

UW-CIMSS MURI Management & Progress Report

John R. Mecikalski
(Program Manager)

- MURI Work Breakdown Schedule
- UW & UH Co-Investigator Interactions
- Tasks of UW–MURI
- Progress Reports: The UW & other Co-Is
- Overall Status

GIFTS/IOMI WBS & Personnel Allocation

Allen Huang (PI)
John Mecikalski (PM)

MURI

Students: Kate LaCasse (DA)
Jon Moskaitis (DA)
seeking others

Jun Li
Fegying Sun

Dave Tobin
Leslie Moy

Bormin Huang

Derek Posselt
John Mecikalski

1st Order

Retrieval Algorithms

Forward Modeling

Information Content

Numerical Modeling

Wayne Feltz
John Mecikalski

Steve Ackerman,
I. Sokolik (UC-B)

G. & R. Dengel,
Chris Velden

Bormin Huang

2nd Order

Stability & Turbulence

Dust & Visibility

PBL Winds

Sea Surface Temperature

Paul Lucey
(UH-HIGH)

Surface Characterization

Clouds & Cloud Modeling

Ping Yang
(UT A&M)
G. Jedlovec
(UAH)

UW-CIMSS Support Staff: Hal Woolf, Elizabeth Weisz, Erik Olson, Dave Santek, Kristopher Bedka

Co-Investigator Interactions for Proposed Tasks

NWP Support

Derek Posselt
John Mecikalski
Michael Morgan

Aerosols & Dust

Steve Ackerman
Irina Sokilik (UCB)
Ping Yang (A&M)

Clouds

Ping Yang (A&M)
Gary Jedlovec (UAH)
Steve Ackerman

IOMI/GIFTS Retrievals

Allen Huang
Jun Li
Paul Lucey
Dave Tobin
Leslie Moy
Bormin Huang

Surface Characterization

Paul Lucey (HIGP)
Allen Huang
Wayne Feltz

Forward Models

Dave Tobin
Leslie Moy
Bormin Huang
Hal Woolf

Atmospheric Parameters

Wayne Feltz
John Mecikalski
Chris Velden

MURI-CIMSS Subcontracts: FY03

Texas A&M:

