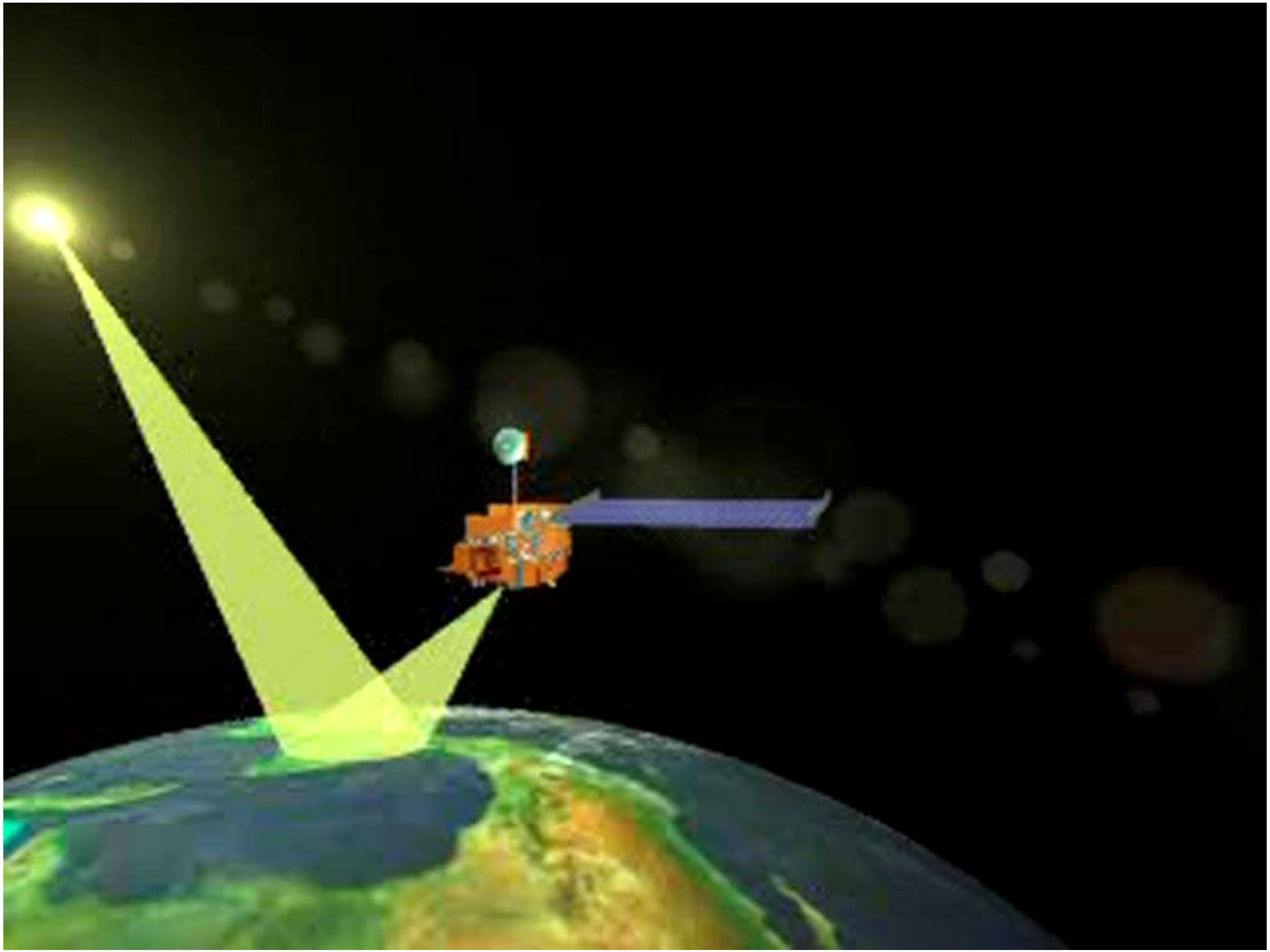
The MODerate resolution Imaging Spectroradiometer (MODIS) on-board the Earth Observing System/NASA Terra and Aqua satellites offers new capabilities for the study of land surfaces with a spatial resolution up to 250 m. Prior to the derivation of various land parameters from radiometrically calibrated MODIS data, the signals measured by the instrument at the top of the atmosphere need to be converted to surface reflectance, that is, to the reflectance that would be measured by MODIS at the ground level without the atmosphere.

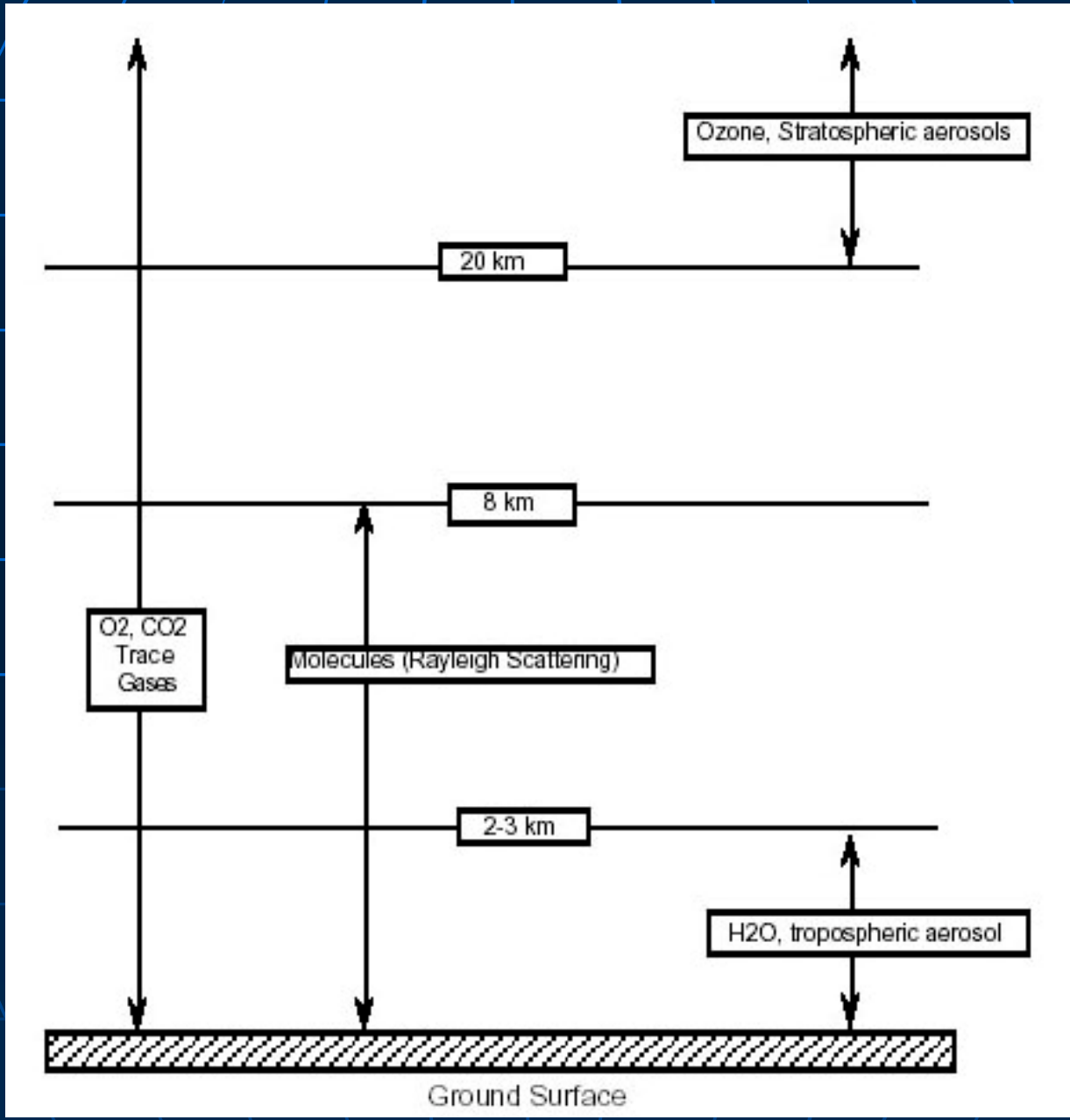
The process necessary for that conversion is called atmospheric correction. It uses the calibrated data as input and performs corrections for the effect of gaseous absorption, molecules and aerosol scattering, coupling between atmospheric and surface bidirectional reflectance function.

