

**Applications with the Newest
Multi-spectral Environmental
Satellites**

*Villa dei Papi, Benevento, Italy
3 - 13 June 2007*

Lectures in Benevento 3 – 13 June 2007

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Schools on remote sensing have been held in

Bologna, Italy (Sep 01),
Rome, Italy (Jun 02),
Maratea, Italy (May 03),
Bertinoro, Italy (Jul 04),
Cape Town, South Africa (Apr 06),
Krakow, Poland (May 06),
Ostuni, Italy (Jun 06)



International Summer School on
APPLICATIONS WITH THE NEWEST MULTI-SPECTRAL
ENVIRONMENTAL SATELLITES
3 -13 June 2007

| | | |
|--------------|--------------------------------------|---|
| Su pm | <i>Welcome</i> <i>Ice breaker</i> | Discussion of Agenda (All) |
| Mo am | <i>Lecture 1</i> <i>Homework</i> | Planck Function, Radiation (Menzel) |
| Mo pm | <i>Lab 1</i> | Lab on Planck Function (Gumley) |
| Tu am | <i>Lecture 2</i> | Radiative Transfer in the Earth Atmosphere (Menzel) |
| Tu pm | <i>Lab 2</i> | Intro to Hydra (Antonelli) |
| We am | <i>Lecture 3</i> <i>Quiz 1</i> | Spectral signatures from Earth's surface & atmosphere (Menzel) |
| We pm | <i>Lab 3</i> | Interrogating MODIS Data (Strabala) |
| Th am | <i>Lecture 4</i> | Dealing with imperfect data (Gumley) Signal gathering with a remote sensing instrument |
| Th pm | <i>Lab 4</i> | Signal Processing Lab (Gumley) |
| Fr am | <i>Lecture 5</i> <i>Quiz 2</i> | Investigations with MODIS and SEVIRI (Prieto, Antonelli) |
| Fr pm | <i>Lab 5</i> | MODIS and SEVIRI looking at clouds (Strabala) |



| | | |
|---------------|----------------------------|--|
| Sa am | <i>Lecture 6</i> | Geostationary Perspective (Puca) |
| Sa pm | <i>Lab catch up</i> | Finish Lab |
| Su | <i>Free day</i> | |
| Mo am | <i>Lecture 7</i> | Hyperspectral resolution (Antonelli) |
| Mo pm | <i>Lab 6</i> | Exploring AIRS/IASI data (Antonelli) |
| Tu am | <i>Lecture 8</i> | AIRS remote sensing properties (Menzel) |
| | <i>Homework Review</i> | |
| Tu pm | <i>Lab 7</i> | Continuing AIRS/IASI Lab (Antonelli) |
| We am* | <i>Lecture 9</i> | Summary (Menzel) |
| | <i>Quiz 3</i> | |
| We pm* | <i>Lab 8</i> | Student Presentations of SEVIRI, MODIS, IASI, AIRS Investigations (All) |
| | <i>Concluding Ceremony</i> | |

AM sessions: 10:00 am – 12:30 pm

PM sessions: 2:30 pm – 5:00 pm

* start one hour earlier

Applications with Meteorological Satellites

ftp://ftp.ssec.wisc.edu/pub/menzel/

CHAPTER 2 - NATURE OF RADIATION

| | | |
|-----|-----------------------------|-----|
| 2.1 | Remote Sensing of Radiation | 2-1 |
| 2.2 | Basic Units | 2-1 |
| 2.3 | Definitions of Radiation | 2-2 |
| 2.5 | Related Derivations | 2-5 |

CHAPTER 3 - ABSORPTION, EMISSION, REFLECTION, AND SCATTERING

| | | |
|------|--|------|
| 3.1 | Absorption and Emission | 3-1 |
| 3.2 | Conservation of Energy | 3-1 |
| 3.3 | Planetary Albedo | 3-2 |
| 3.4 | Selective Absorption and Emission | 3-2 |
| 3.7 | Summary of Interactions between Radiation and Matter | 3-6 |
| 3.8 | Beer's Law and Schwarzschild's Equation | 3-7 |
| 3.9 | Atmospheric Scattering | 3-9 |
| 3.10 | The Solar Spectrum | 3-11 |
| 3.11 | Composition of the Earth's Atmosphere | 3-11 |
| 3.12 | Atmospheric Absorption and Emission of Solar Radiation | 3-11 |
| 3.13 | Atmospheric Absorption and Emission of Thermal Radiation | 3-12 |
| 3.14 | Atmospheric Absorption Bands in the IR Spectrum | 3-13 |
| 3.15 | Atmospheric Absorption Bands in the Microwave Spectrum | 3-14 |
| 3.16 | Remote Sensing Regions | 3-14 |

