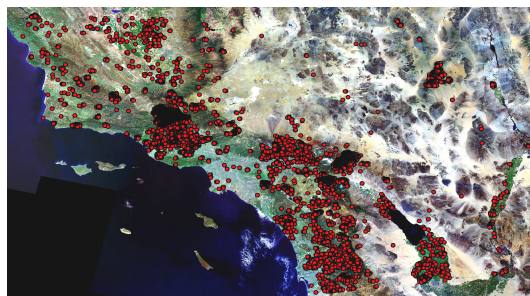


TQ2. Global Biomass Burning

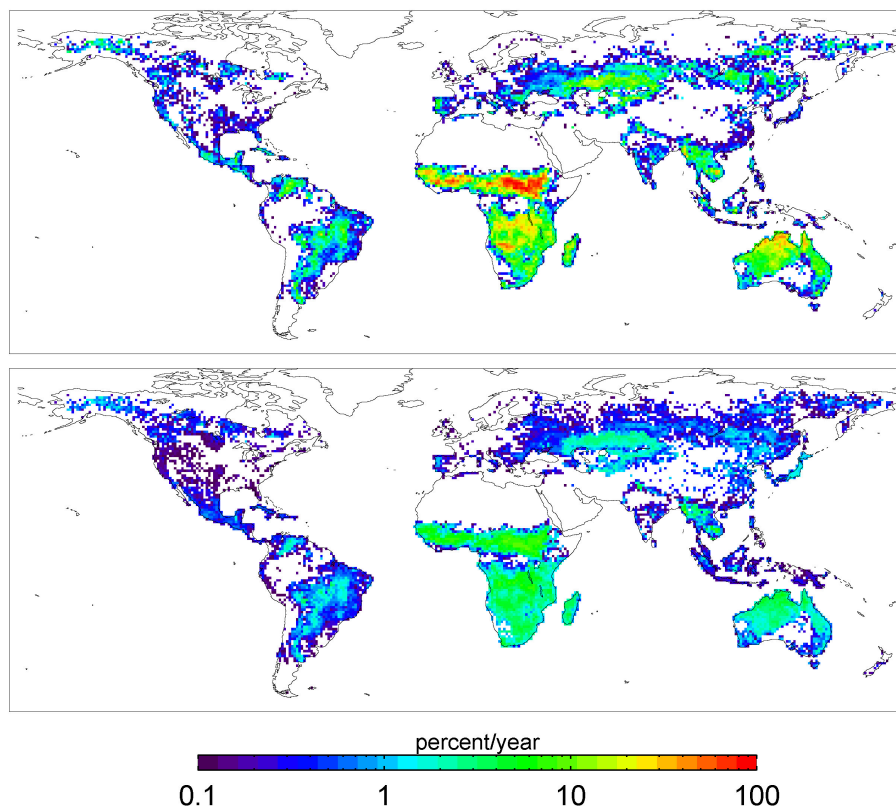
What is the impact of global biomass burning on the terrestrial biosphere and atmosphere, and how is this impact changing over time?

TQ2a: How are global fire regimes (fire location, type, frequency, and intensity) changing in response to changing climate and land use practices? [DS 198]

