Vis/NIR
Data Quality, Cloud Detection
and IR co-registration

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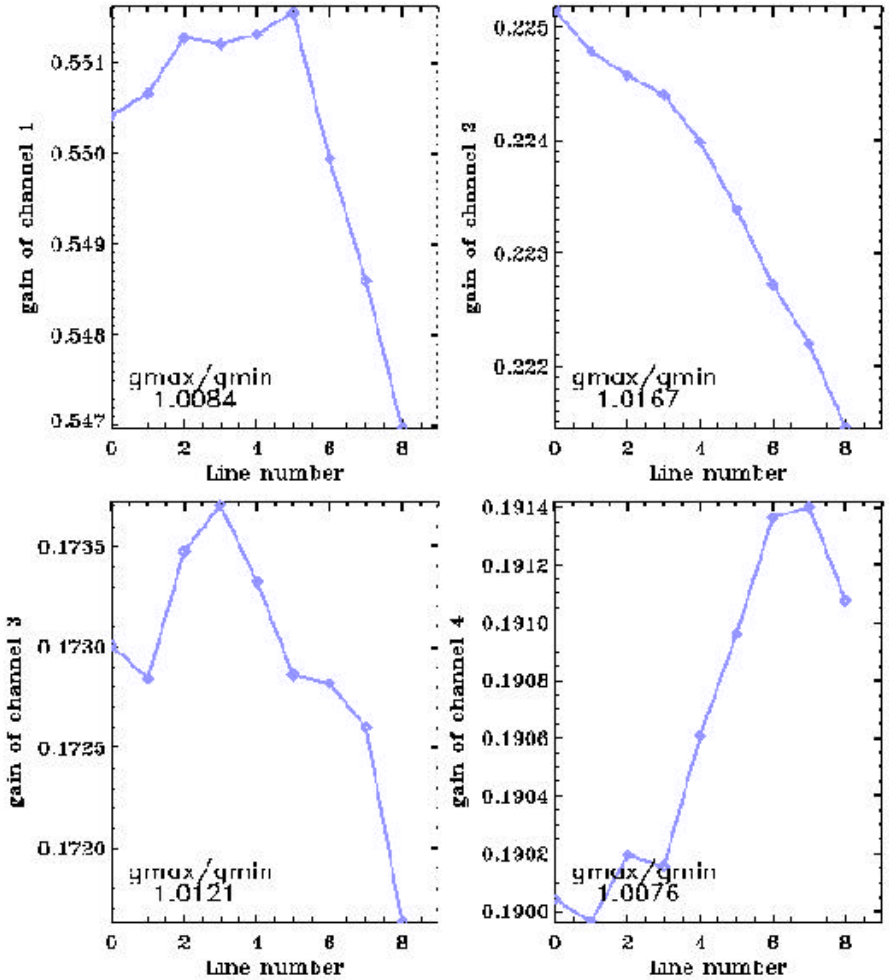
Overview

- Data Quality
  - Stripes
  - Co-alignment between Vis/NIR and AIRS
- Effect Registration between Vis/NIR and 1993 NDVI on cloud detection
- Cloud Detection
- Future Work

Stripes

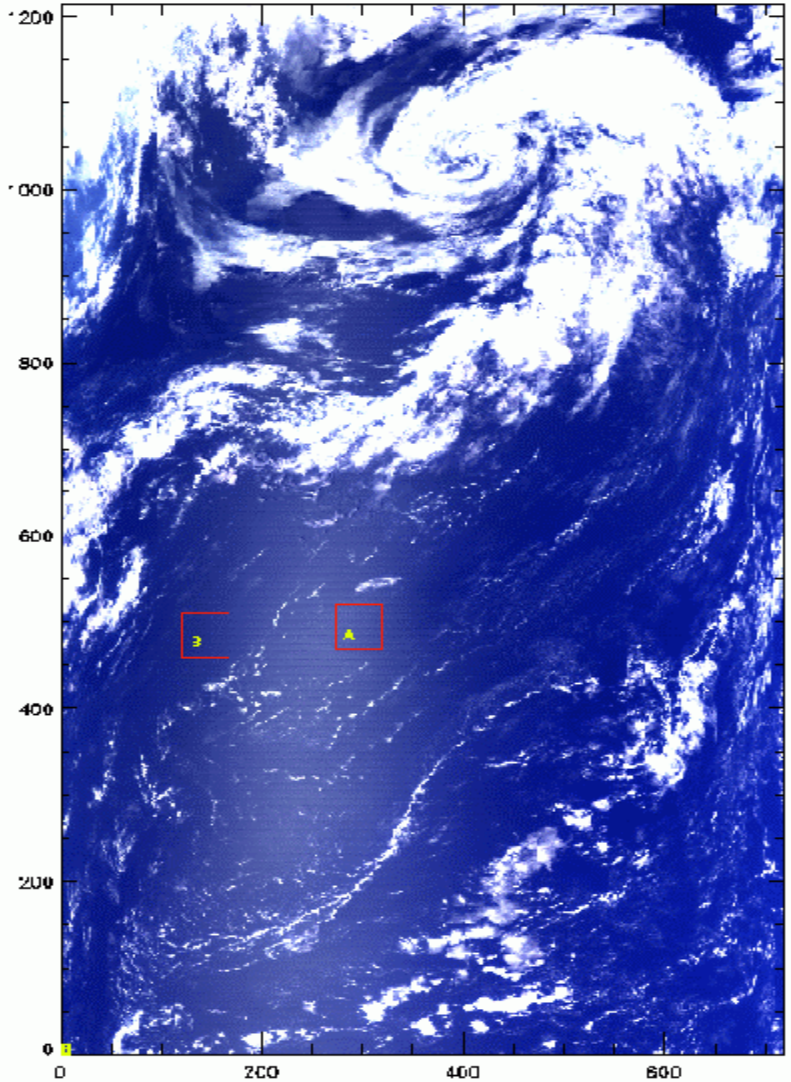
- Stripes caused by difference of gain and offset between 9 Vis/NIR elements
- In-between element adjustment + vicarious calibration used to remove stripes
- Remaining small stripes in different conditions
- Detailed investigation of stripes characteristics