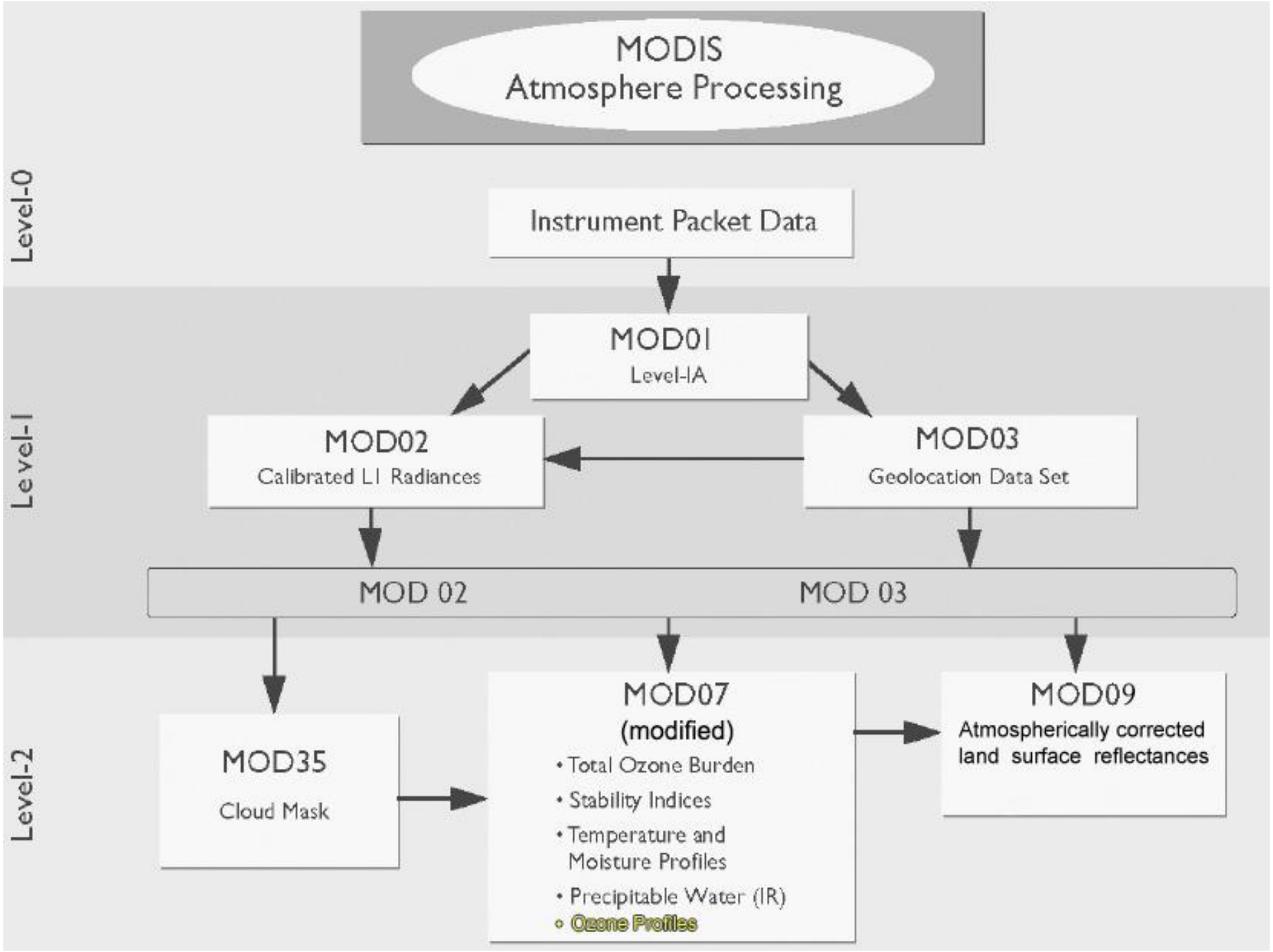
Goals:

Present the approaches and codes used at Altai State University for the atmospheric correction of visible to middle-infrared MODIS data and for retrieval of land parameters such as the vegetation indices, bidirectional reflectance distribution function, albedo, snow mask.

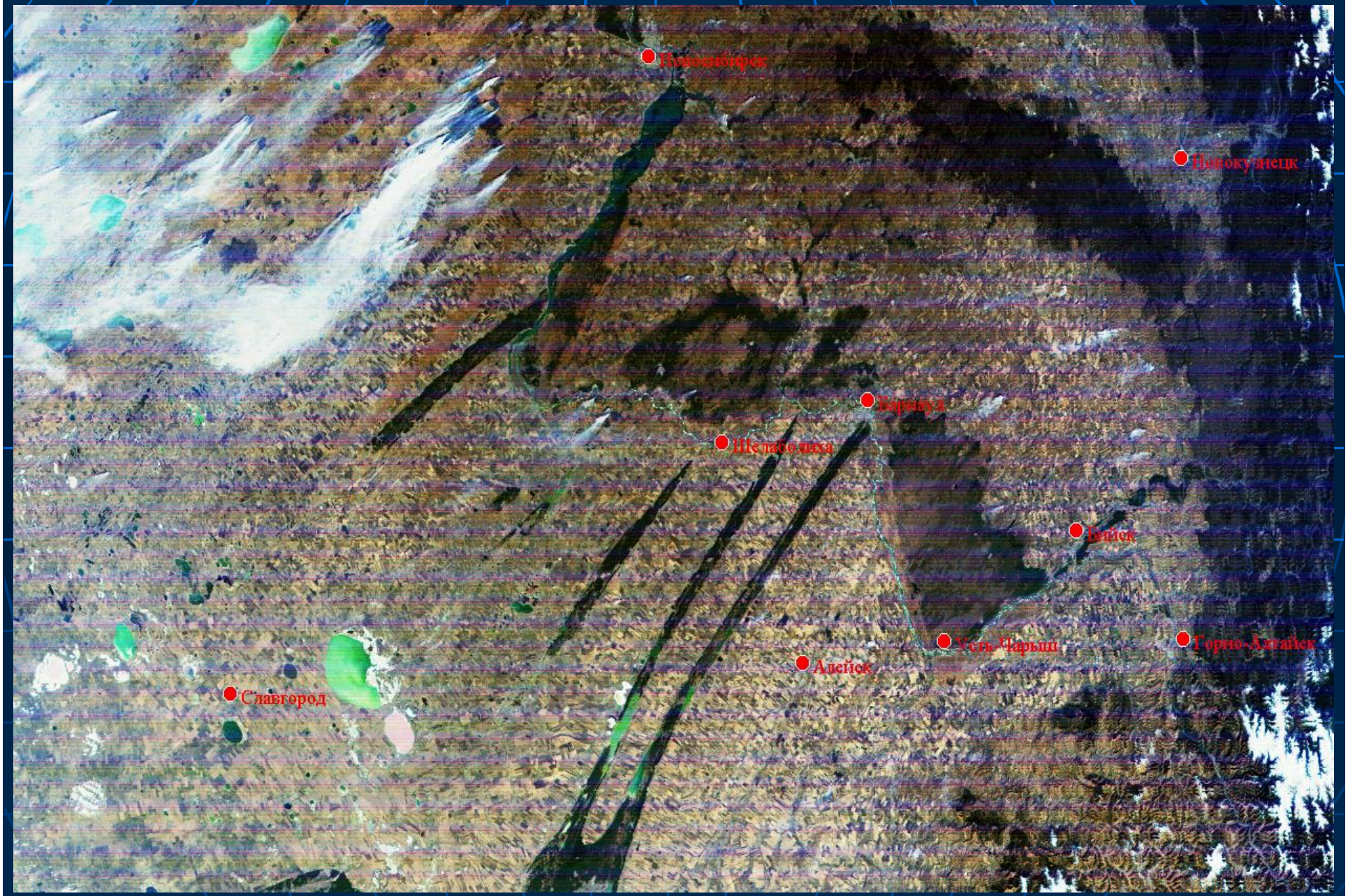


The components affecting the remote sensing signal in the 0.4-2.5 µm range



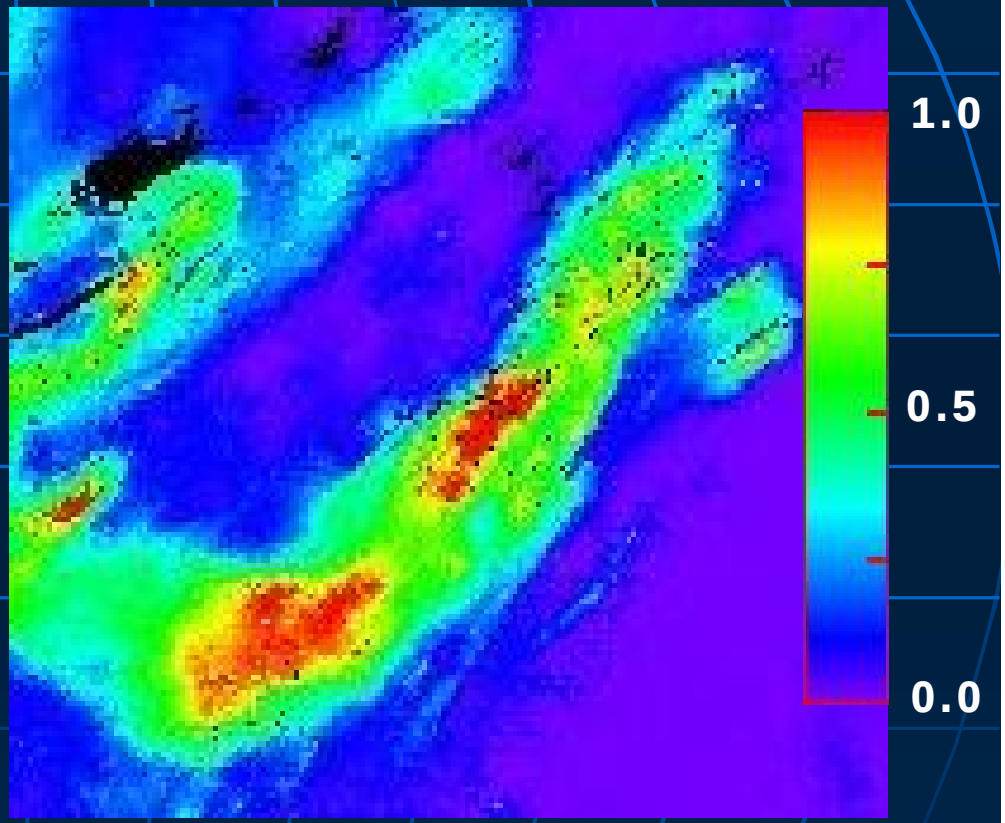

MODIS
Atmosphere Processing
Level-0
Instrument Packet Data
Level-1
MOD01
Level-1A
MOD02
Calibrated L1 Radiances
MOD03
Geolocation Data Set
MOD 02
MOD 03
Level-2
MOD35
Cloud Mask
MOD07
(modified)
• Total Ozone Burden
• Stability Indices
• Temperature and Moisture Profiles
• Precipitable Water (IR)
• Ozone Profiles
MOD09
Atmospherically corrected land surface reflectances