Dr. P. Yang

- Cloud parameterization
- Cloud RTE

U. Colorado-Boulder:

Dr. I. Sokolik

- Dust and Aerosol identification
- Hyperspectral analysis of dust

U. Alabama:

Drs. G. Jedlovec,

S. Christopher

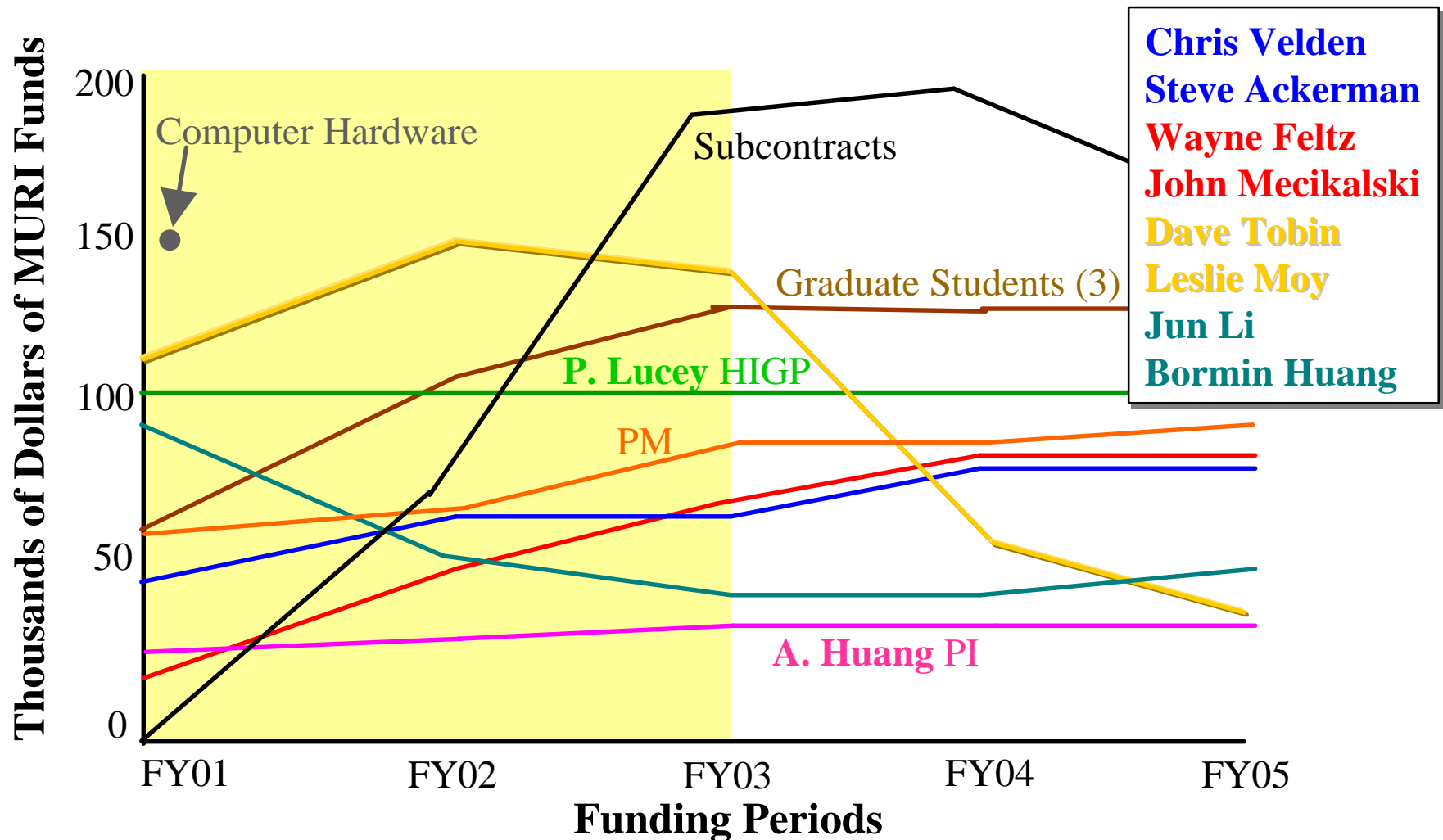
- Cloud identification
- Cloud parameters from hyperspectral IR

U. Hawaii:

Dr. P. Lucey

- Surface emissivity
- Hyperspectral analysis of surface characteristics

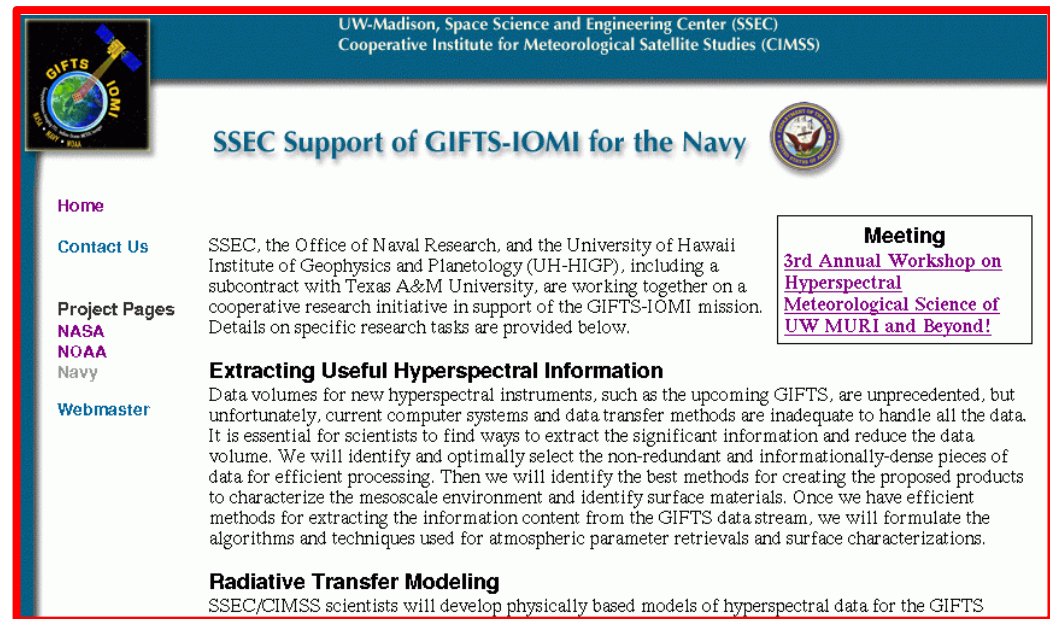
Investigator Funding Schedule for UW & UH MURI



