The *FLAMES* Project

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RESEARCH TEAM

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ACKNOWLEDGEMENTS

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WEBSITE http://www.stat.osu.edu/~flames/

PUBLICATIONS

Munroe, D.K., Wolfinbarger, S., Calder, C.A., Shi, T., Xiao, N., Lam, C.Q, Li, D. (2007). The relationships between biomass burning, land-cover/use change, and the distribution of carbonaceous aerosols in mainland Southeast Asia: A review and synthesis. Department of Statistics Preprint No. 793, The Ohio State University. *Under Review.*

OVERVIEW

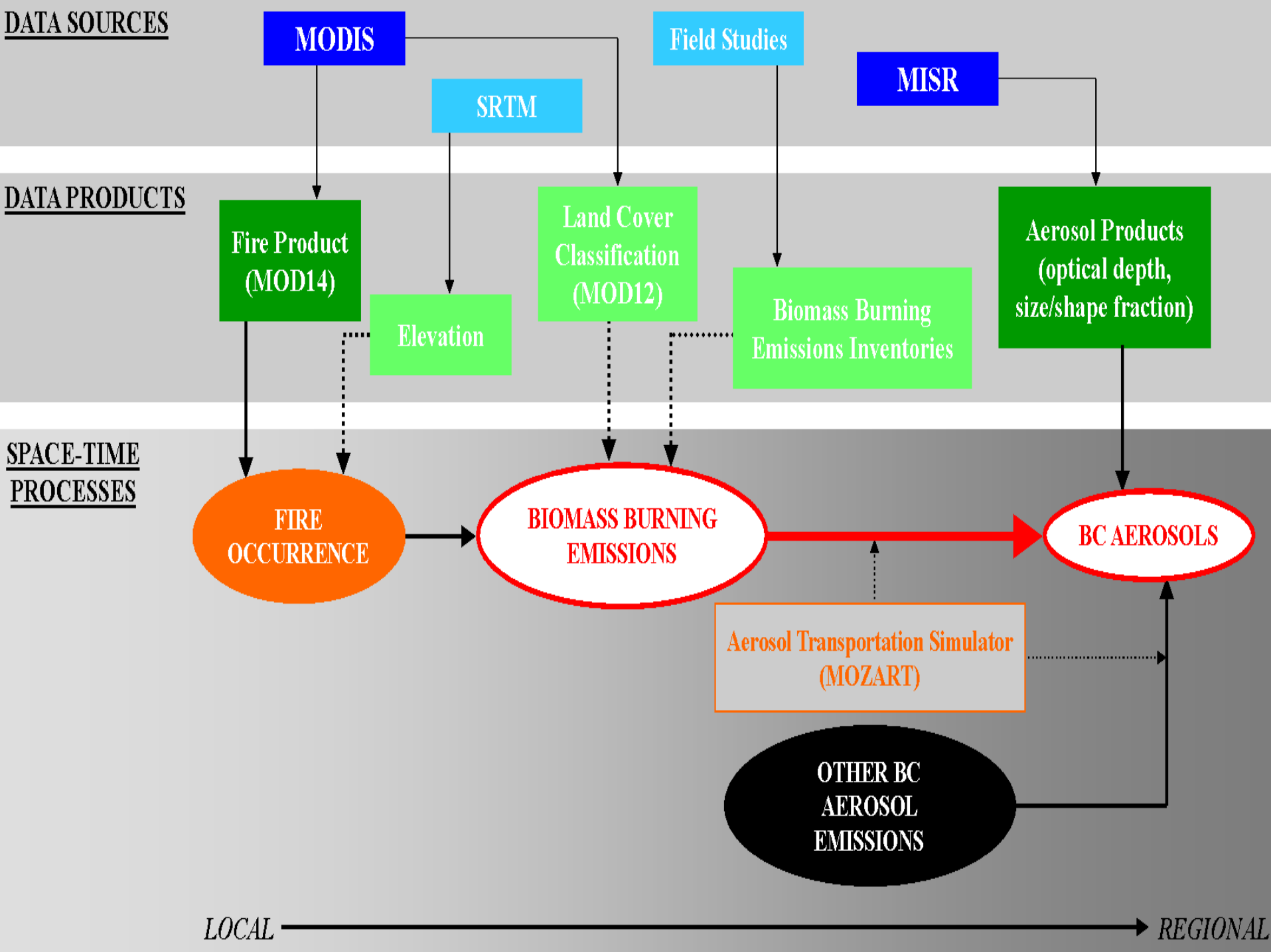
It is increasingly recognized that social and physical processes must be conceptualized and studied as an integrated system. Land-atmosphere relationships represent one major class of such integrated systems. Knowledge of these relationships is more developed for some phenomena than others. Large datasets exist on the relationship between land-use change and carbon dioxide (for a summary, see IPCC, 2001). On the other hand, the information on aerosol production resulting from land-use change is more limited, including how such changes will affect aerosol transportation patterns, precipitation states and efficiency. The **Fire-Land-Atmosphere Modeling and Evaluation for Southeast Asia (FLAMES) Project** is focused on exploring the relative effects of biomass burning (BB) in mainland Southeast Asia on the levels of carbonaceous aerosols within the region, directly accounting for the spatial structure of the biomass burning-aerosol relationship given air transport patterns.