Altai region, October 13, 2003



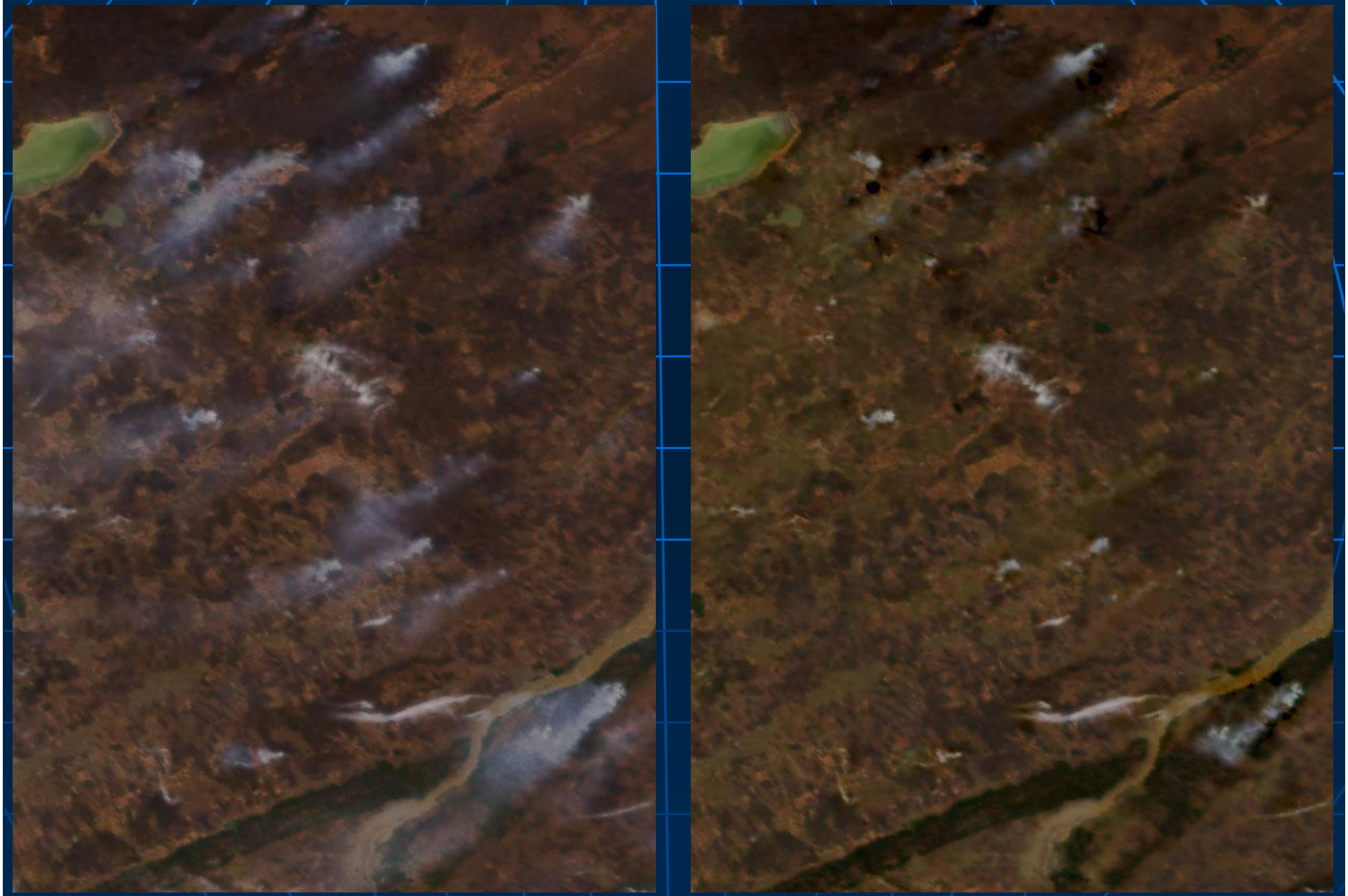
Atmospheric correction and AOT_0,66 for fires

Scene of the October 13, 2003

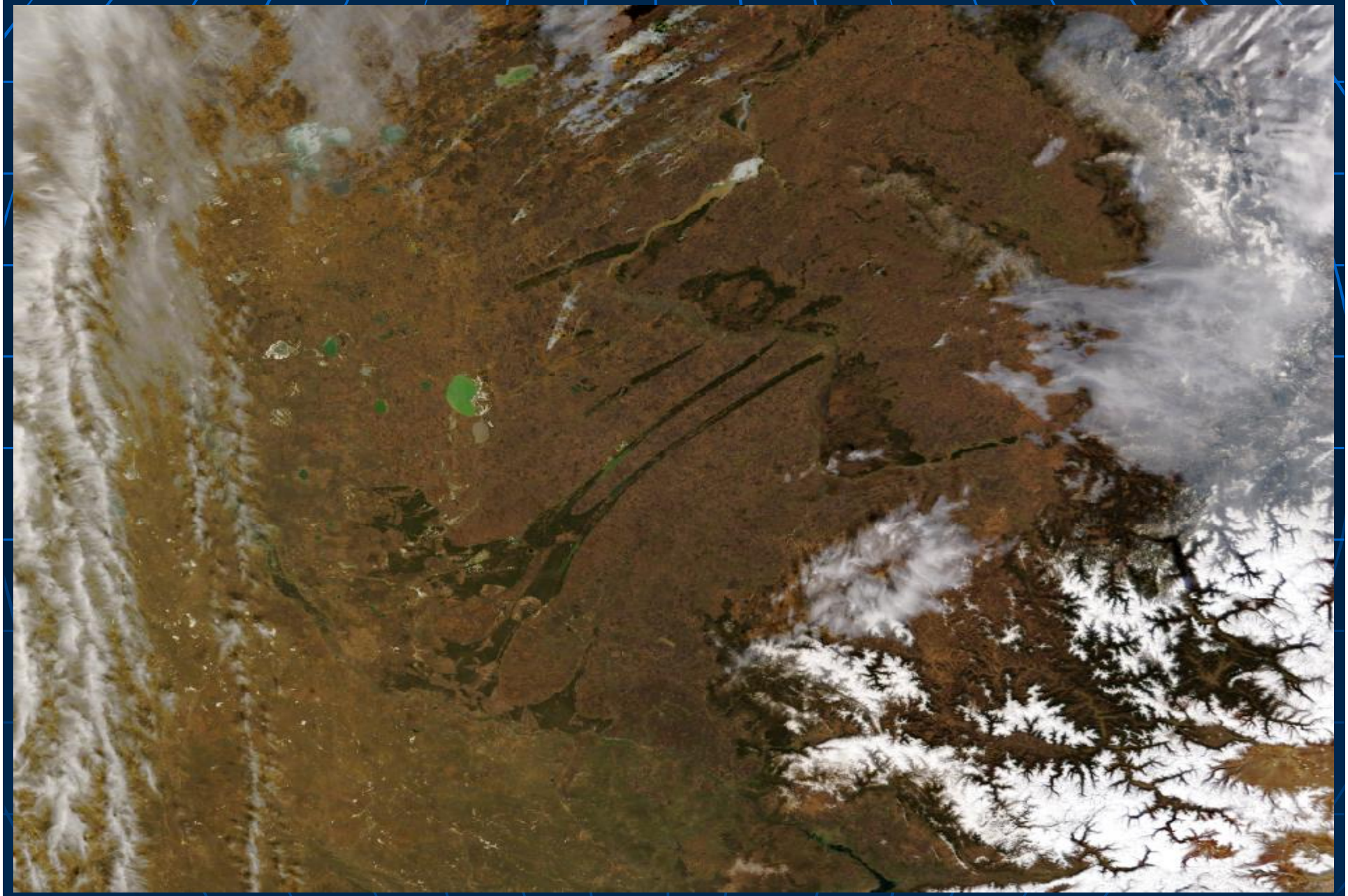


After atmospheric corrections (PGE11)