CHAPTER 5 - THE RADIATIVE TRANSFER EQUATION (RTE)

| | | |
|------|-----------------------|------|
| 5.1 | Derivation of RTE | 5-1 |
| 5.10 | Microwave Form of RTE | 5-28 |

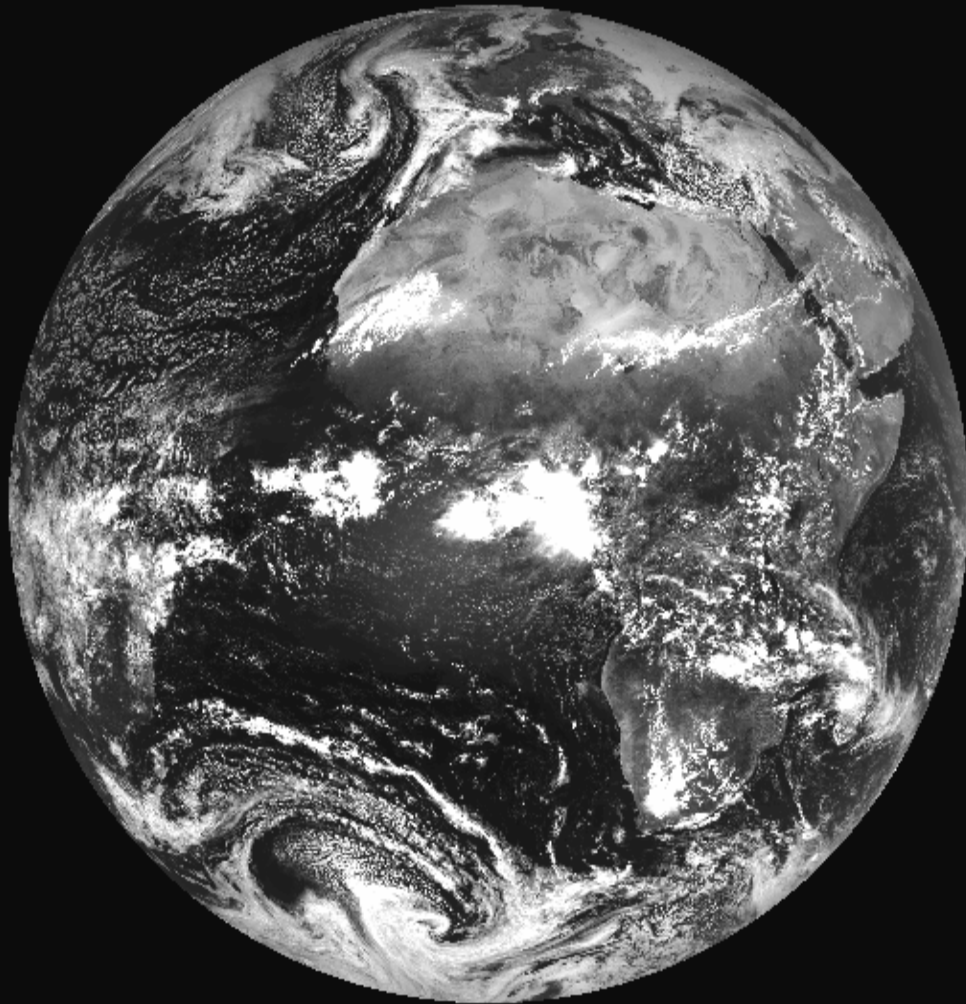
CHAPTER 12 - RADIOMETER DESIGN CONSIDERATIONS

| | | |
|------|-----------------------|------|
| 12.3 | Design Considerations | 12-1 |
|------|-----------------------|------|



