Long-term regional fire inventories in Northern Eurasia

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HISTORICAL DATASETS

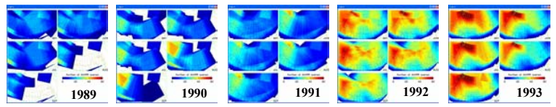
Major Regional AVHRR-based Datasets:

- Sukachev Forest Institute (SFI, Krasnoyarsk)
- Institute of Solar and Terrestrial Physics (ISTP, Irkutsk)
- Space Research Institute (SRI)
- Center of Forest Economy and Productivity (CFEP, Moscow)
- Institute of Atmospheric Optics (IAO, Tomsk)
- University of Tokyo (UT, Tokyo, Japan)

Dataset	Active fire	Burn scar	Temporal extent	Spatial extent
SFI	+	selected scars	1996-2003	Eastern Russia
ISTP	+		1997-2001	Eastern Russia
SRI	+		1995-2003	Entire Russia
CFEP		+	2002, ongoing	Eastern Siberia
IAO	+		1998-2003	Central Russia
UT		+	1984-1999	Russian Far East

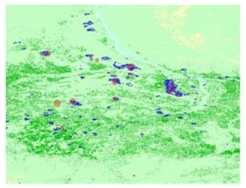
The datasets are based on AVHRR data from local direct-readout (HRPT) receiving stations. The SFI dataset has been complemented by data from the NOAA Satellite Active Archive (SAA). Most products and datasets are intended to serve primarily the fire management community.

With no HRPT/AVHRR coverage in Russia before ~ 1995, further temporal extension of the datasets is possible using LAC (Local Area Coverage) data from SAA.

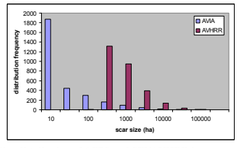


Maps of 1 km AVHRR coverage over Eastern Russia from NOAA/SAA for the 1989-1993 burning seasons (May-October).

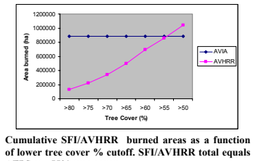
Use of in-situ observations from the Areal Forest Protection Service Avialesookhrana (AFPS)



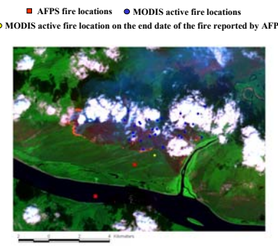
Burned area maps from AFPS (red circles) and SFI/AVHRR (blue clusters) for the 2001 burning season. The areas of the red circles represent the areas reported by AFPS. The background map is the UMd/MODIS continuous tree cover product. Only data over AFPS protected area are shown.



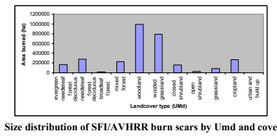
Size distribution of AFPS and SFI/AVHRR burn scars.



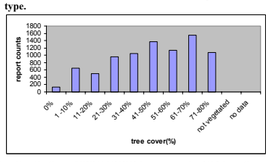
Cumulative SFI/AVHRR burned areas as a function of lower tree cover % cutoff. SFI/AVHRR total equals AFPS at ~55% tree cover.



ASTER imagery centered at 60.3 N and 116.87 E with active fires on August 10 2002.

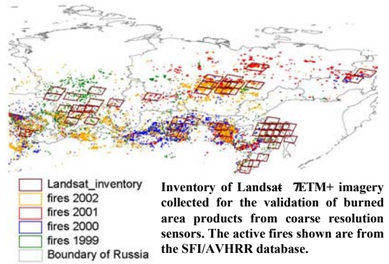


Size distribution of SFI/AVHRR burn scars by Umd and cover type.

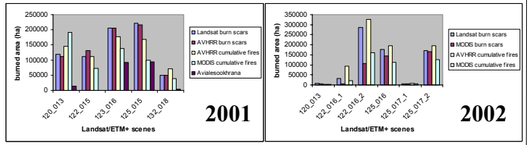


Size distribution of SFI/AVHRR burn scars by UMd continuous tree cover %.