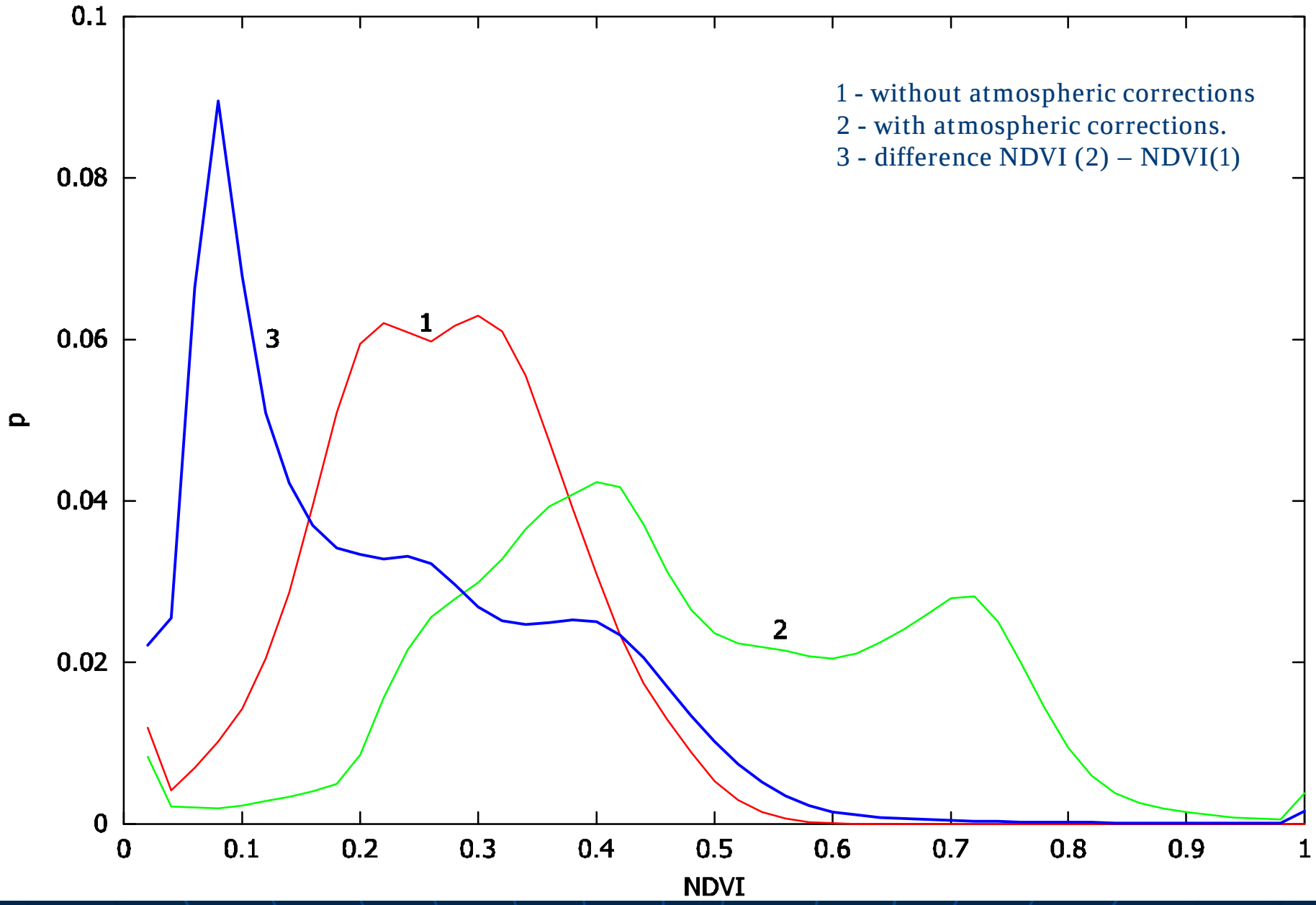
Fire. May 15, 2006



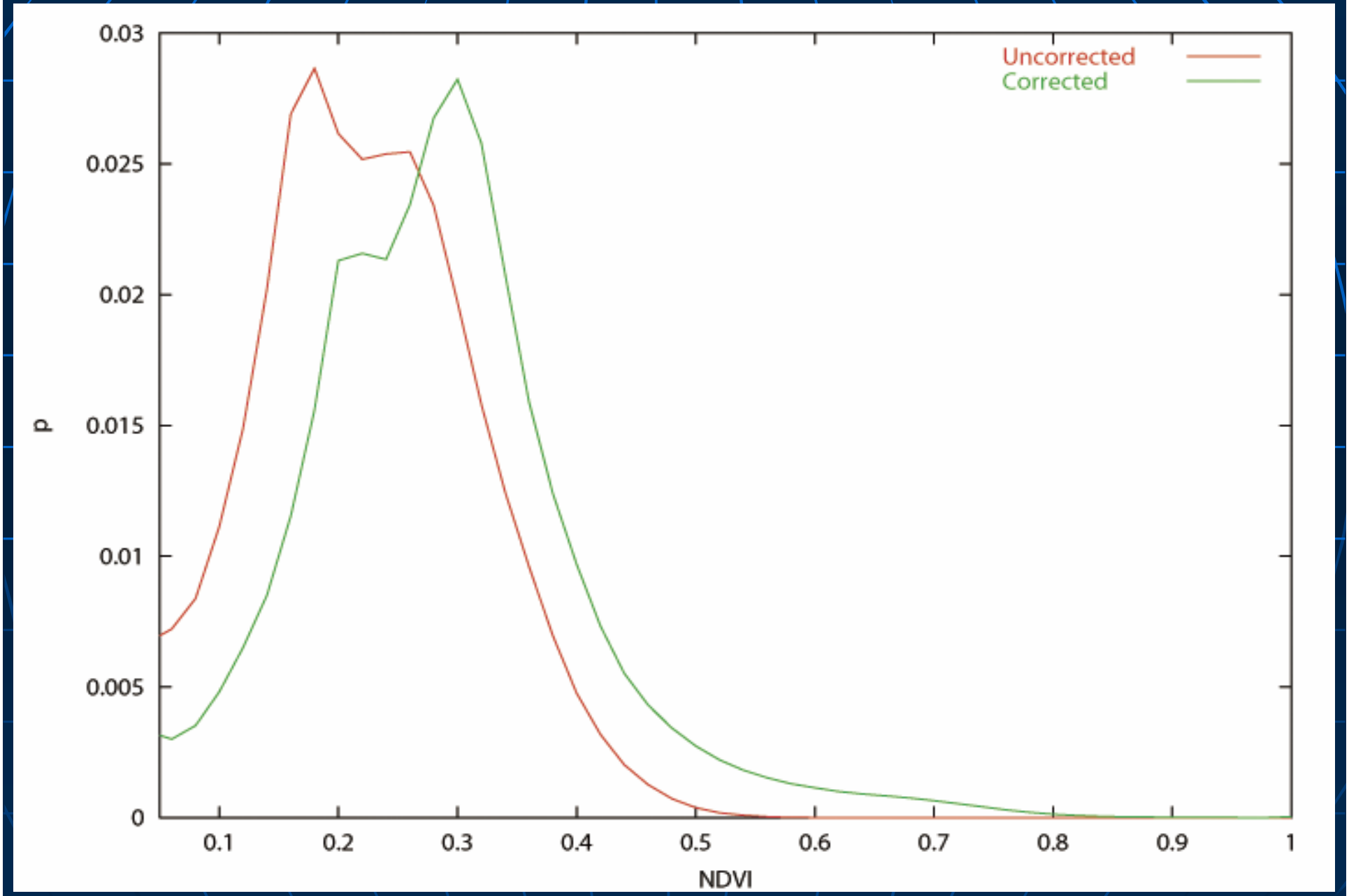
Altai region. May 12, 2006



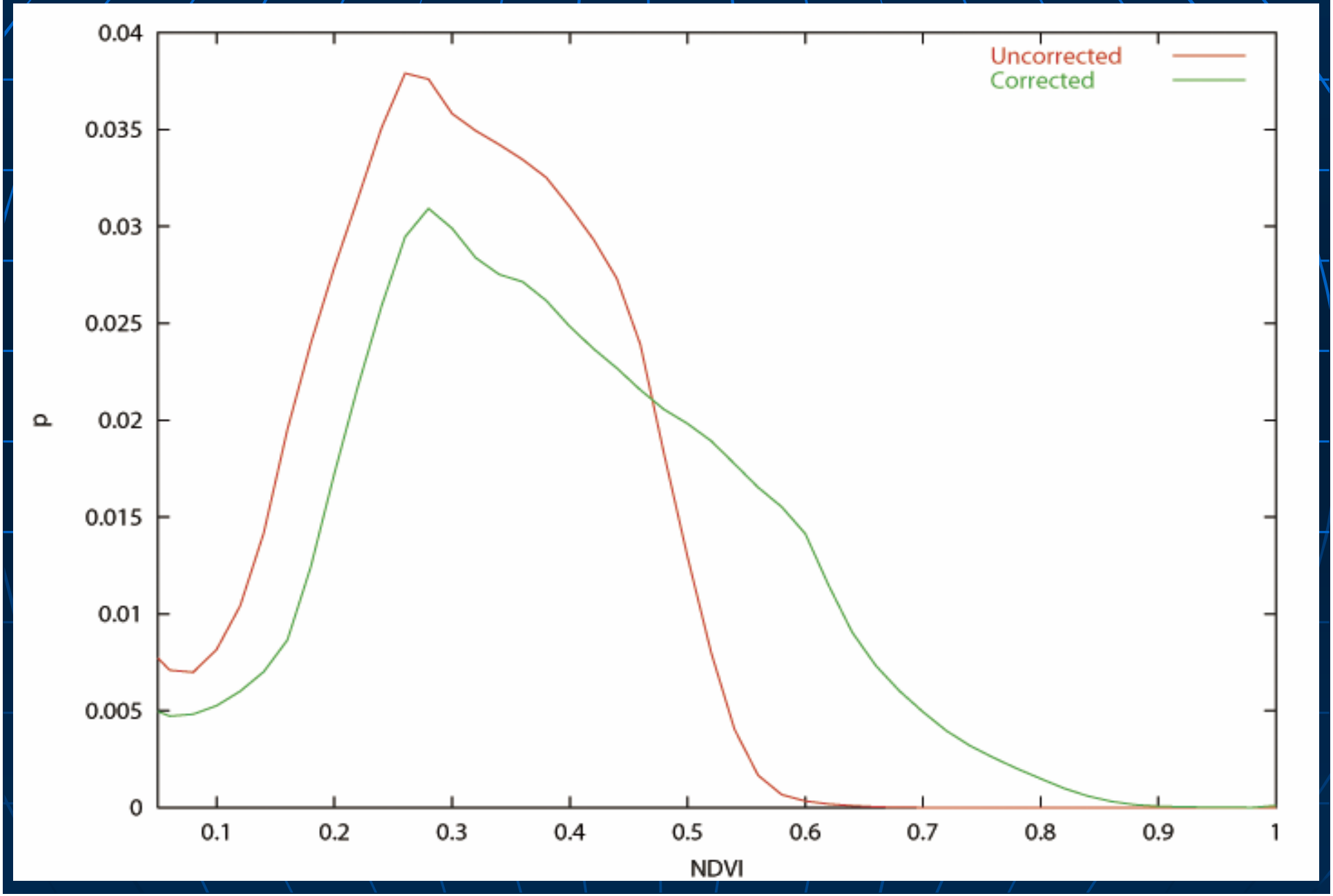
NDVI distribution function for the South-Western Siberia according to MODIS/Terra data, October 13, 2003