MODIS

SEVIRI



1

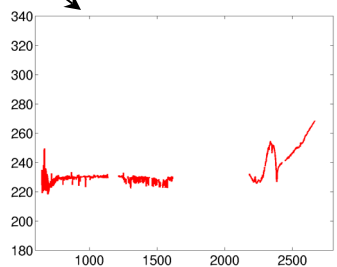
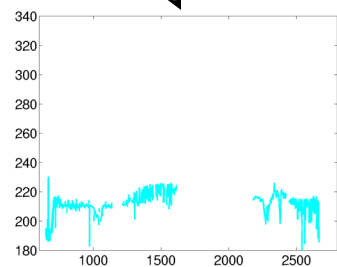
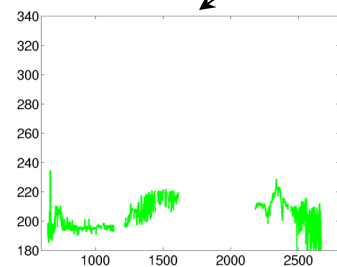
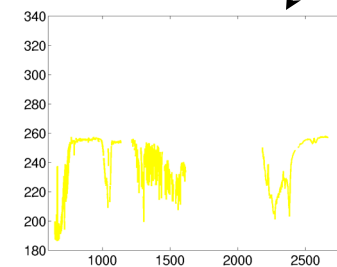
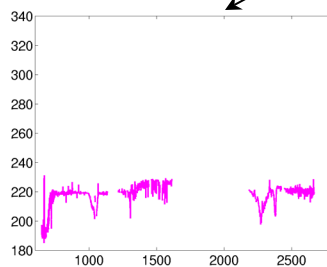