OBJECTIVES

1. Construct a hierarchical Bayesian statistical model to formally account for sources of uncertainty and synthesize various types of relevant data, which are observed at different spatial resolutions and temporal scales and are often incomplete
2. Develop statistical methods to use the output of an aerosol transport simulator (MOZART) to characterize the dependence structure of the aerosol process over space and time
3. Contribute to the understanding of the implications of current land-use changes in Southeast Asia given the measured effects of biomass burning in the last 5 years on regional aerosol concentrations
4. Conduct scenario and sensitivity analyses at a regional level that advance the understanding of the implications of biomass burning

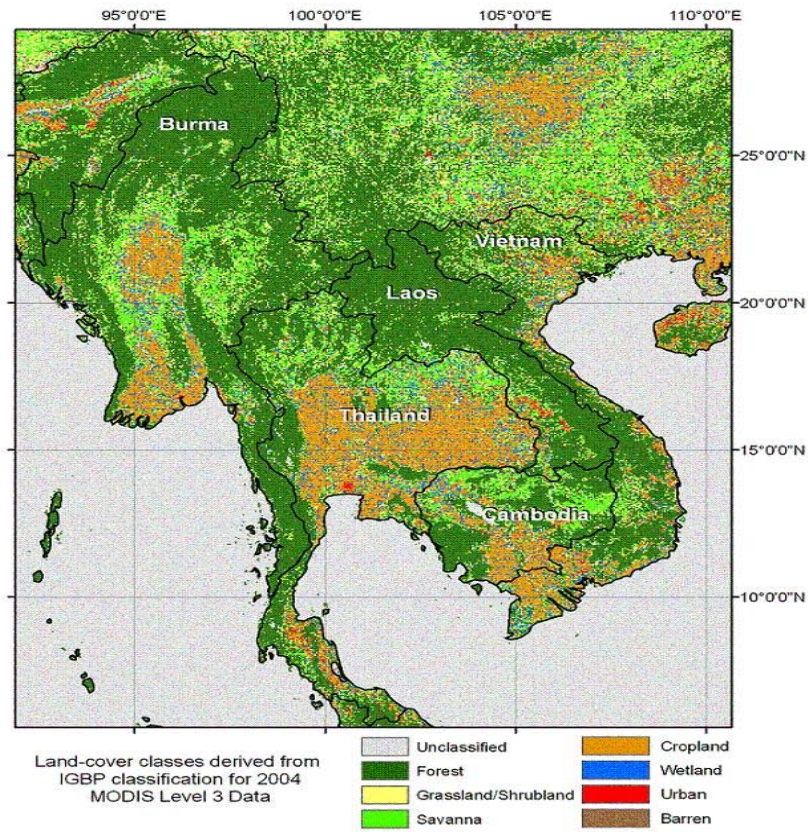
PROGRESS

- Developed Java-based applications to search, retrieve, modify, and display MODIS and MISR data, as an initial step toward an interactive web-based application to support regional scale studies