MODIS active fire detections 2000-2006 for Southern California



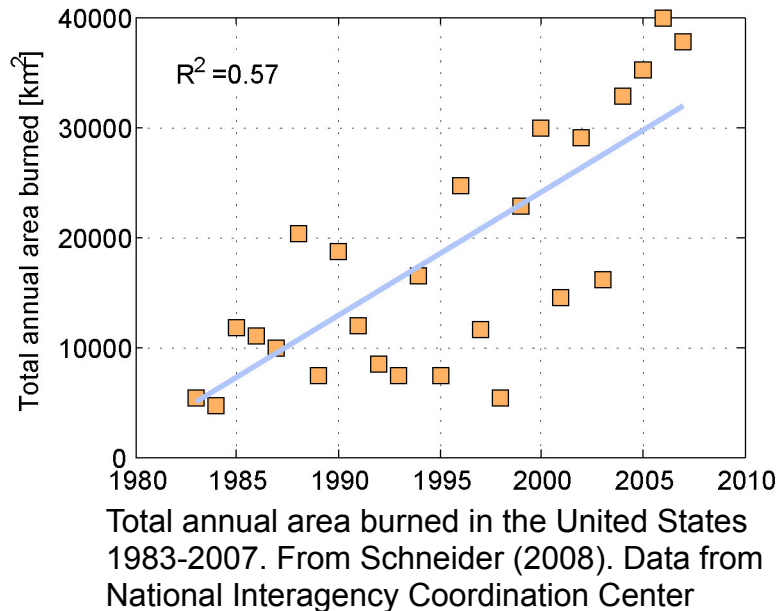
2001-2004 mean annual burned area derived from Terra MODIS active fire observations (top) and accompanying one-sigma uncertainties (bottom), expressed as fraction of grid cell that burns each year. From Giglio et al. (2005), *Atmos. Chem. Phys. Discuss.*, 5, 11091-11141



- Science issue
Fire regimes vary considerably on a regional and global scale. Mapping fire location, type, frequency, and intensity at different times can contribute to an understanding of how they are affected by a changing climate and land use patterns.
- Tools
Requires long-term regional or global data sets of thermal infrared imagery (low and normal gain channels at 4 and 11 μm). HypsIRI TIR data has a significantly improved capability of mapping flaming and smoldering fires. HypsIRIs greatly expanded spatial and temporal coverage can provide large sample sizes. Requires further pre-fire and post-fire thematic maps of climate variables and land use.
- Approach
The HypsIRI thermal infrared data will provide large samples of detailed fire characteristics that are useful for statistical modeling of fires and their behavior. The database of fire detections can be analyzed in conjunction with thematic data sets of climate and land use.

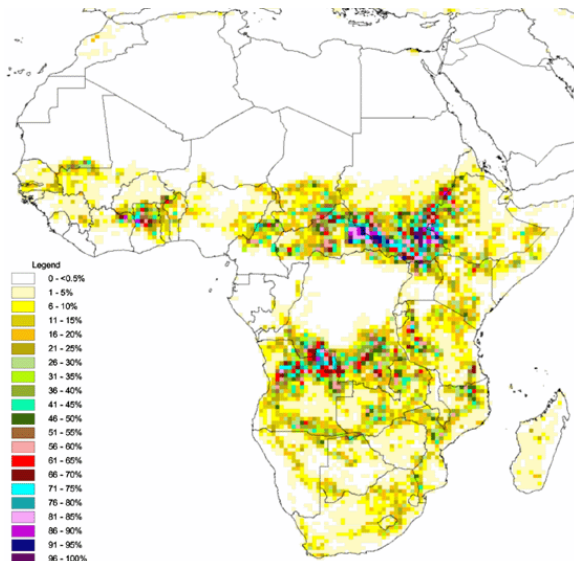
TQ2b: Is regional and local fire frequency changing?

[DS 196]



