MODIS Science Data Support Team

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SAIC/GSC

MODIS Science Team Meeting

May 3, 1995

BARBARA PUTNEY
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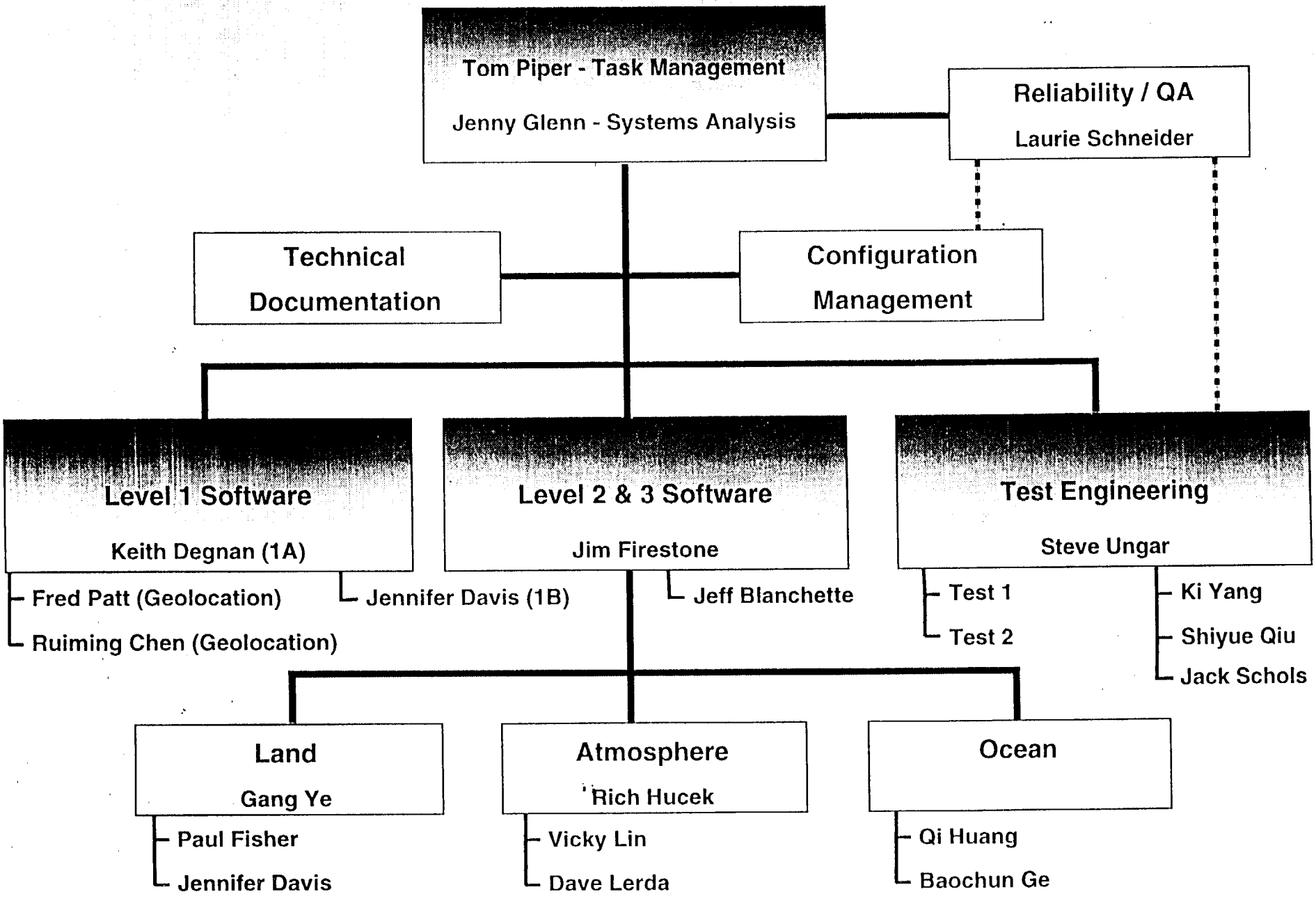
Integration Lead for Atmosphere and Land

Previous Experience

ESDIS-Science Software Systems Manager

Space Geodesy
Software Manager for GEODYN Orbit Determination
and Parameter Estimation Computer System
(500,000+ lines of code)
Manager of TOPEX/Poseidon Precsion Orbit
Determination Production System
Manager of Earth Models that included gravity,
solid earth and ocean tides, polar motion, station locations, GM

MODIS Science Data Support Team



We Need From You

- Data Product Reference Handbook Write-up
  - What: 1 page description of your product
  - Why: Project requirment for June IWG
  - When: May 1995