- Performed preliminary analyses to assess the relationships between fire occurrence, elevation, land cover, and aerosol composition and concentration
- Obtained output from the MOZART simulator and are currently using spatial statistical methods to characterize the space-time-atmospheric pressure dependence structure of the aerosol processes
- Reviewed and synthesized the existing literature on the biomass burning-aerosol relationship in the context of land use practices in Southeast Asia (see Munroe *et al.*, 2007)


DATA SOURCES
MODIS
Field Studies
MISR
SRTM
DATA PRODUCTS
Fire Product (MOD14)
Land Cover Classification (MOD12)
Aerosol Products (optical depth, size/shape fraction)
Elevation
Biomass Burning Emissions Inventories
SPACE-TIME PROCESSES
FIRE OCCURRENCE
BIOMASS BURNING EMISSIONS
BC AEROSOLS
Aerosol Transportation Simulator (MOZART)
OTHER BC AEROSOL EMISSIONS
LOCAL
REGIONAL

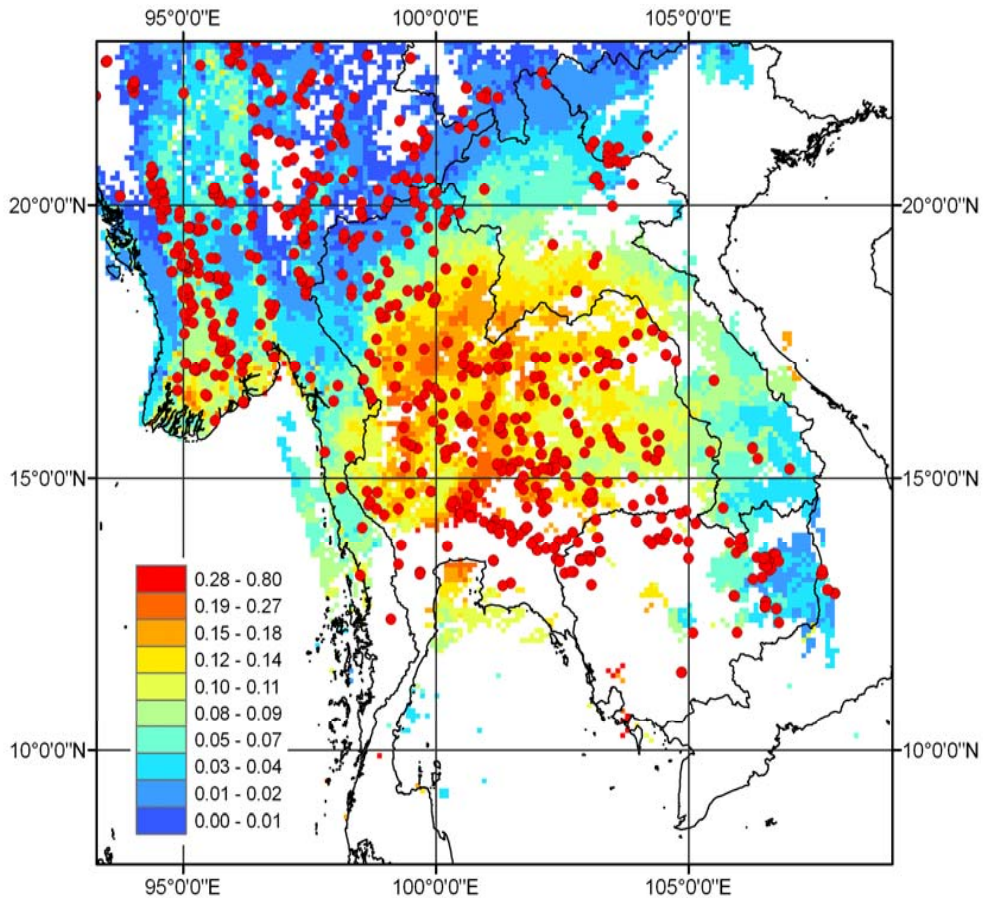
LAND-COVER CLASSIFICATION

IGBP classification for 2004 derived from MODIS level 3 data.