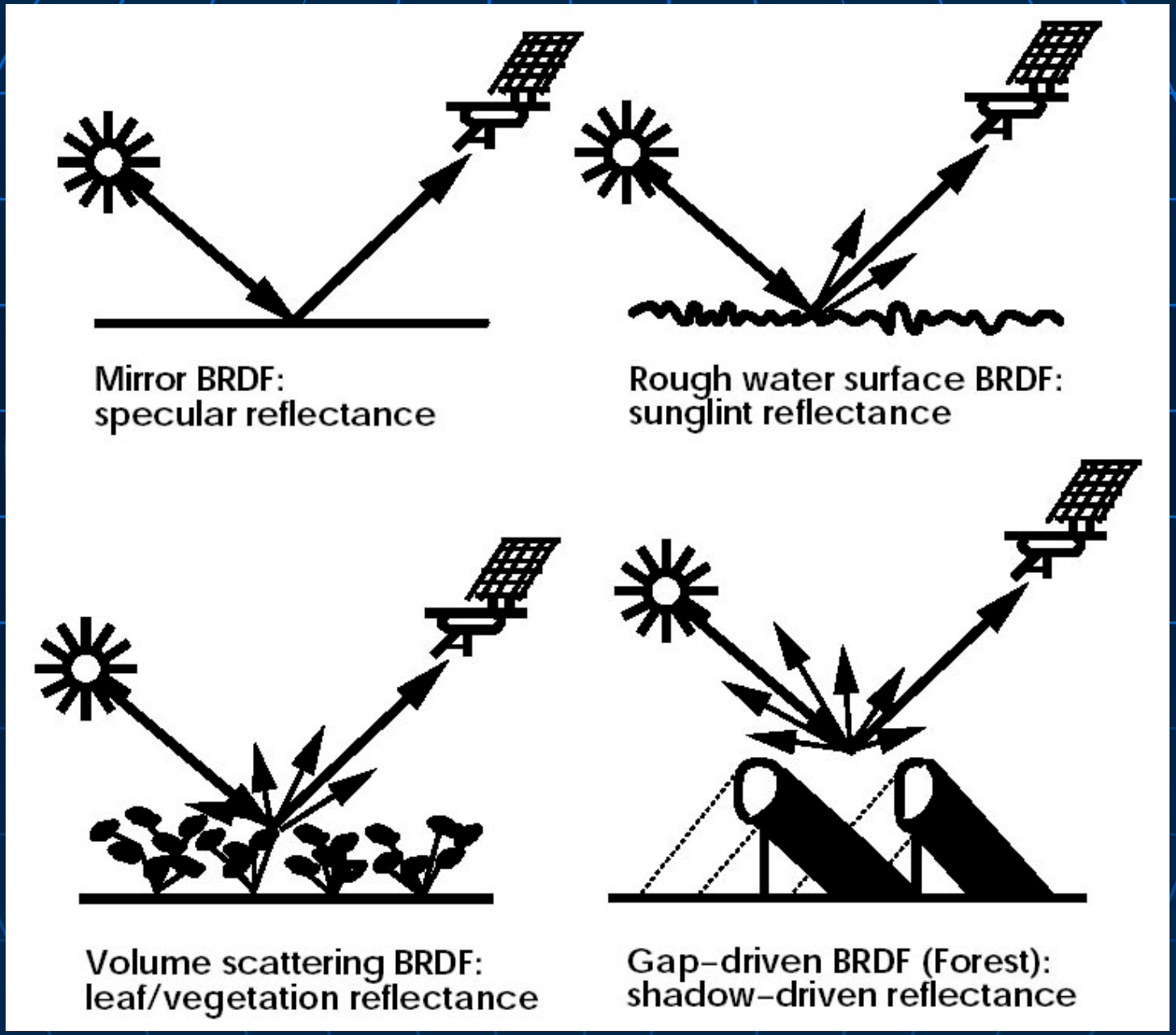
NDVI distribution function for the South-Western Siberia, May 12, 2006



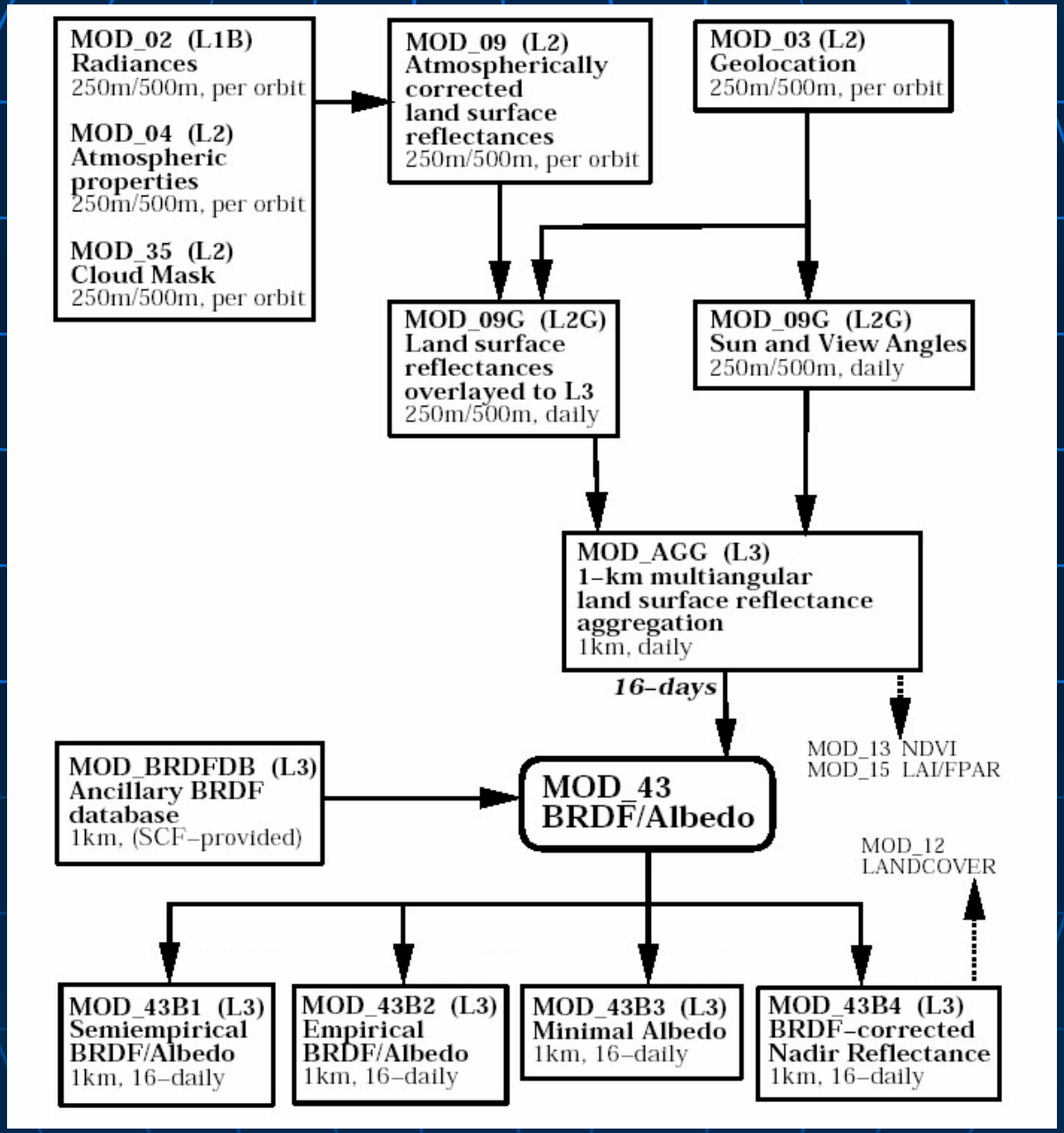
NDVI distribution function for the South-Western Siberia, May 15, 2006