3rd Annual Workshop on Hyperspectral Meteorological Science of UW-MURI and Beyond
28-29 May 2003, Madison, Wisconsin

Co-Investigator Interactions for Proposed Tasks

- Monthly CIMSS Meetings and Monthly Presentations
- Teleconference with UH-HIGP
- Discussions with Subcontractors
- UW-MURI Web Page:
- Data Sharing
- Model Sharing
- Joint Publications
- Billing & Progress Reporting

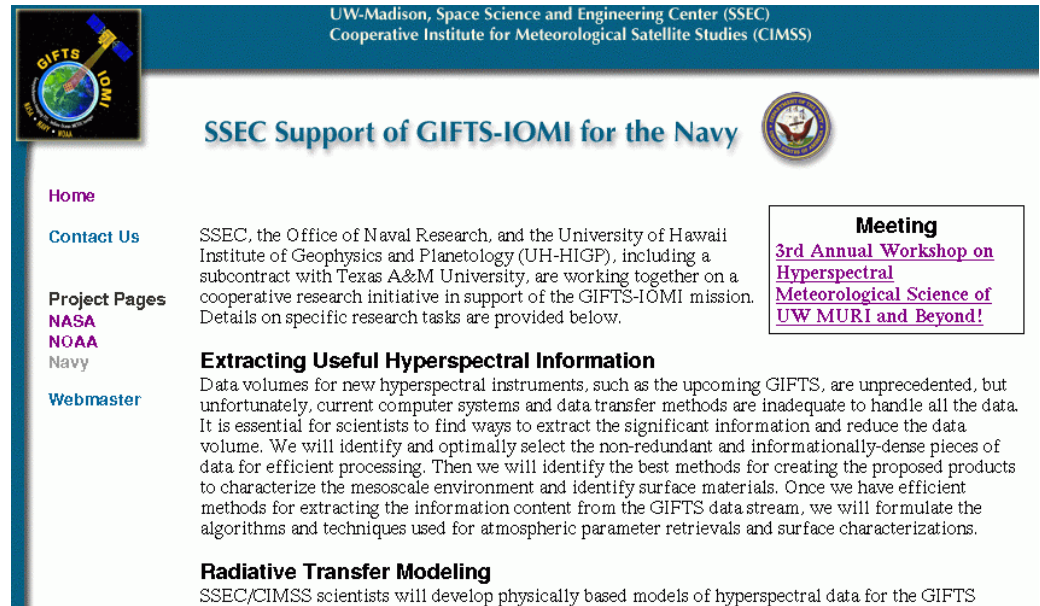


The screenshot shows a website header with the text "UW-Madison, Space Science and Engineering Center (SSEC) Cooperative Institute for Meteorological Satellite Studies (CIMSS)". The main title is "SSEC Support of GIFTS-IOMI for the Navy". A navigation menu on the left includes "Home", "Contact Us", "Project Pages" (with sub-links for NASA, NOAA, and Navy), and "Webmaster". The main content area contains a paragraph about the cooperative research initiative, a section titled "Extracting Useful Hyperspectral Information" with a detailed description of data processing challenges and solutions, and a section titled "Radiative Transfer Modeling" stating that SSEC/CIMSS scientists will develop physically based models of hyperspectral data for the GIFTS mission. A "Meeting" box on the right highlights the "3rd Annual Workshop on Hyperspectral Meteorological Science of UW MURI and Beyond!".

Progress & Status Management

- Monthly CIMSS MURI Budget Meetings
- Program Manager involvement in Expenditures
- Co-I Billing & Communications

- Through the UW-MURI Page:



UW-Madison, Space Science and Engineering Center (SSEC)
Cooperative Institute for Meteorological Satellite Studies (CIMSS)

SSEC Support of GIFTS-IOMI for the Navy

Meeting
[3rd Annual Workshop on Hyperspectral Meteorological Science of UW MURI and Beyond!](#)

Extracting Useful Hyperspectral Information
Data volumes for new hyperspectral instruments, such as the upcoming GIFTS, are unprecedented, but unfortunately, current computer systems and data transfer methods are inadequate to handle all the data. It is essential for scientists to find ways to extract the significant information and reduce the data volume. We will identify and optimally select the non-redundant and informationally-dense pieces of data for efficient processing. Then we will identify the best methods for creating the proposed products to characterize the mesoscale environment and identify surface materials. Once we have efficient methods for extracting the information content from the GIFTS data stream, we will formulate the algorithms and techniques used for atmospheric parameter retrievals and surface characterizations.