PRODUCT EVALUATION AND DATA CONTINUITY



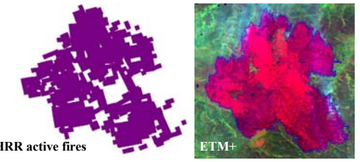
Inventory of Landsat 7 ETM+ imagery collected for the validation of burned area products from coarse resolution sensors. The active fires shown are from the SFI/AVHRR database.



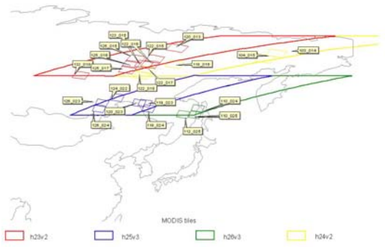
Comparison of burned area estimates. The AVHRR product is from SFI. All estimates are over AFSP protected areas.

MODIS burned area products

- standard algorithm by Roy et al.
- experimental algorithm by Giglio et al.



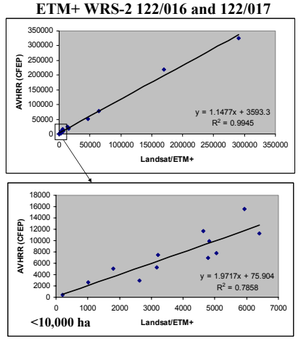
A fire complex in WRS 2 125/16 on 23 July 2002 as mapped by various sensors and methods.



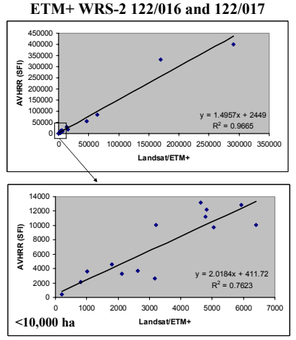
Map of MODIS 10 degree tiles where "collection 4" MODIS data have been collected for experimental burned area mapping. Landsat 7/ETM+ imagery used for product evaluation is also shown. To date tile h23v2 has been processed.

Burs scar estimates from AVHRR and MODIS vs. ETM+

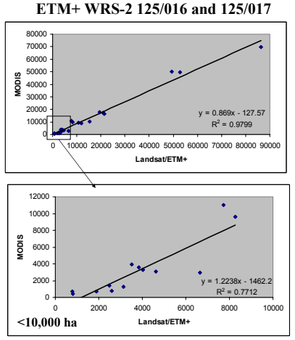
CFEP/AVHRR burned area 08/19/2002 ETM+ WRS-2 122/016 and 122/017



SFI/AVHRR burned area 08/19/2002 ETM+ WRS-2 122/016 and 122/017

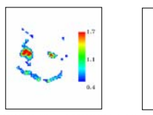


MODIS burned area 07/23/2002 ETM+ WRS-2 125/016 and 125/017

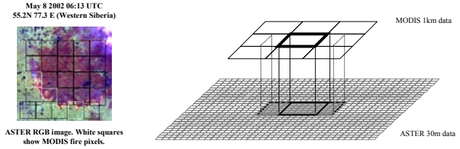


New technologies

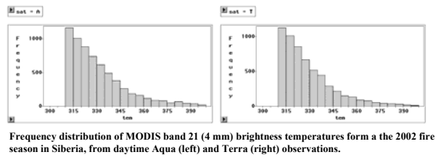
ASTER fire detection and characterization → MODIS/BIRD subpixel fire masks and characteristics ↔ MODIS/BIRD radiance, Fire Radiative Energy, Fire Size and Temperature analysis



BIRD (left) and MODIS (right) 4 μm band radiances (Wm-2μm-1str-1) of a fire complex near the Russian-Mongolian border on July 24, 2002. The diameter of the cluster is ~ 10km.