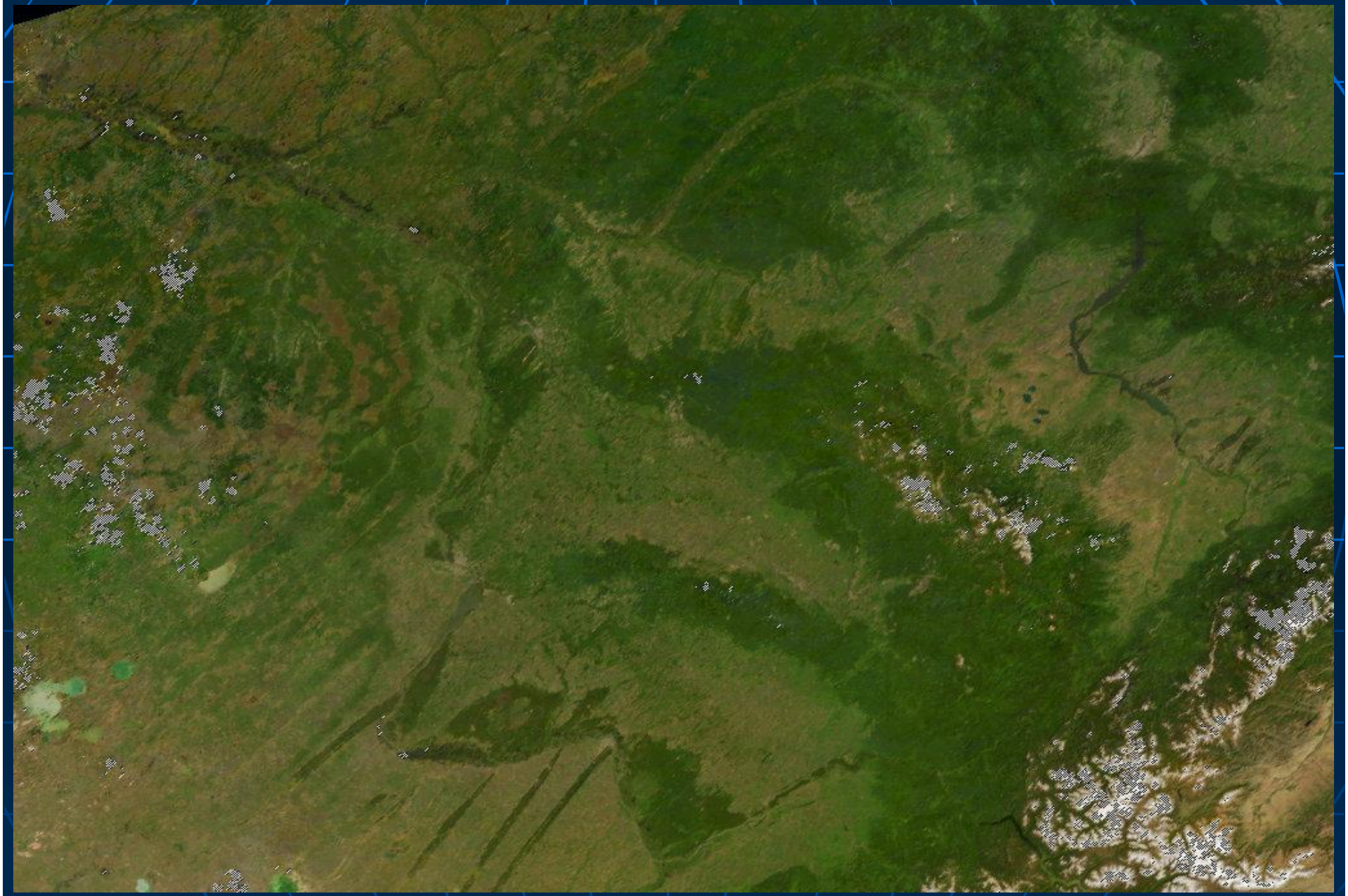
Key causes for land surface reflectance anisotropy



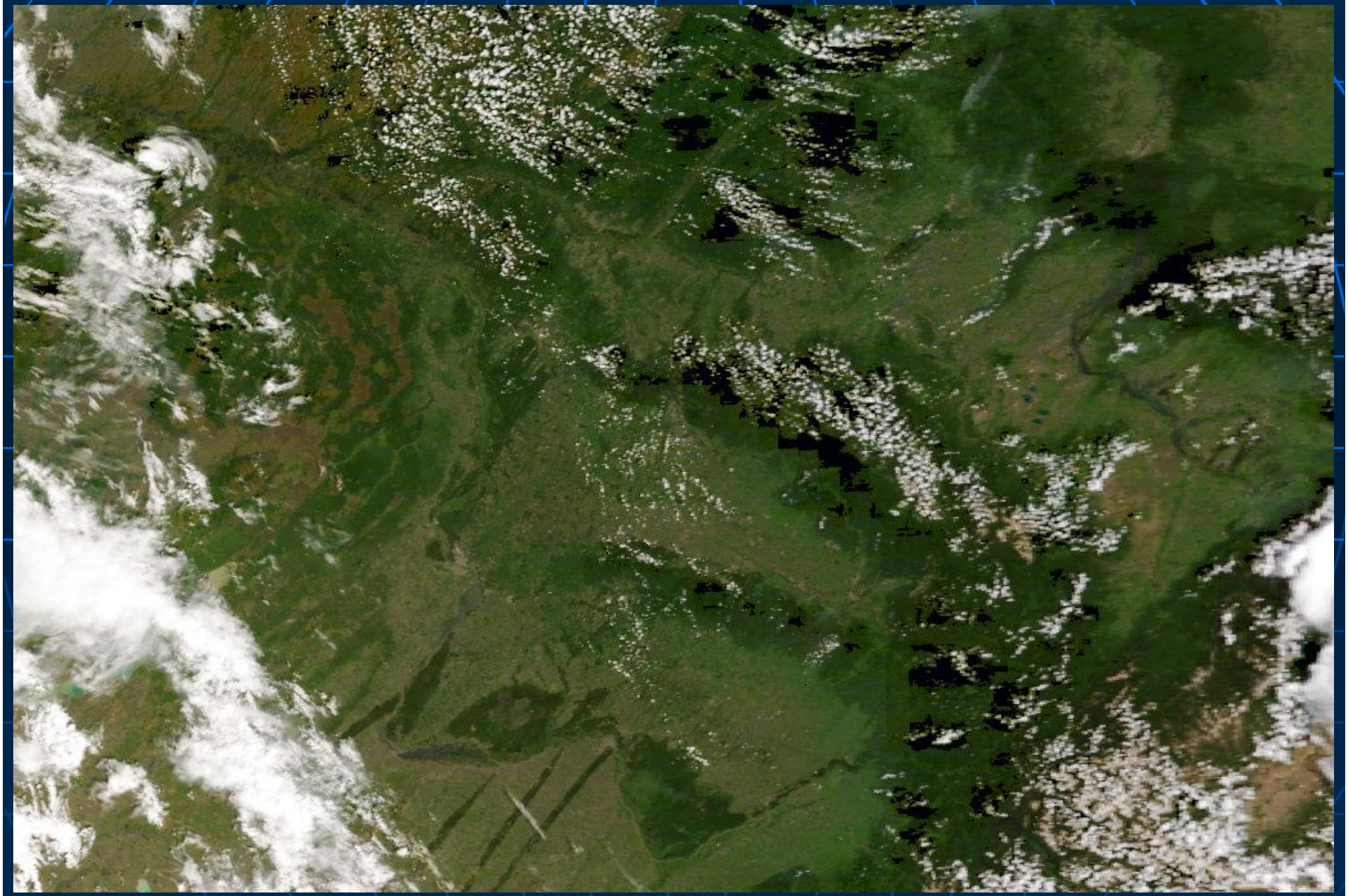
MODIS BRDF/Albedo Processing Scheme



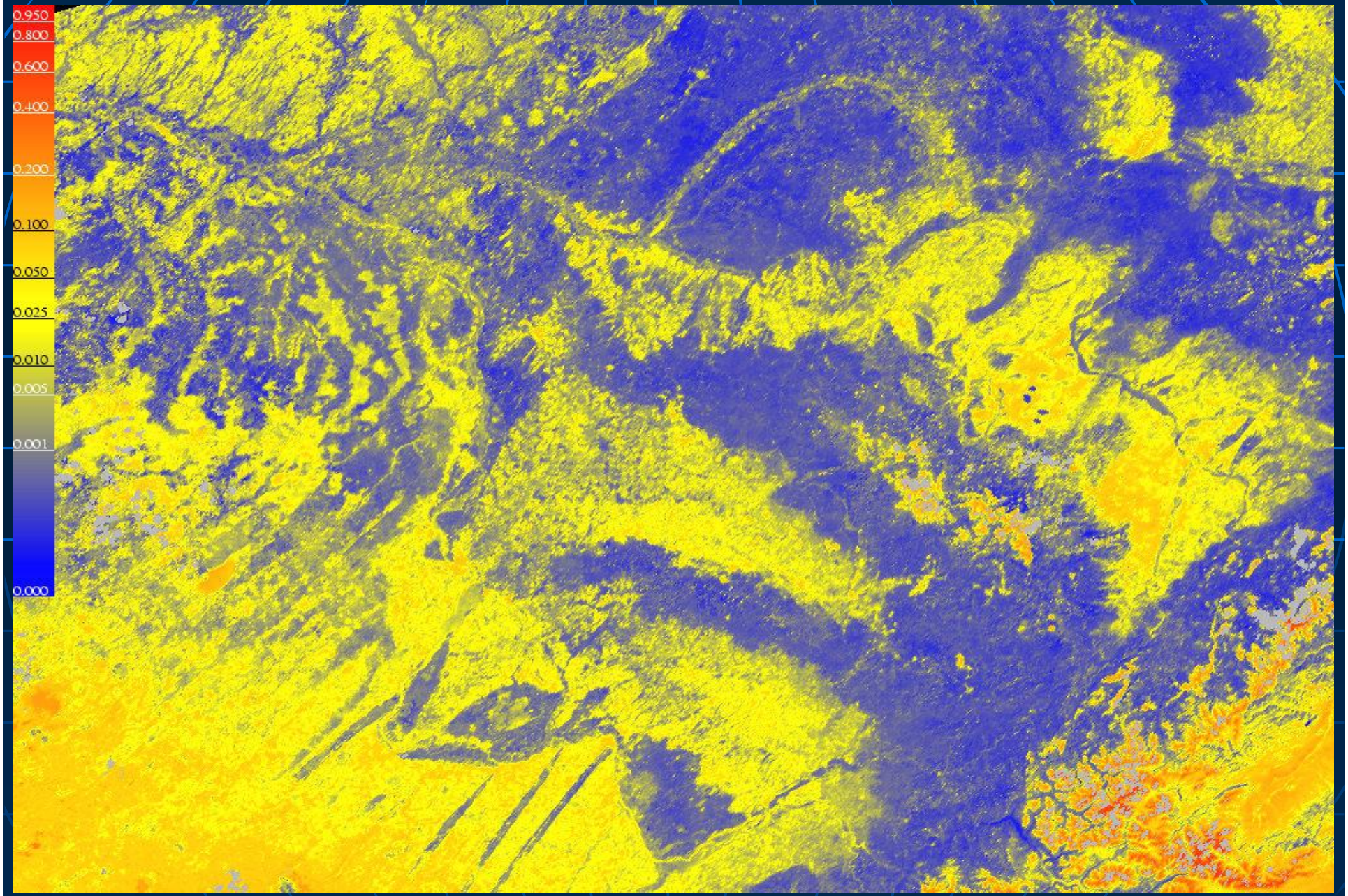
Nadir Sun-View reflectance (bands 1-4-3)
(From 11th to 25th Juny, 2006)