Radiative Transfer Modeling
SSEC/CIMSS scientists will develop physically based models of hyperspectral data for the GIFTS

Home
Contact Us
Project Pages
NASA
NOAA
Navy
Webmaster

Contact with ONR

- Annual Progress Reports
- Monthly Budget Reporting
- Annual MURI Workshops
 - Seek Direct Feedback from ONR
 - Guide research with ONR interactions
 - MURI Research Demonstrations
- PM & PI Visits with Subcontractors
- Again, through the UW-MURI Web Page

Tasks for UW-MURI

1 Mathematical Quantification of Useful Hyperspectral Information

2 Radiative Transfer Modeling

- **Clear Sky Emission/Absorption**
- **Atmospheric Particulate Emission/Absorption**
- **Surface Emission/Absorption**

3 Mathematical Retrieval Algorithm Development

- **Atmospheric Parameters**
- **Suspended Particulate Detection and Quantification**
- **Sea Surface Temperature**
- **Surface Material Identification**

4 Product Research

- **Ocean Surface Characterization**
- **Lower Tropospheric Temperature, Moisture and Winds**
- **Surface Material Products**
- **Aerosols**
- **Derived (Second Order) Products**

Progress Reports: The UW & UH Co-Is

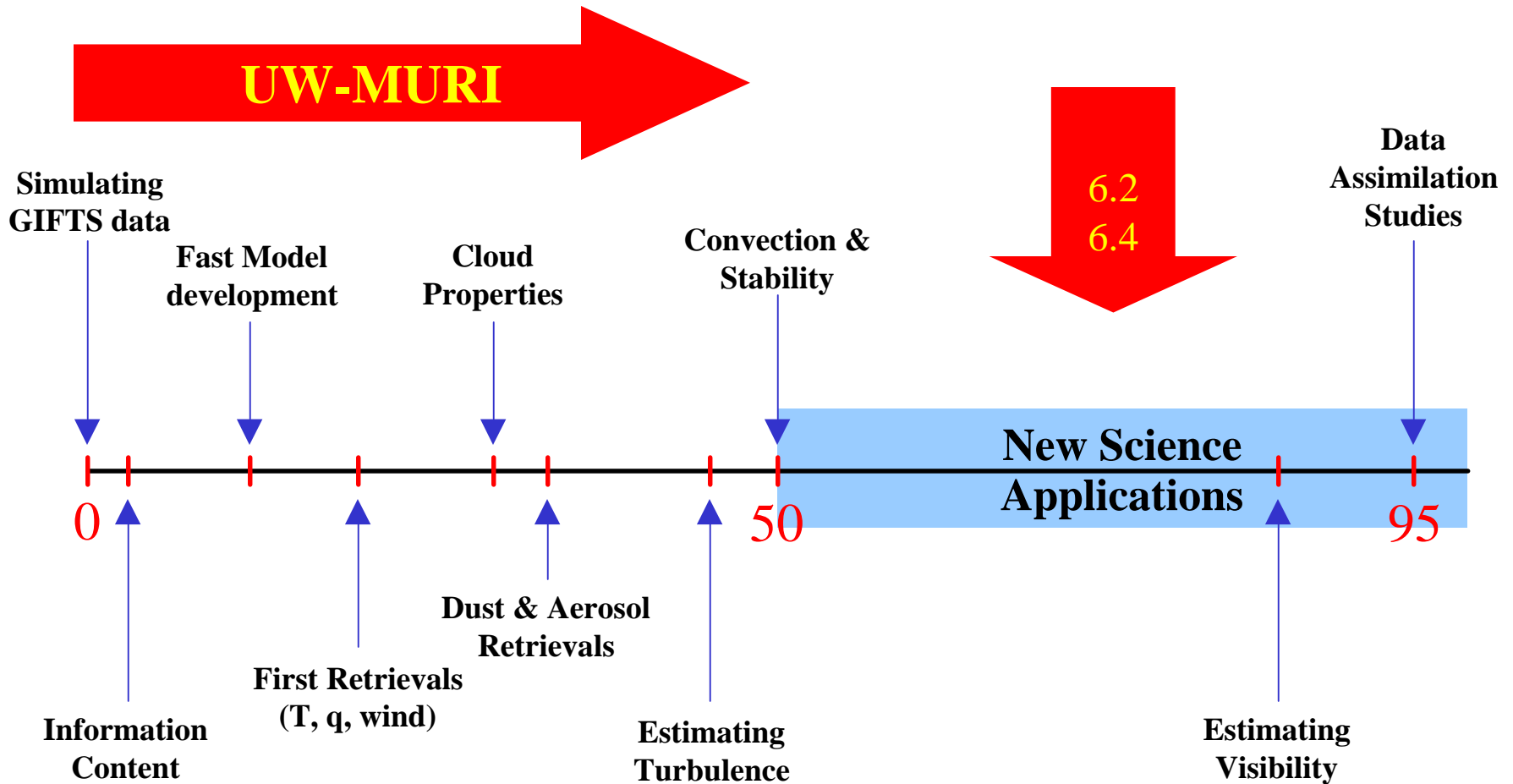
UW-CIMSS:

- NWP in support of Simulating GIFTS data
- Information Content
- “Clear Sky” RTE Development
- IOMI/GIFTS Clear/Cloudy Retrievals
- Aerosols & Dust
- Winds & Atmospheric Parameters; SST

UH-HIGP:

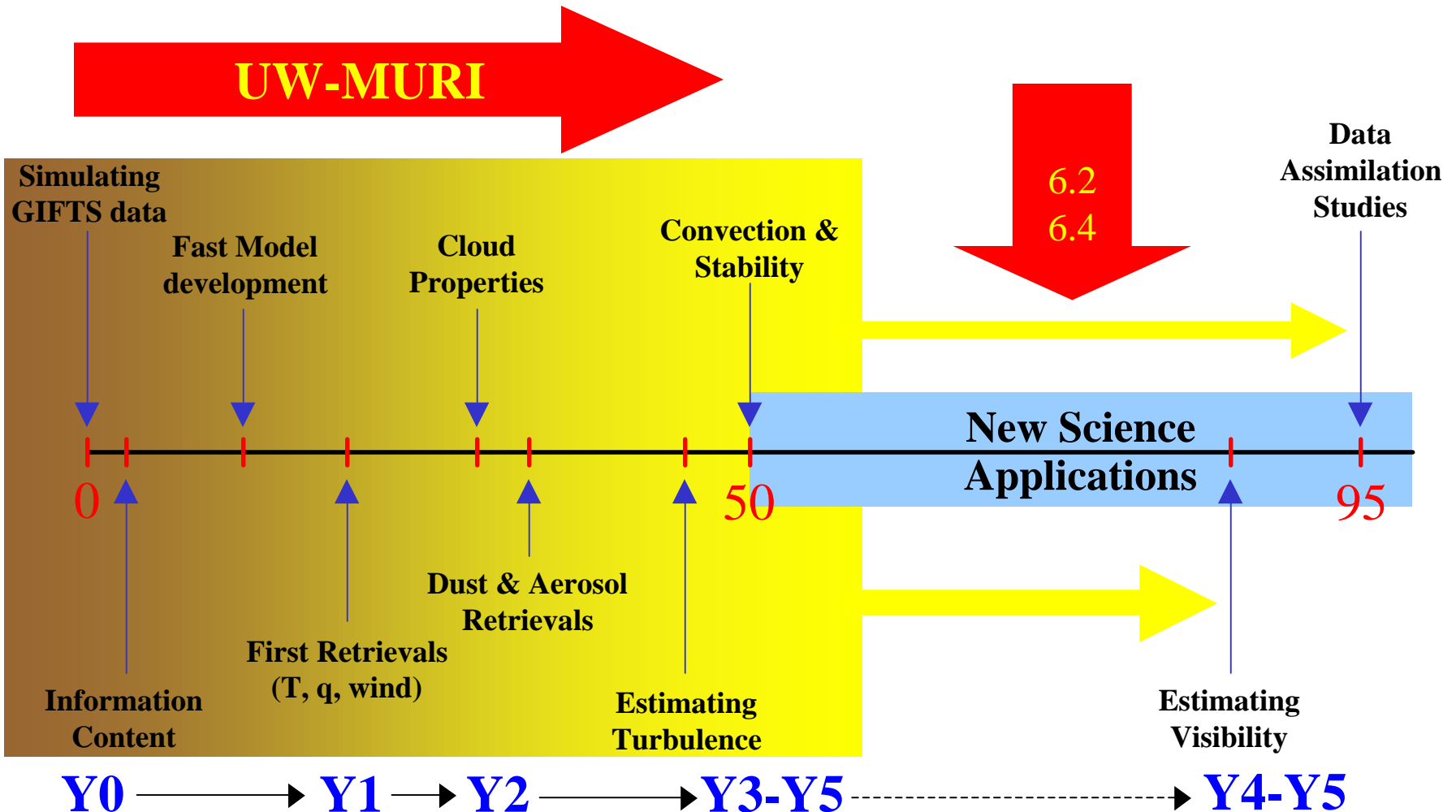
- AHI field experiments & hyperspectral modeling
- Surface Emissivity
 - More from P. Lucey