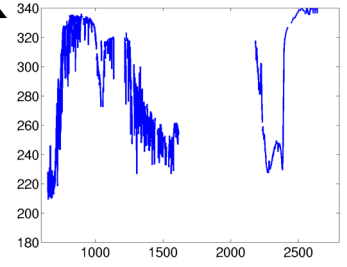
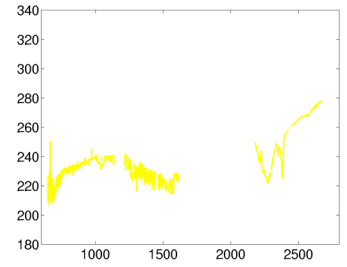
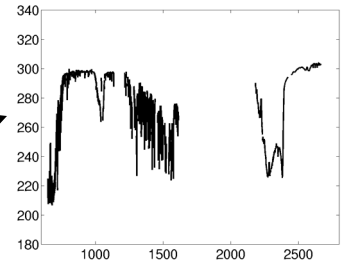
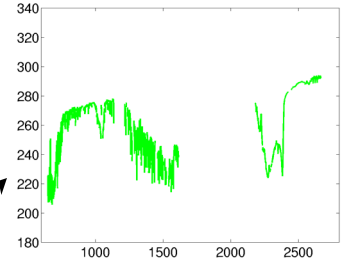
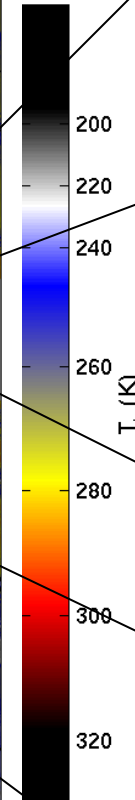
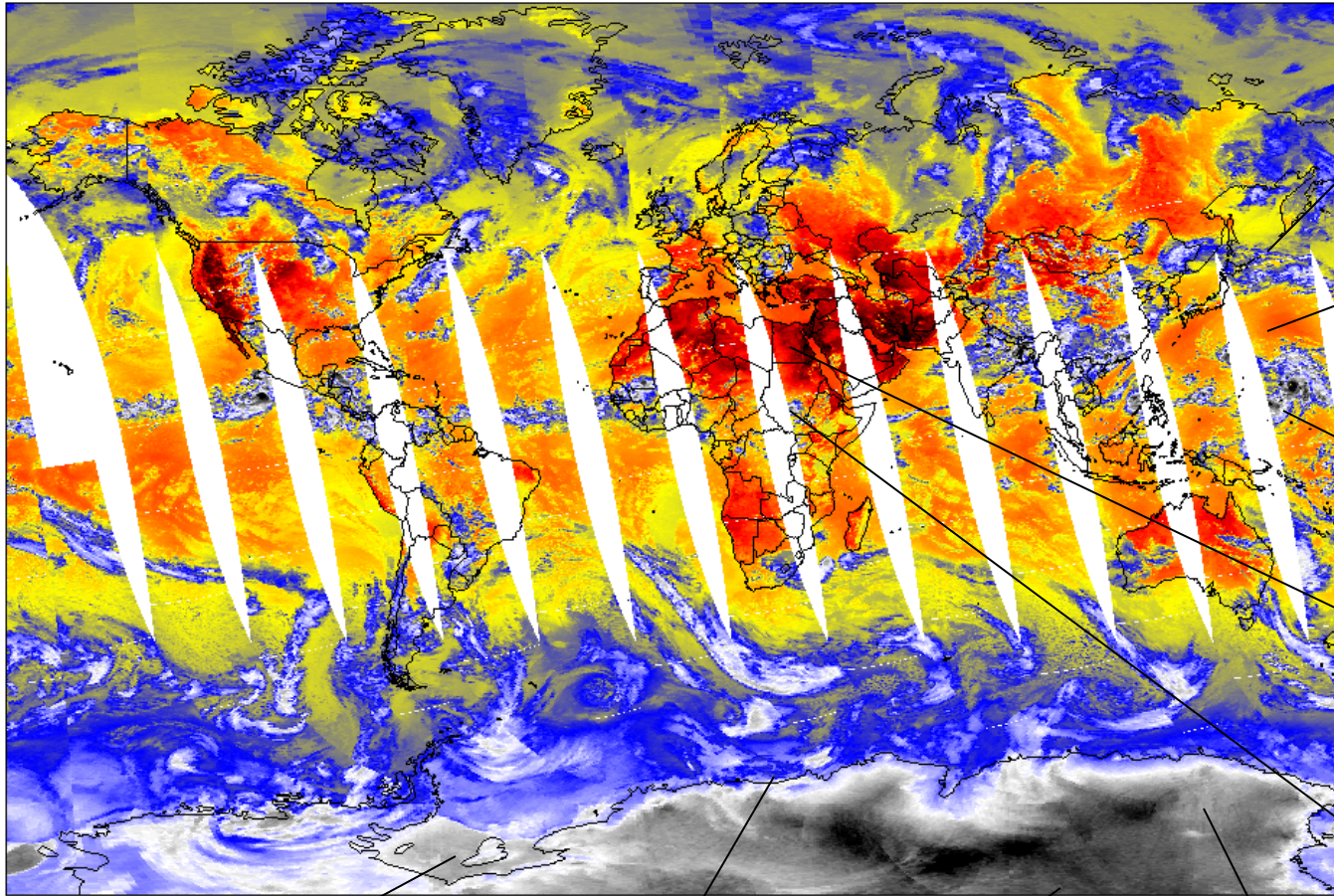
BAND 01