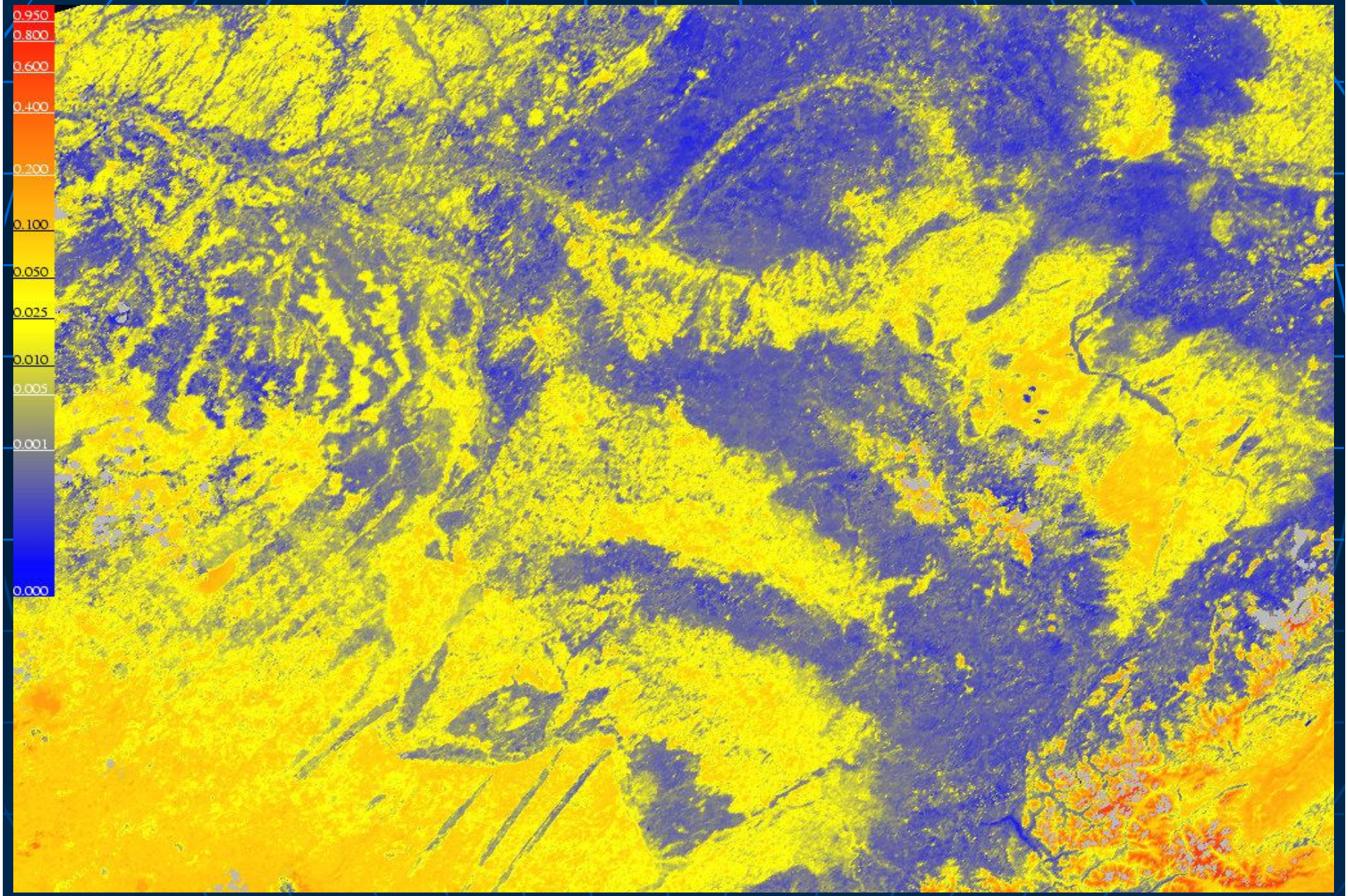
Atmospherically corrected reflectances, bands 1-4-3 (June 22, 2006)



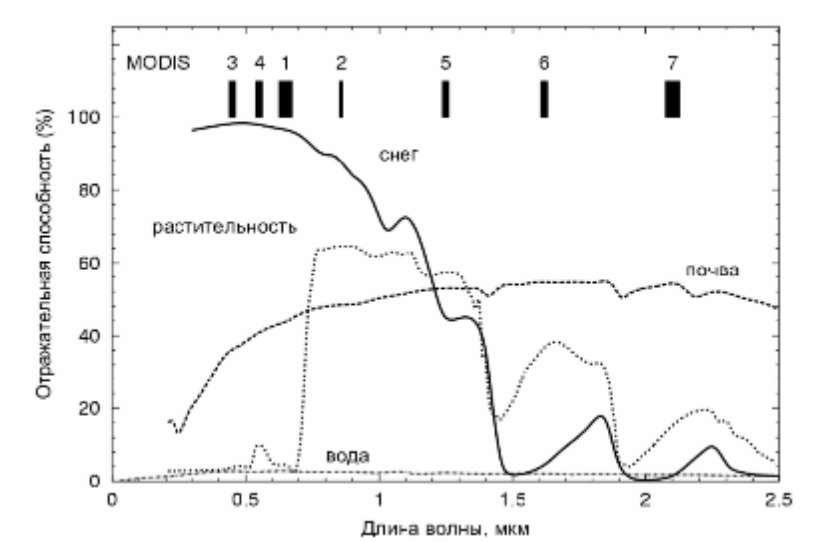
Black-sky albedo for 45 degrees solar zenith, band 1 (From 11th to 25th Juny, 2006)



White-sky albedo, band 1
(From 11th to 25th Juny, 2006)



Snow mapping



Reflectance of snow, water, soil and vegetation (according to Klein A. G. et al., 1998) and location of the MODIS channels (1 – 7)

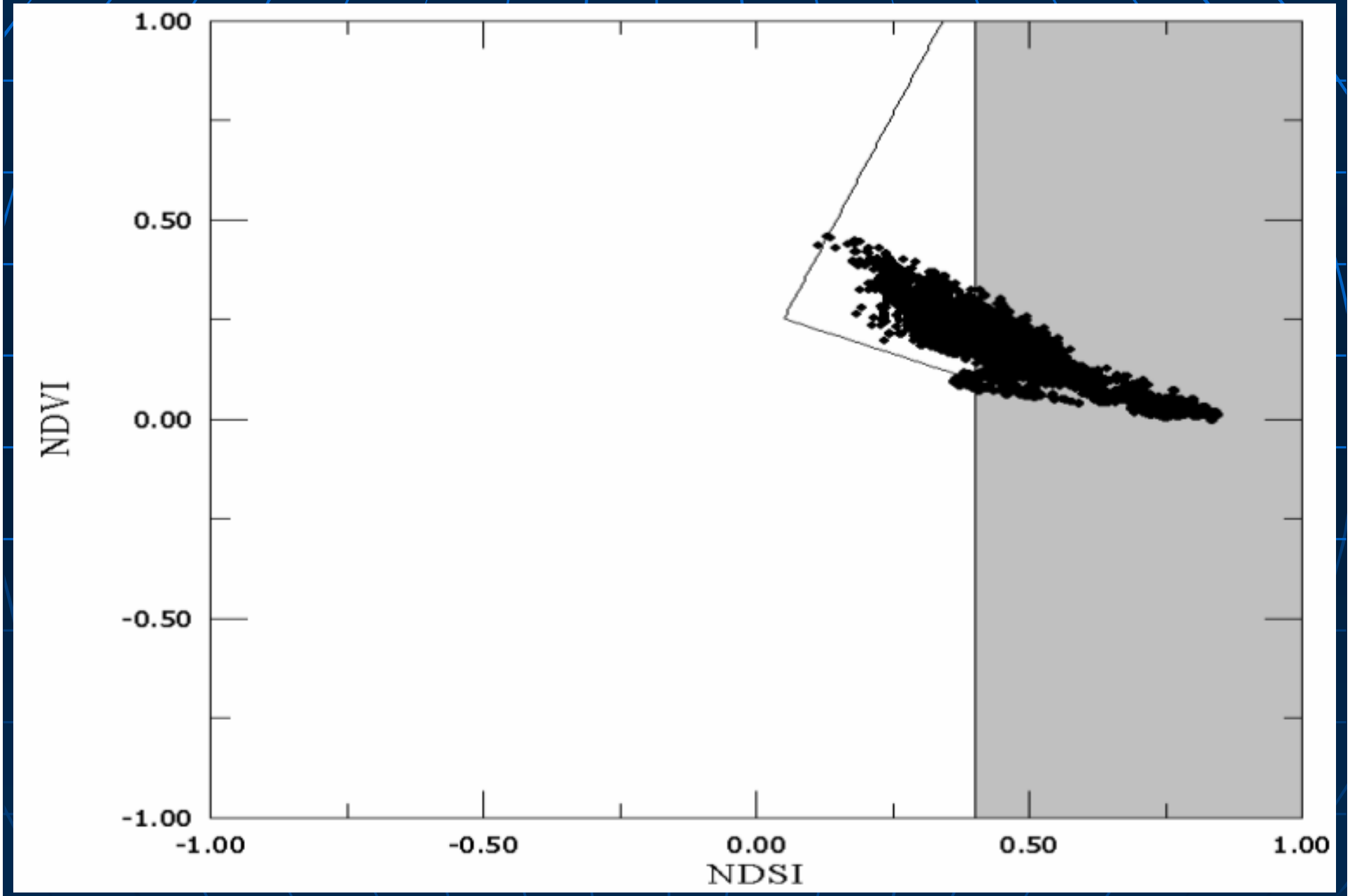
Criteria applied in snow mapping using MODIS data