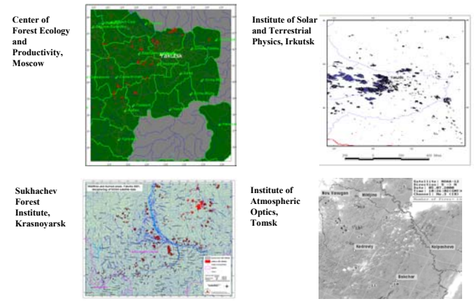


ASTER RGB image. White squares show MODIS fire pixels.

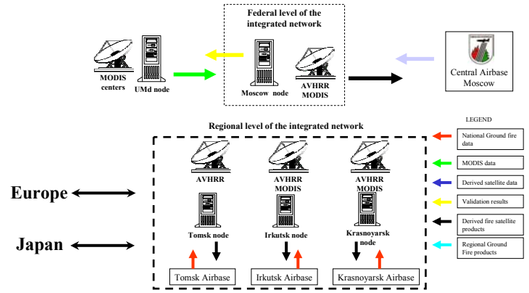


Frequency distribution of MODIS band 21 (4 mm) brightness temperatures form a the 2002 fire season in Siberia, from daytime Aqua (left) and Terra (right) observations.

INTEGRATED MULTI-SENSOR NETWORK



Satellite based fire products in Russia.



Structure of prototype Integrated Fire Database

MODIS thermal anomalies

id	Id number of anomaly
dt	Date and time
lat	Latitude
lon	Longitude
temp	Temperature
lat_delta	Pixel size across track
lon_delta	Pixel size along track

AVHRR thermal anomalies

id	Id number of anomaly
dt	Date and time
lat	Latitude
lon	Longitude
lat_delta	Pixel size across track
lon_delta	Pixel size along track

AFPS fire data ("Aviaiesookhrana")

id	Id number of fire
dt	Date
lat	Latitude of fire (place of its detection)
lon	Longitude of fire (place of its detection)
area	Current burnt area
state	Class of fire condition (flaming/smoldering, localized etc.)
dt_disc	Date of detection of fire
area_disc	Burnt area in the moment of detection
id	Id number of fire
id_avia	Internal ID number of fire of Aviaiesookhrana
state	Code of fire condition
desc	Description of class of fire condition

Fire data from Aviaiesookhrana have been collected into a digital database and merged with AVHRR and MODIS data for quantitative analysis at the Space Research Institute.

This system is the core of the Northern Eurasian regional fire network of the Global Observation of Forest and Landcover Dynamics (GOFC/GOLD) program. This program, among other objectives, promotes free data sharing and the comprehensive evaluation of data products.

Preparations are also underway for the processing of data from the next generation of operational environmental satellites from NPOESS (National Polar-Orbiting Environmental Satellite System) and NPP (NPOESS Preparatory Project). MODIS is being used as a proxy for the Visible/Infrared/Imager/Radiometer Suite (VIIRS), which will replace the current AVHRR sensor on these missions.

While real-time fire products are primarily generated to facilitate prompt decision making within the various fire management agencies, fire products are also essential for the Russian and international science community for the analysis of the local, regional and global effects of biomass burning in Northern Eurasia. The emerging GOFC/GOLD regional network has been recognized as a major data provider for international research programs such as the new Northern Eurasian Earth Science Partnership Initiative (NEESPI).

gofc-fire.org

Acknowledgments

This work is being done within the project "Intercalibration of fire products from AVHRR and MODIS towards a consistent long-term record of biomass burning in Northern Eurasia", which has been recently funded by the NASA New Investigator Program in Earth Sciences (NRA 2004 NRA-04-OES-04).

Landsat/ETM+ imagery used in this study has been acquired with the help of the NASA/MODIS program in support of CEOS Land Product Validation and GOFC/GOLD fire objectives, and the NASA Land Cover Land Use Change Program.

MODIS and ASTER data were acquired from the Distributed Active Archive Centers. NOAA AVHRR data were obtained from the NOAA Satellite Active Archive. BIRD data were provided by the Deutsches Zentrum für Luft- und Raumfahrt (DLR).

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