Science Use of GIFTS Data: “End-to-End”



Science Use of GIFTS Data: *Where do we stand today?*

UW-MURI



NWP in Support of TOA GIFTS Radiances

Recent NWP Work:

- Produced simulations of IHOP 2002 12 June convective initiation case at both 4 km and 1.3 km grid spacing with MM5 model.
- Generated TOA radiance datasets for both of the above IHOP simulations.
- Produced simulation of 2003 Pacific THOR_{pex} Observing System Test 12.
- March jet streak case at 4 km grid spacing with 3x3 GIFTS cubes dimensions.
- Updated GIFTS fast model to include new regression coefficients and the Texas A&M cloud model. Work to produce a total of 6 unique GIFTS data “cube” sets in support of GIFTS simulation studies and RTE development.

GIFTS Information Content

Recent Information Content (IC) Work:

- IC Analysis of RAOB – Eigenvector Decomposition
 - Obtain eigenvectors from five classes' of T and q profiles.
 - Obtain truncated T & q profile to the residual level of 0.25K (3%) for five classes of RAOBs.
- IC Analysis of geostationary broadband and hyperspectral measurements:
 - Construct information matrix of GOES/GIFTS measurements using channel T and q weighting functions (W) and instrument noises (E); also uses global model forecast error covariance of T and q profiles (CB). Define information matrix as
$$(WTE-1W+CB-1) -1$$
 - Define Vertical Resolution matrix from information matrix as
$$(WTE-1W+CB-1) -1 WTE-1W$$

“Clear Sky” RTE Development

Recent Clear Sky RTE Work:

- Improvements to water vapor continuum representation.
- Validation of Line-by-line models with AIRS overpasses of the ARM sites
- Successfully reproduced UW PLOD model with newer, more modular software
- Implemented new regression scheme in PLOD development.

“Cloudy Sky” RTE Development

Recent Cloudy Sky RTE Work:

- Implementation of parameterization of ice and water cloud reflection and transmission coefficients: 4D lookup tables: (wavenumber, zenith angle, effective particle size, optical thickness) in GIFTS fast top-of-atmosphere radiance model.
- Development of procedures for verifying GIFTS fast top-of-atmosphere radiance model against more rigorous line-by-line and multiple scattering codes.
- Imminent release of tested production version of GIFTS fast top-of-atmosphere radiance model.

IOMI/GIFTS Retrievals

Recent Retrieval Work:

- Update the retrieval version with new fast model and new data cube.
- Make a better training data by coupling the realistic surface emissivity and surface skin temperatures from ground observations.
- Select channels for physical retrieval, physical retrieval algorithm now can be applied to cube data.
- Testing algorithm using AIRS radiance measurements.

Aerosols & Dust

Recent Aerosol & Dust Work:

- Performing trade studies to determine the accuracy of the existing fast models.
- Determine ways to improve the existing models.
- Collaborate with I. Sokolik at UC-Boulder for data and model exchange.

Atmospheric Parameters

Recent Atmospheric Parameter Work:

- Implementation of stability procedures used with AERI data on simulated GIFTS retrievals of T and q .
- New research on quantifying atmospheric boundary layer turbulence as measured with hyperspectral (AERI) data.
- Convection and convective initiation work using simulated GIFTS data.
- Definition of optimal q_e of parcel. Test between MODIS, GOES and simulated GIFTS (ready for AIRS), for GIFTS.
- Analysis of current stability/cloud information from GOES.
- Good first effort on wind retrievals, but need to improve boundary layer winds. Focus on the use of simulated GIFTS.

Status

- The UW & UH MURI is a healthy research collaboration, especially when considering the four subcontracts.
- We are basically through our proposed Year 2 and well into the Year 3 tasks, especially with respect to product research.
- We are progressing on many fronts, from RTE and IC development to atmospheric/surface parameter retrievals.
- We are using the simulated GIFTS and AIRS data.