- Science Product Q/A Plan
  - What: Panel Discussion
  - Why: Team Leader Agreement
  - When: June 1995

What We Need From You

- Data Product Catalog, ICDs
  - What: Describe product at bit level
  - Why: Team Leader Agreement, s/w integration, inform community
  - When: June 1995

- Validation Plan
  - What: Panel discussion
  - Why: Team Leader Agreement
  - When: December 1995

Interface Control Documents

- Developed and maintained by Science Team
- Describe format and content of data product
- Provide characteristics of the data
- Describe quality control flags
- Describe validation of data product
- SDST acts as collection and distribution point

What We Need From You

- Level 2 Beta 3 Science Software
  - What: Integrated science software (swath)
  - Why: To meet Beta delivery schedule
  - When: July 1995

- Level 3 Beta 3 Science Software
  - What: Integrated science software (grid)
  - Why: To meet Beta delivery schedule
  - When: August 1995

Beta 3 Science Software

- Uses MODIS radiances
- Reads ancillary data
- Performs limit checking (cloud, land, scan)
- Performs error handling
- Output is product described in your ICD
- Reads output of product above it in a processing thread

Beta 3 Software Also Includes

- SDP Toolkit (file I/O, messaging, Process Control File, memory allocation)
- MODIS Level 2 API (swath, HDF based)
- MODIS Level 3 API (ISSCP grid, incremental processing)

Status of Delivered Code

Product (per code)	Receipt Date (B2)	Code Testing	Standards Compliance	SDP Toolkit Integration
MOD04: Aerosol over land	2/1/95	Done	ESDIS	PCF, Gen-I/O
MOD04: Aerosol over sea	2/28/95	To be done in beta 3		
MOD05: Preciptable Water, NIR	10/1/94	Done	ESDIS	PCF, Gen-I/O
MOD06: Cloud Phase Thermal IR	1/1/94	Done	In progress	To be done by ST
MOD06: Cloud Drop	10/1/94	Done	To be done in beta 3	
MOD06: Cloud Top Properties	8/1/94	Done	To be done in beta 3	
MOD07, 08, 30, 38: Profiles	1/1/94	Done	To be done in beta 3	
MOD35: Classification Masks	1/1/95	Done	To be done in beta 3	
MOD18-28,31-32,36-37,39: Oceans	4/28/95 (B3)	To begin 5/1/95		

Status of delivered Code (continued)

Product (per code)	Receipt Date (B2)	Code Testing	Standards Compliance	SDP Toolkit Integration
MOD09/13: SR & VI	2/27/95	Done	ANSI	PCF, Gen-I/O
MOD09: BRDF	10/1/94	Done	ANSI	To be done in b-3
MOD10: Snow Cover	1/1/95	Done	ESDIS	PCF, Gen-I/O
MOD11: LST & Emissivity	11/1/94	Done	To be done in beta 3	
MOD12: Land Cover	10/1/94	Done	To be done in beta 3	
MOD14: Fire	4/13/95	Done	ANSI	PCF, Gen-I/O
MOD29: Sea_Ice Max Extent	1/27/95	Done	ESDIS	PCF, Gen-I/O
MOD33: Gridded Snow Cover	1/1/95	Done	ESDIS	PCF, Gen-I/O
MOD02: Level-1B	11/3/94	Done	ANSI	To be done in b-3

Beta 3 Software Delivered

MCST Level 1B

OCEAN Team (SeaWiFS)

- MOD18 Atmospheric Correction - Gordon
- MOD19 Pigment Concentration - Clark
- MOD21 Chlorophyll - Clark & Carder
- MOD22 PAR, IPAR - Carder (Gordon)
- MOD25 Detached Coccolith - Gordon
- MOD26 Ocean Water Atten. - Clark
- MOD37 Aerosol Properties - Gordon

Schedule

May 1995

- Level 2 API (swath) C
- Data Product Reference Handbook

June 1995

- Level 2 API (swath) FORTRAN
- Science Q/A plan
- ICDs, Data Product Catalog
- Software for ISSCP grid

Schedule

July 1995

- Level 2 science s/w (using MODIS bands and products)

August 1995

- Level 3 science s/w (using MODIS L2, L3 products)
- Final SCF Plan
- Level 2 processing scripts and threads done

Schedule

October 1995

- Level 1 and Level 2 system test begins
- Level 3 processing threads and scripts done

November 1995

- Level 1 and 2 system test completed
- Level 3 system test begins

December 1995

- Documentation for DAAC completed
- Level 3 system test ends
- MODIS science validation plan completed

Schedule

January 1996

- End-to-end system test complete
- Beta release baselined
- Delivery to DAAC

April 1996

- Integration and debug of MODIS s/w at DAAC complete

Test Data

Dr. Albert Fleig, University of Maryland
MODIS Science Data Support Team

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301-286-7747

SIMULATED DATA

Two primary products
- Complete test data sets
- Tools for making test data on order