Number	Criterion
1	NDSI = (R4 – R6) / (R4 + R6) ≥ 0,4
2	R2 > 0,11
3	0,05 ≤ NDSI <0,4 and NDVI = (R2 – R1) / (R2+R1) Є D
4	R4 ≥ 0,1

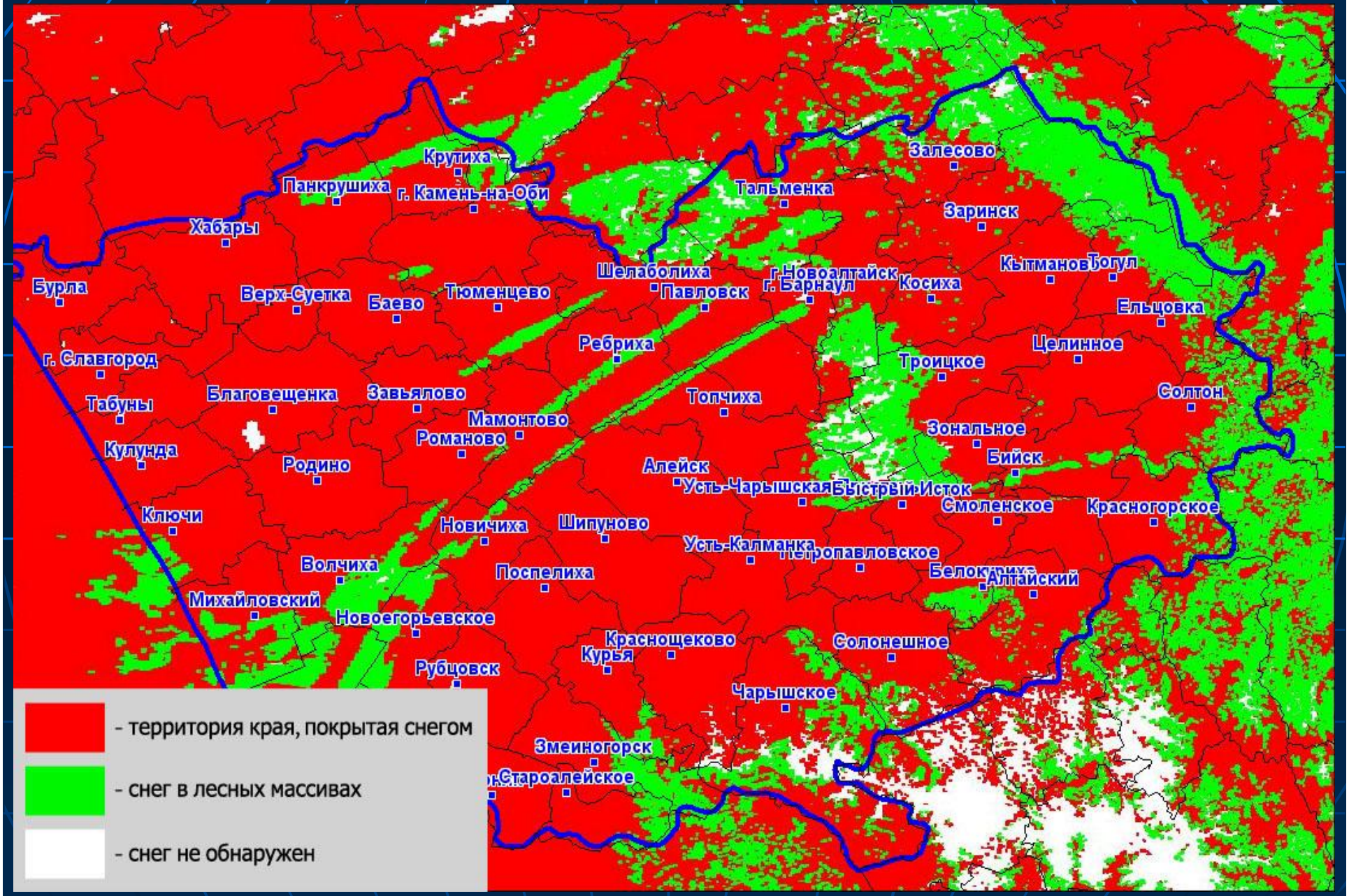
- Hall D. K. et al. // Remote Sens. Environ., 1995, v. 54, pp. 127-140.
- Hall D. K. et al. // Remote Sens. Environ., 1998, v. 66, pp. 129-137.
- Klein A. G. et al. //Hydrol. Process., 1998, v. 12, pp. 1723-1744.
- Hall D. K. et al. Algorithm theoretical basis document (ATBD) for the MODIS snow and sea ice-mapping algorithms. NASA EOS-MODIS Doc., 2001, 55 p.

NDSI versus NDVI plot for snow-covered siberian forests.

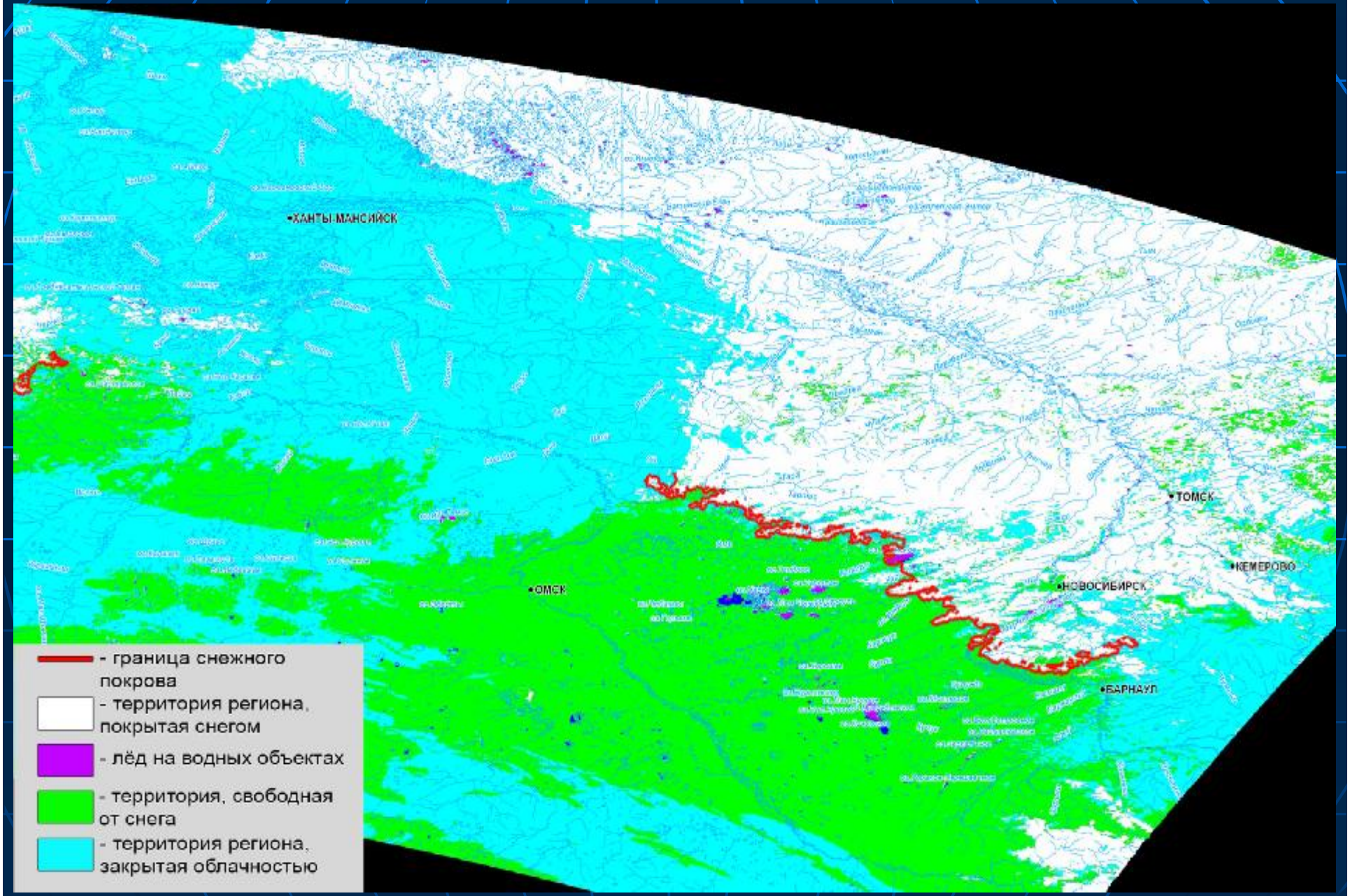
• - our data, — - Klein A. G. et al., 1998



Snow mapping. MODIS data. March 21, 2006



Snow mapping. MODIS data. April 20, 2006



Snow mapping. MODIS data. May 15, 2006