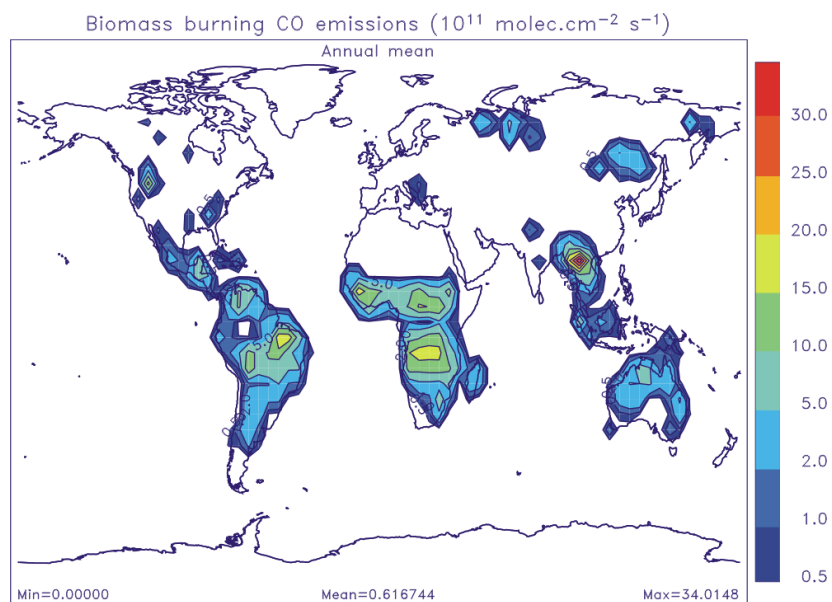
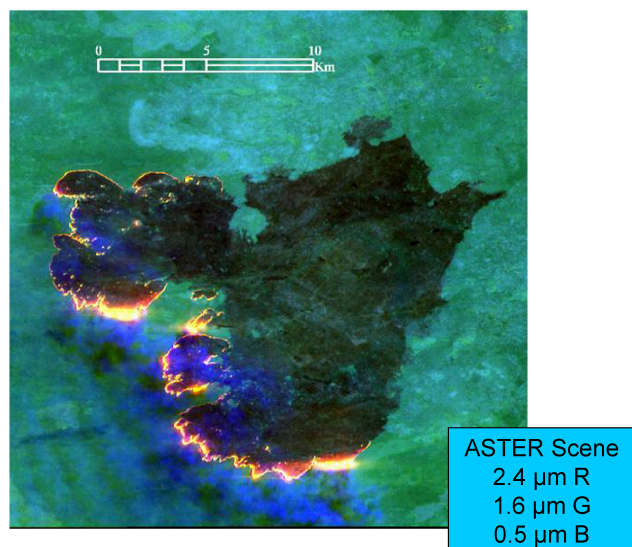
Percentage of total surface areas of each cell burned in the year 2000

From http://www-tem.jrc.it/Disturbance_by_fire/activities/occurglobal.htm



- **Science Issue**
A warming climate has the potential for increased fire activity and more severe fires. Statistics show an increase in burned area in some regions but more accurate detection of fire events, in particular fire size, is necessary
- **Tools**
Requires accurate detection of all fire types, including small agricultural fires and smoldering fires as small as ~10 sqm in size (difficult with coarser resolution sensors) and very hot fires, which often saturate existing sensors.
HypSIIRI TIR data has a greatly expanded spatial and temporal coverage compared to previous sensors, thus allowing for improved global fire mapping.
Requires historical context from other sensors with measurement intercalibration to establish a baseline
- **Approach**
Use HypSIIRI TIR imagery to develop a comprehensive database of global fire events and compare with existing data sets of fire occurrence to determine trends in fire activity

TQ2c: What is the role of fire in global biogeochemical cycling, particularly trace gas emissions? [DS 195]