Available in a series of builds
- First useful data set available this month
- Several planned upgrades
- Input as to what is useful needed from Science Team

JOINT EFFORT
- Implementation and production by Yang, Qiu, Fleig
- Investigations and theory by Ungar, Harnden, Barker, and Schols

FIRST BUILD DATA SET

Available this Month

Correct Viewing Geometry
- EOS Orbit, 1 day, 3 orbits over continental US (and Ocean)
- MODIS scan pattern with bowtie
- MODIS Level 1B format (250m and 500m data are replicates)
- Sun Earth geometry as a function of time, date, location
- Spectral Irradiance at 1-5cm^{-1}

All 36 Channels with actual bandpass

Atmospheric correction based on MOSART (AF Phillips Lab)
- U.S. standard atmosphere 1976,

Single surface temperature (boundary layer from atmosphere)

Mixture of 16 surface classes from PRA with 4 km resolution

Lambertian surface with reflectance a function of wavelength

ETOPO5 terrain height

FUTURE BUILDS

Include BRDF classes from Strahler/Warner

Higher resolution surface classification (artificial)

Varying surface temperature

Global coverage

More days

Better ocean data from SeaWIFS model or reality

Flat opaque clouds

More camera model effects
- ghosting
- triangular weighting function
- noise
- band to band misregistration
- geolocation errors

NEED FROM THE SCIENCE TEAM

What features should be included to exercise the paths through your level 2 and 3 algorithms?

What surfaces and atmospheres should be added?

Is there any test data you would like from us to enable you to debug the connections for your algorithms as you develop them?

Do you have sets of reflectance and emissivity for various classes (e.g. as a function of time) that you would like us to use?

Do you have any preferred priority for the enhancements we will make?

Simulated Data

Dr. Steven Ungar, GSFC
MODIS Science Data Support Team

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301-286-4007

Simulated MODIS USA Scenes

- 36-band MODIS USA scene (1534x1534), with bands defined by MODIS bandpass specs. Includes single atmospheric correction, but variable illumination. Flat CCD array geometry.

- MODIS simulated USA scene refined to include the MODIS instrument response (filter) functions supplied by Ed Knight.

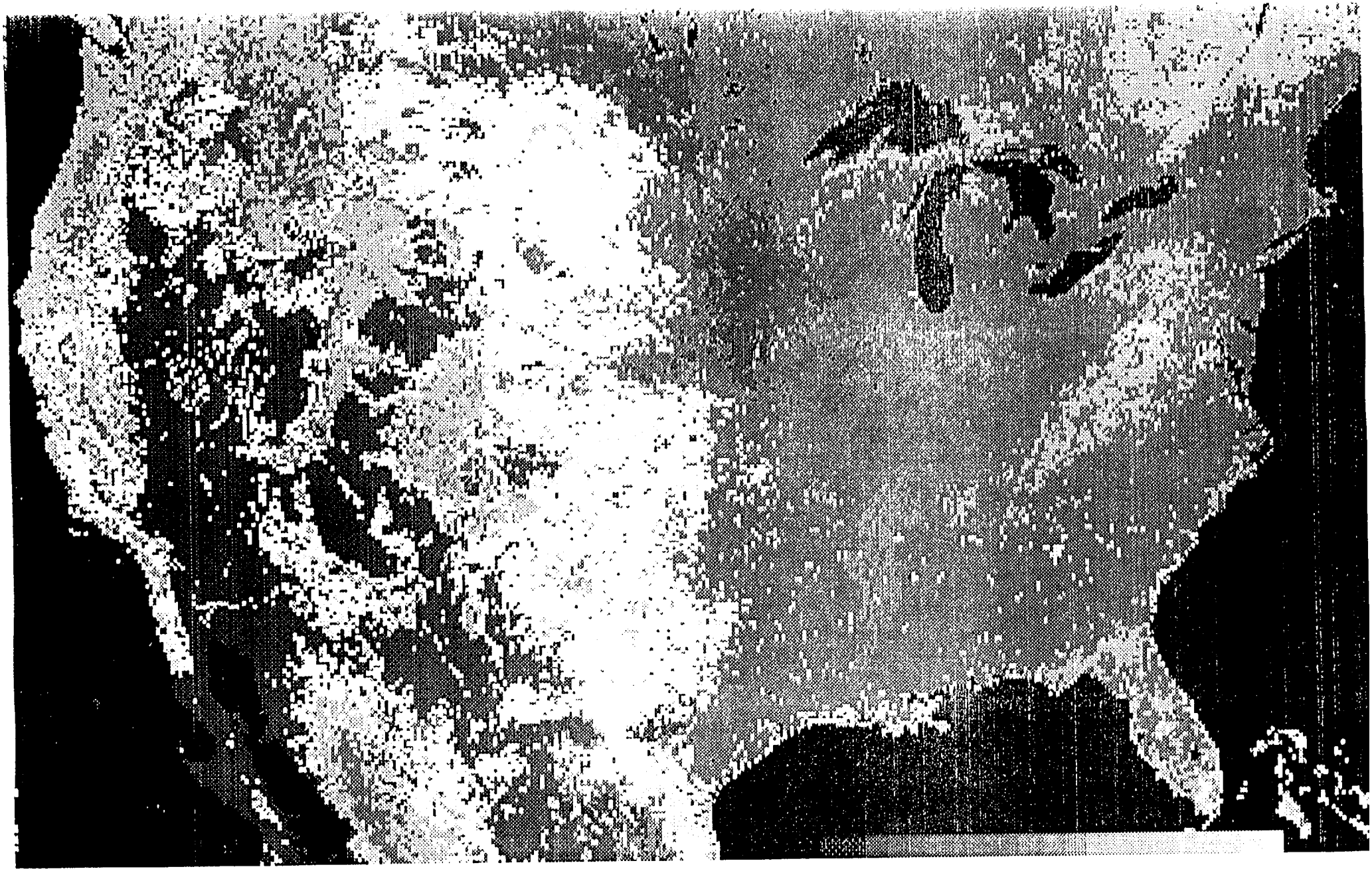
- The next level of refinement will include an improved representation of the MODIS scan geometry and variable atmospheric path length.