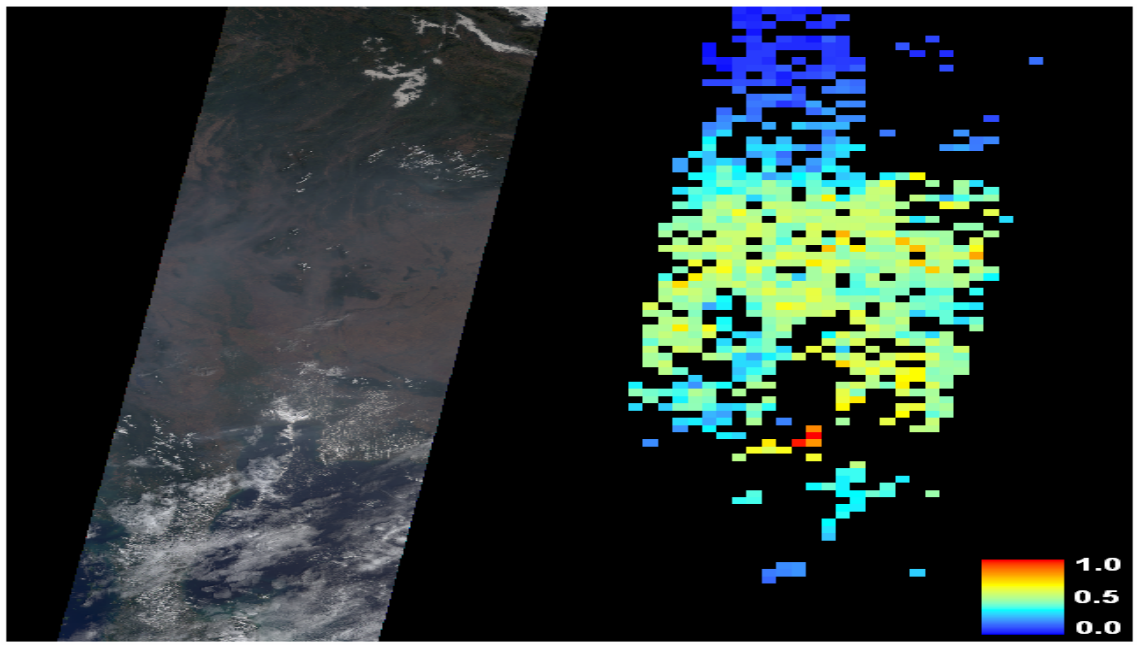
FIRE PRODUCT

MODIS product “Fire and Thermal Anomalies” provides the center point of a 1km resolution pixel where a fire has occurred (Justice et al., 2002). MODIS Level 2 Aerosol Optical Thickness (MOD04_L2 and MYD04_L2) are also shown.