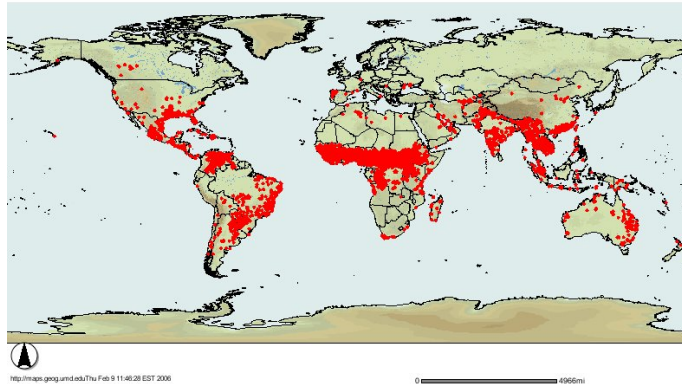


http://www.aeronomie.be/tropo/models/models_a_priori_emissions.htm

- Science issue
Emissions from fires, such as carbon, carbon dioxide, carbon monoxide, methane, nitrogen oxides, particulate matter etc, affect the atmosphere on a local, regional and global scale. However, quantifying and modeling the impacts of such emissions is challenging and more detailed satellite imagery of fires, such as provided by HypsIRI, can contribute to this task.
- Tools
Requires accurate fire detection including small and smoldering fires, fire monitoring, mapping of burn severity, and delineation of burned area. HypsIRI TIR data can detect fires as small as ~ 10 sqm in size. Also requires accurate measurements of fire temperature and fire area, as well as a fuel fire modeling element.
- Approach
Use systematically acquired HypsIRI TIR data to develop a regional database of fire occurrence and characteristics of individual fire events. Model trace gas emission using the obtained fire characteristics

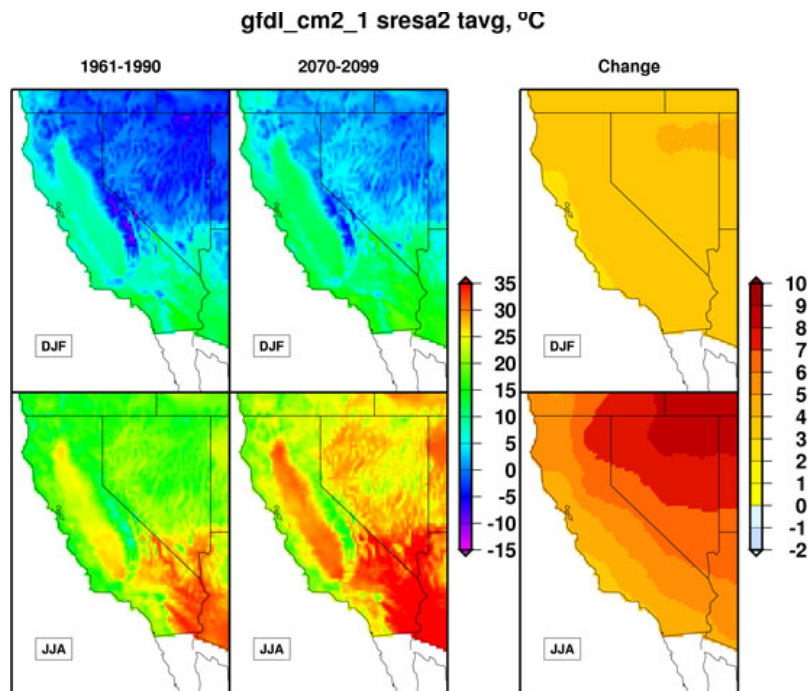
TQ2d: Are there regional feedbacks between fire and climate change?

HyspIRI can provide a more detailed database of fire events than traditional sensors (here the MODIS Active Fire Product)



http://maps.geog.umd.edu/images/modis_fire_global.jpg

Regional climate models are improving and can be used in conjunction with a fire database to investigate potential feedbacks



http://meteora.ucsd.edu/cap/images/CA_gfdl_cm2_1_sresa2_delta_tavg_1961_2070.jpg

- Science issue
Regional and global fire activity has the potential to affect regional climate, in particular through impacts on atmospheric transmission. Furthermore, climate change has the potential to affect regional fire regimes.
- Tools
The objectives for this task are mapping of the extent of the fire front and the confirmation of burn scars. Such measurements require the detection of flaming and smoldering fires as small as ~10 sqm in size
Requires satellite observations from HyspIRI, in particular its multispectral TIR capability to detect fires and monitor fire activity, as well as mapping fire temperature and fire area. Further requires information on pre-fire vegetation cover, fuel condition and fuel load, as well as output from regional climate models.
- Approach
Use systematically acquired HyspIRI TIR data to develop a regional database of fire occurrence and characteristics of individual fire events. Compare changes in regional fire activity with observed climate variables and with the output of regional climate models