Simulated MODIS Scene Characteristics

- 1354 X 1354 pixels (1.7 km average size)
- full MODIS FOV (~2300 km)
- 36 Channels (using SBRC filter func's)
- 40°N 90°W on July 12 at 16:30 GMT
- Mid-latitude Summer St'd Atmosphere
- Elevations derived from ETOPO5
- Surface Spectral Optical Properties from 4 km "Ground Truth"

Simulated MODIS 4 km "Ground Truth"

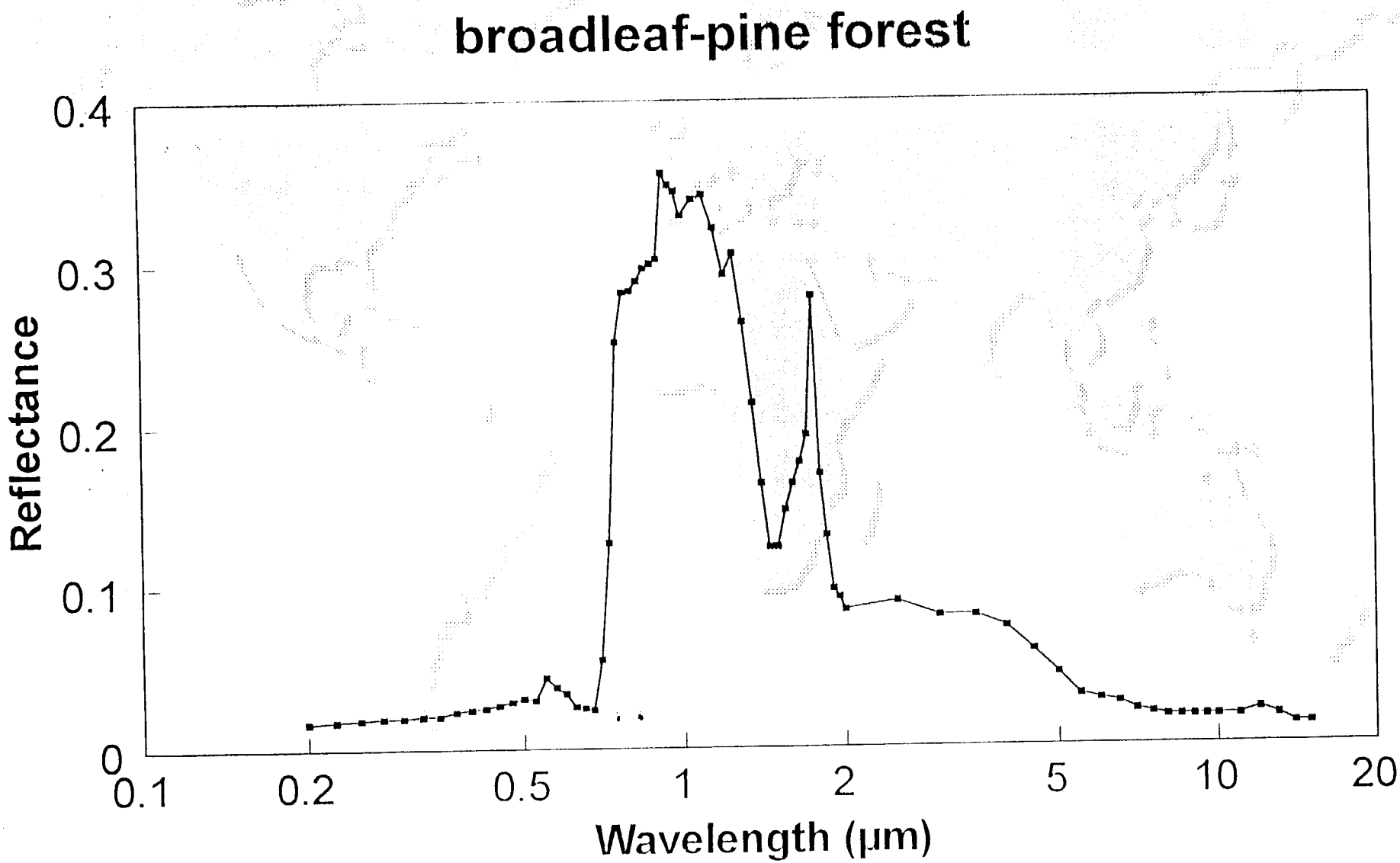
- Each Ground Truth element consists of:
  - Primary Surface Type (11 categories)
  - Secondary Surface Type (16 Categories)
  - Mixture Ratio (percent of Primary)
  - Elevation (in meters)
- Surface Type assignment based on classification of eight 1 km AVHRR NDVI images from March to November 1991.
- Mixture Ratio based on the July 5-18, 1991 NDVI image.
- Elevations based on ETOPO5 (~9 km).