McIDAS

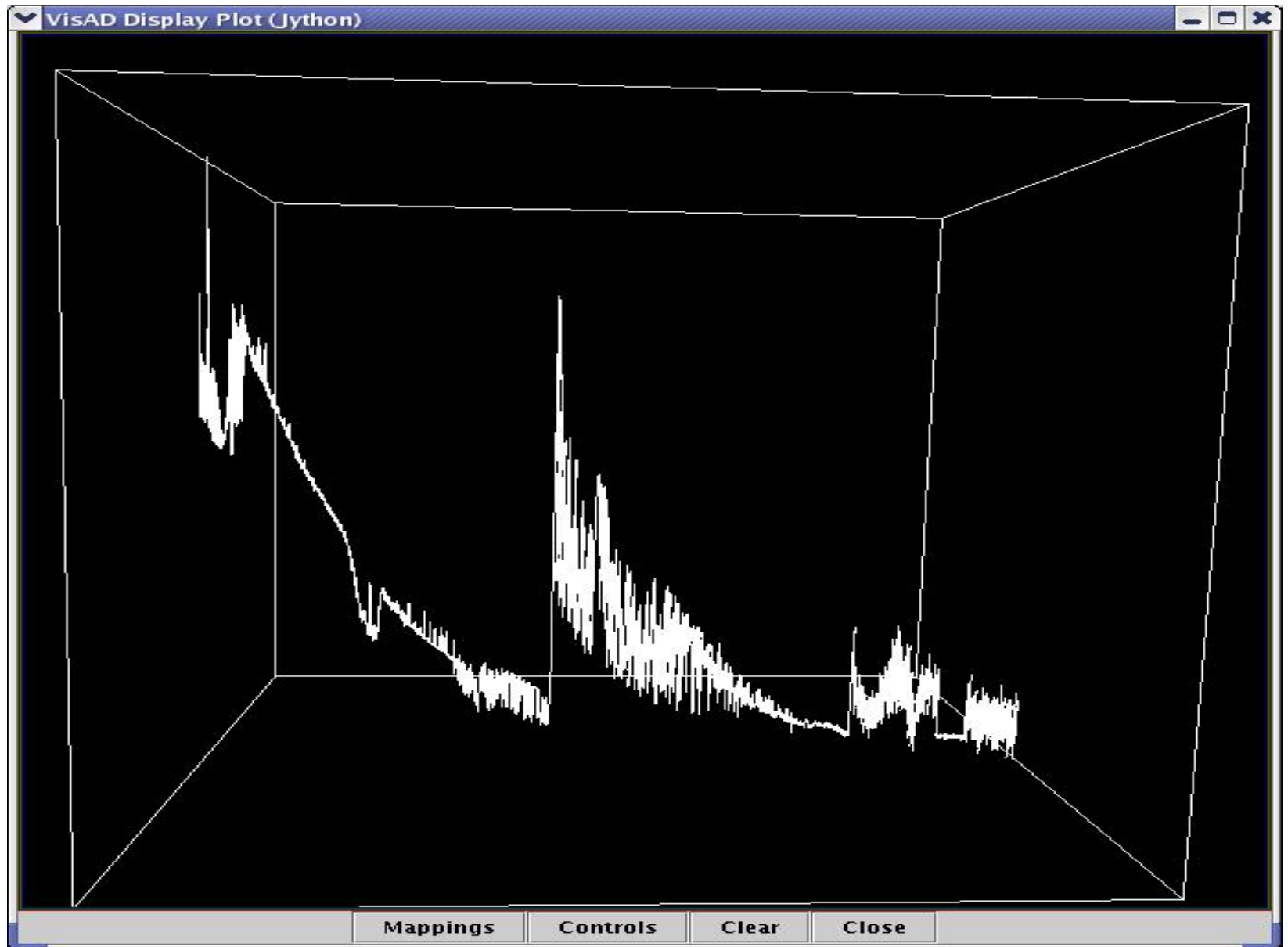
| HRV | Broadband |
|--------|-----------|
| VIS0.6 | 0.635 |
| VIS0.8 | 0.81 |
| NIR1.6 | 1.64 |
| IR3.9 | 3.90 |
| WV6.2 | 6.25 |
| WV7.3 | 7.35 |
| IR8.7 | 8.70 |
| IR9.7 | 9.66 |
| IR10.8 | 10.80 |
| IR12.0 | 12.00 |
| IR13.4 | 13.40 |

AIRS

20-July-2002 Ascending LW_Window

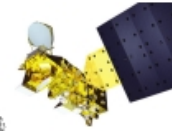


IASI



HYperspectral viewer for Development of Research Applications - HYDRA

MSG,
GOES



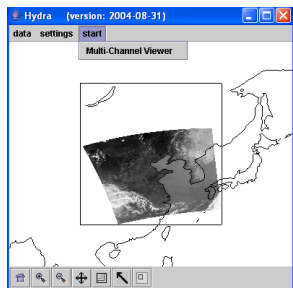
MODIS, AIRS
IASI, CALIPSO

Freely available software
For researchers and educators
Computer platform independent
Extendable to more sensors and applications
Based in VisAD
(Visualization for Algorithm Development)
Uses Jython (Java implementation of Python)
runs on most machines
512MB main memory & 32MB graphics card suggested
on-going development effort



Developed at CIMSS by
Tom Rink
Tom Whittaker
Kevin Baggett

With guidance from
Paolo Antonelli
Liam Gumley
Kathy Strabala
Allen Huang
Paul Menzel



<http://www.ssec.wisc.edu/hydra/>

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