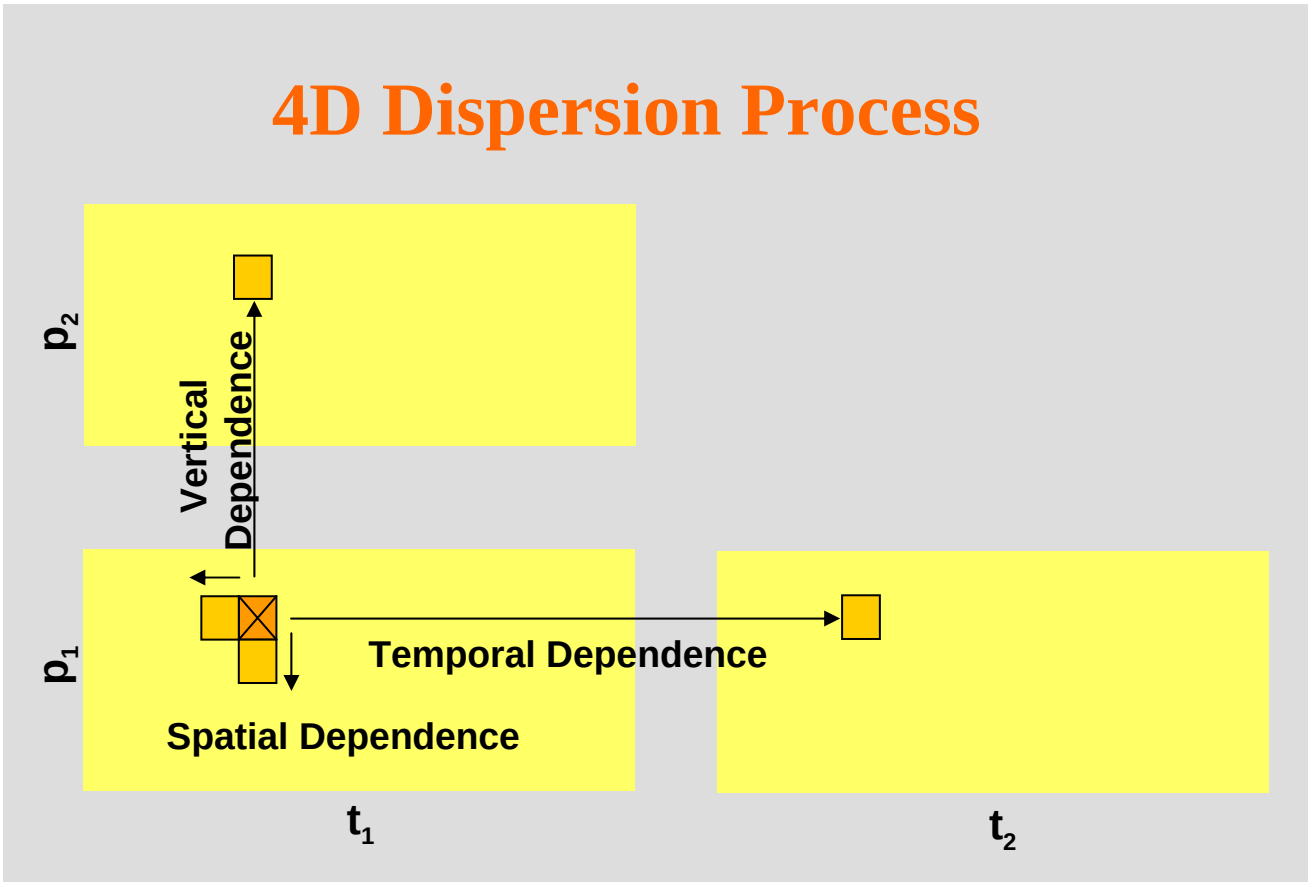
AEROSOL PRODUCTS

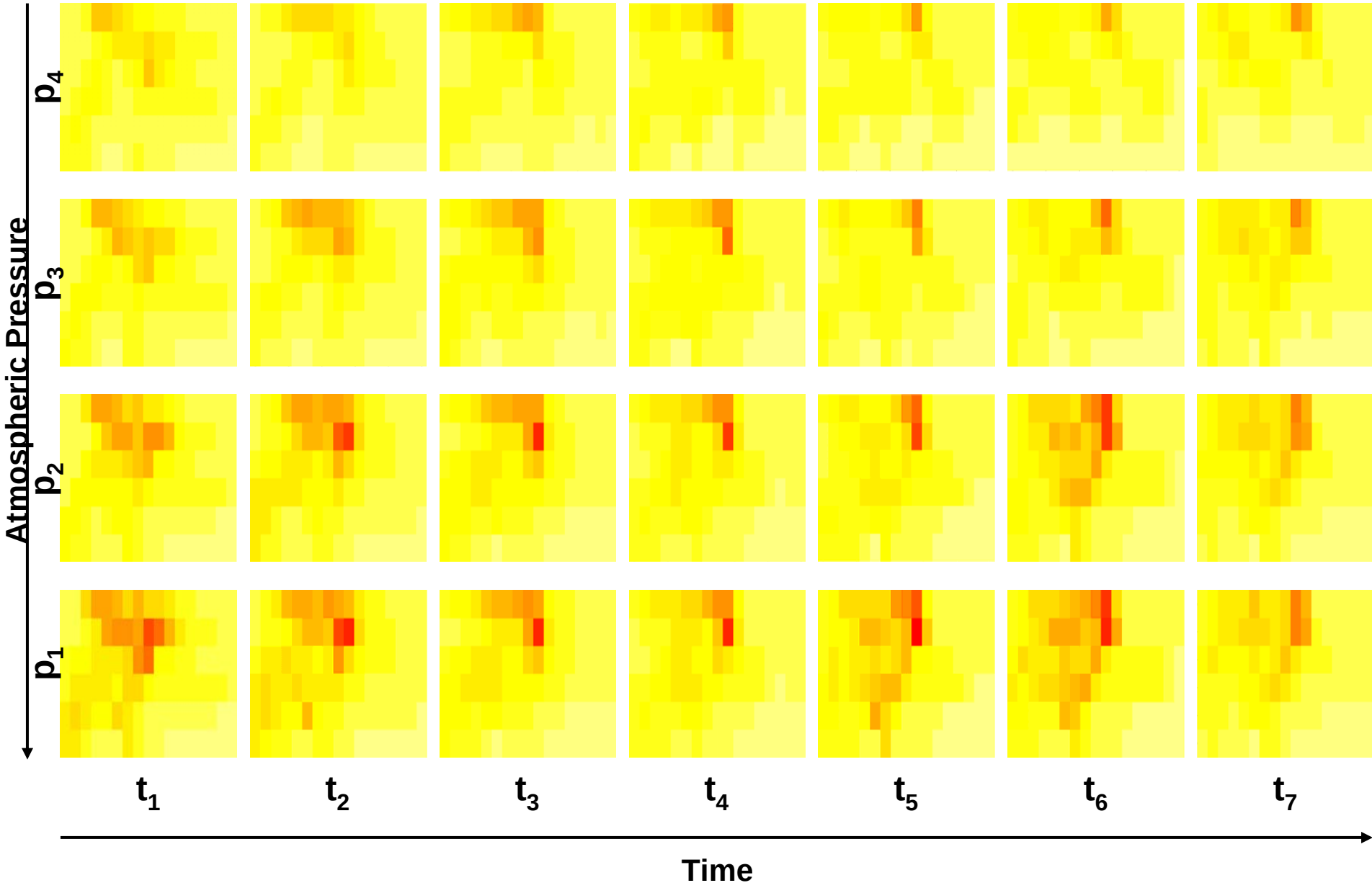
MISR products for aerosol composition: 17.6 km resolution optical depth, size and shape of aerosols, Angstrom component, and single-scattering albedo (Diner et al. 1998).



MOZART OUTPUT

NCAR's Model for Ozone and Related Chemical Tracers (MOZART) provides aerosol values (ppb) corresponding to 47.6 degree by 16.8 degree regions at atmospheric pressure layer p_i. This information will be use to characterize the space-time-air pressure dependence structure of the aerosol process in order to predict aerosol optical depth in regions where satellite measurements are not available.




Atmospheric Pressure
p4
p3
p2
p1
t1
t2
t3
t4
t5
t6
t7
Time