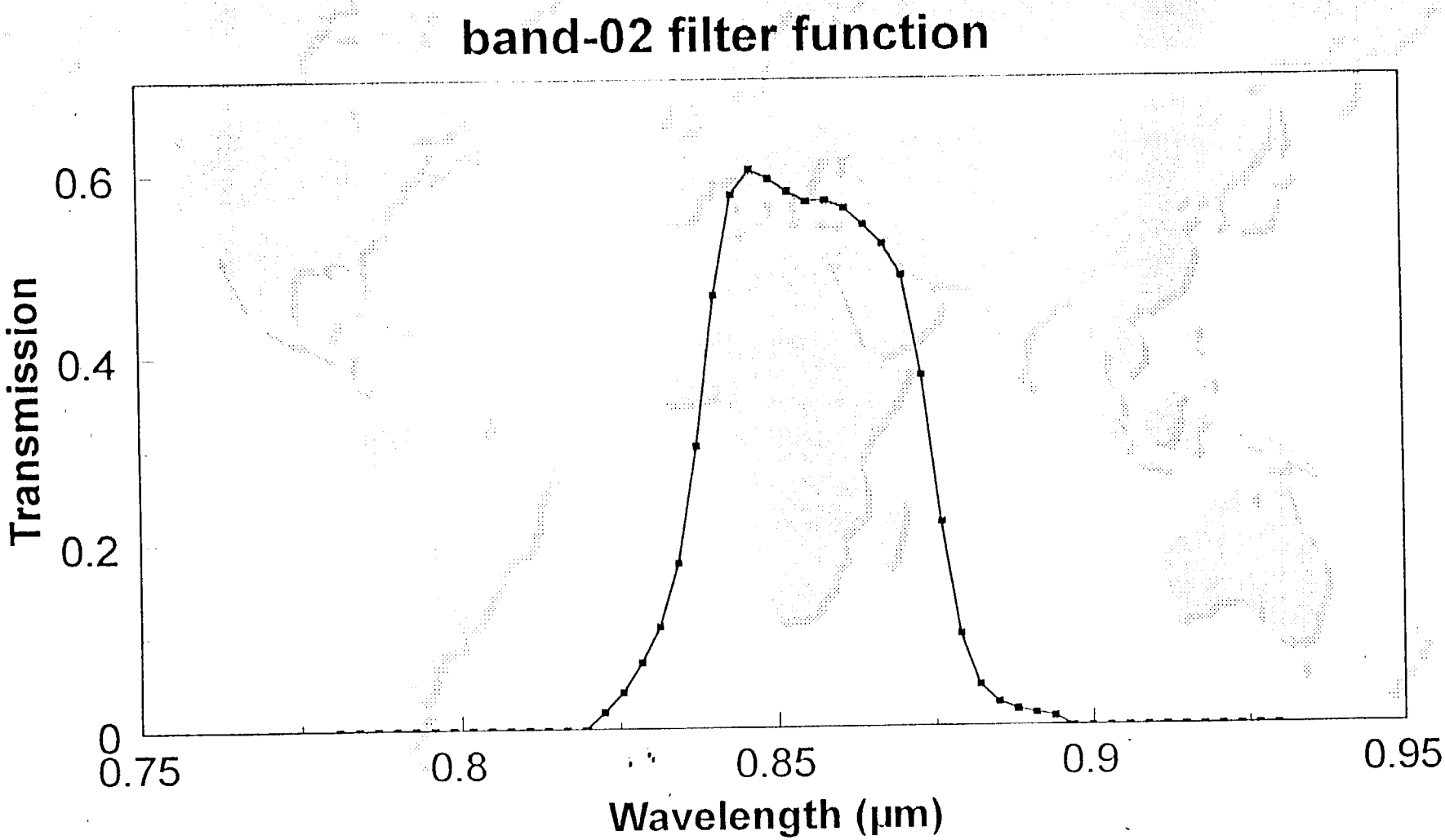
Simulated MODIS Surface Types

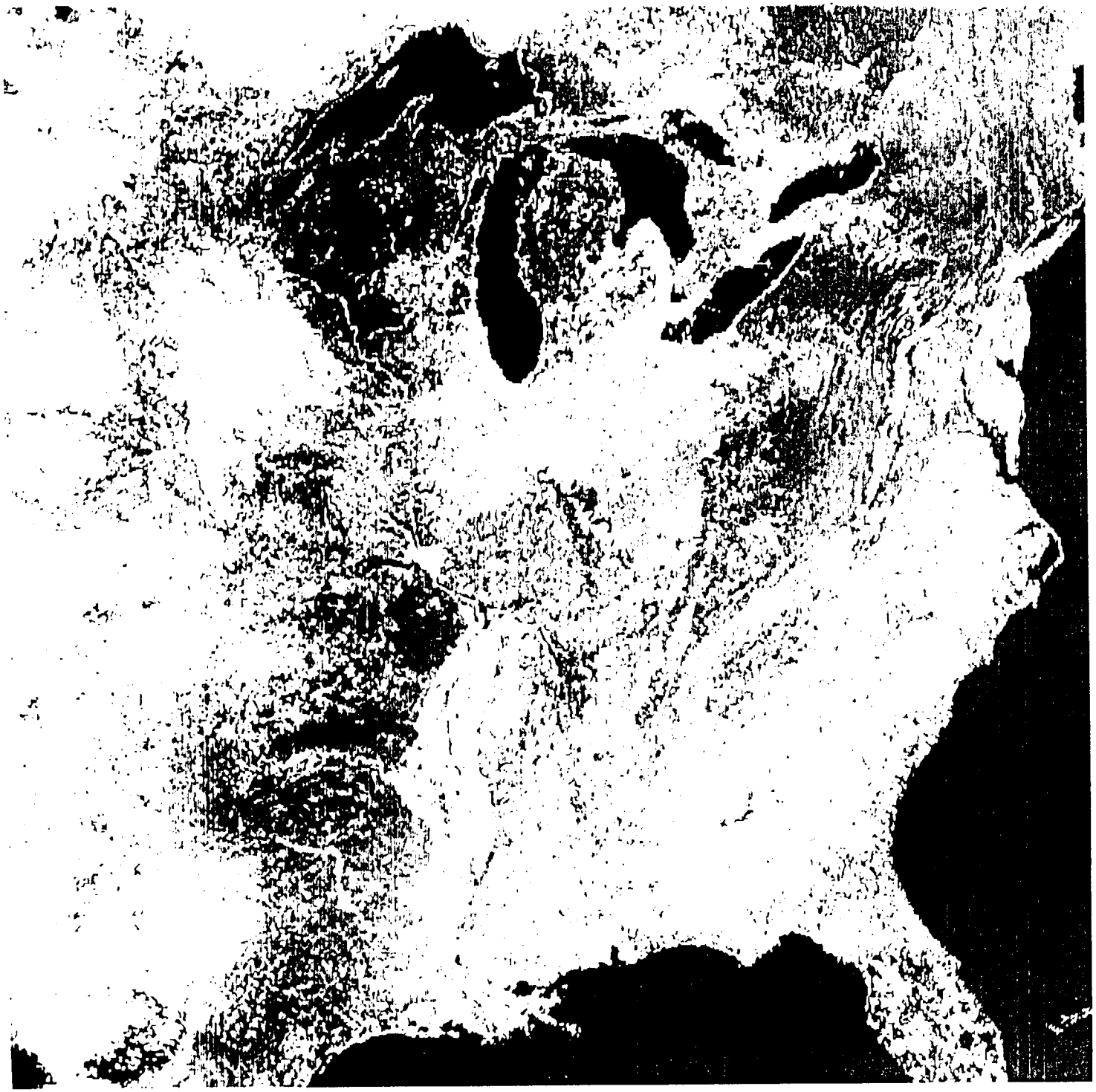
- water
- old snow (1000 μm radius)
- fresh snow (50 μm radius)
- compacted soil
- tilled soil
- sand
- rock
- irrigated low vegetation
- meadow grass
- scrub
- broadleaf forest
- pine forest
- tundra
- grass-soil
- broadleaf-pine forest
- grass-scrub
- soil-grass-scrub
- urban commercial
- pine-brush
- broadleaf-brush
- wet soil
- scrub-soil
- broadleaf 70-pine 30

Simulated MODIS Spectro-optical Properties



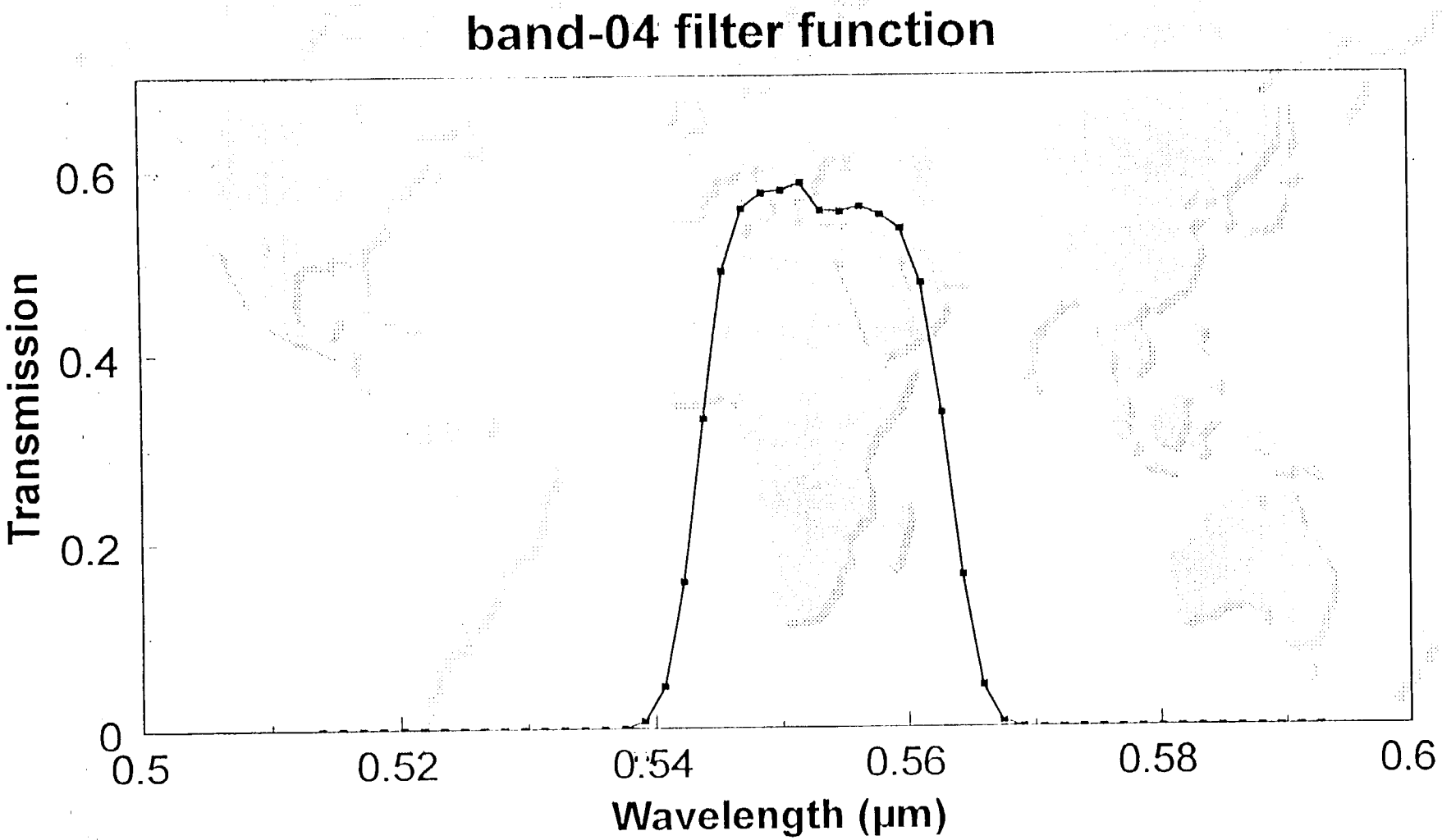
Simulated MODIS Instrument Response Func's

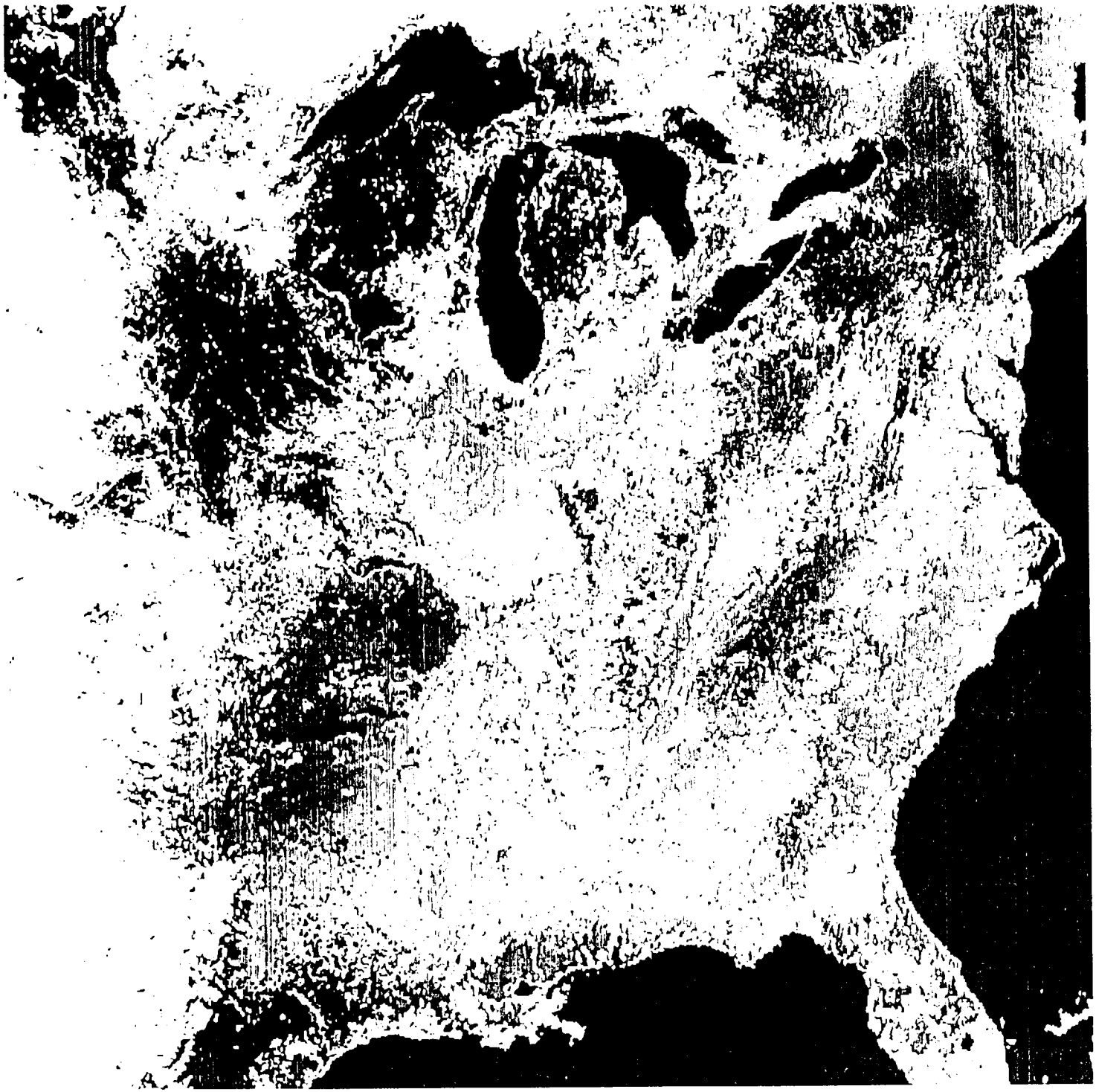




HiFlyer MODIS Swath (10:30 lt)
Uniform Summer Mid-Lat Atmo
Square Bandpass 02

Simulated MODIS Instrument Response Func's





HiFlyer MODIS Swath (10:30 lt)
Uniform Summer Mid-Lat Atmo
Square Bandpass 04

Simulated MODIS FTP Internet Access

- Use anonymous FTP to highwire.gsfc.nasa.gov
- Change to directory (cd) "/pub/modsim"
- This directory contains the following files, where the band index *nn* ranges from 01 to 36:
  - file.description — index of files in directory
  - README — simulation documentation
  - usa.*nn*.img — TOA radiances for band *nn*
  - modis_*nn*.flt — band *nn* filter function (ff)
  - usa.*nn*.filter.img — radiances convoluted with ff