Gain computed over bright surface

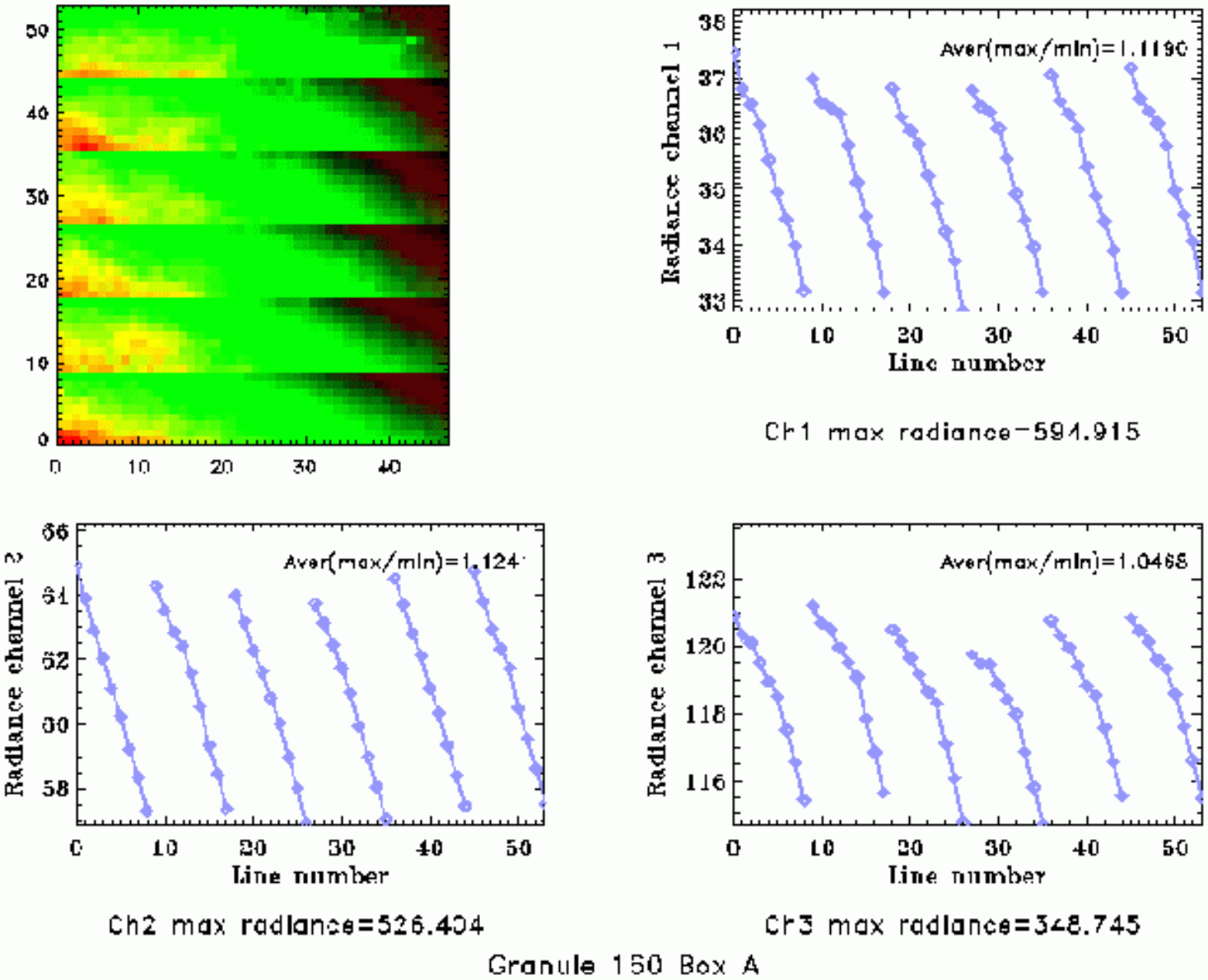


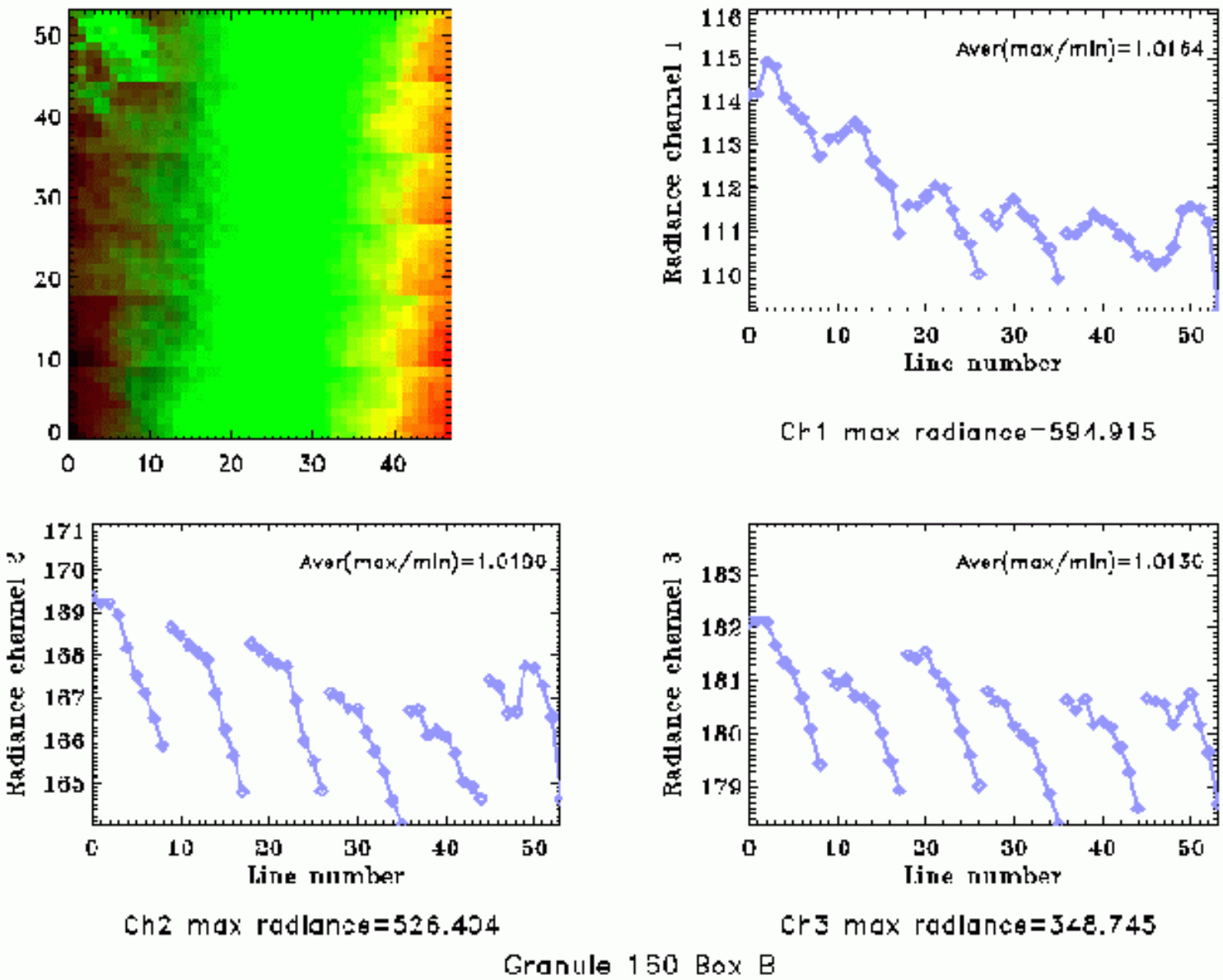
The gain factor derived from homogeneous desert area
(data provided by Mark Hofstadter)

Stripes in Sunglint area



Grcrcle 160, The stripes in surglint area


Aver(max/min)=1.1190
Radiance channel 1
Line number
Ch1 max radiance=594.915
Aver(max/min)=1.124
Radiance channel 2
Line number
Ch2 max radiance=526.404
Aver(max/min)=1.0468
Radiance channel 3
Line number
Ch3 max radiance=348.745
Granule 150 Box A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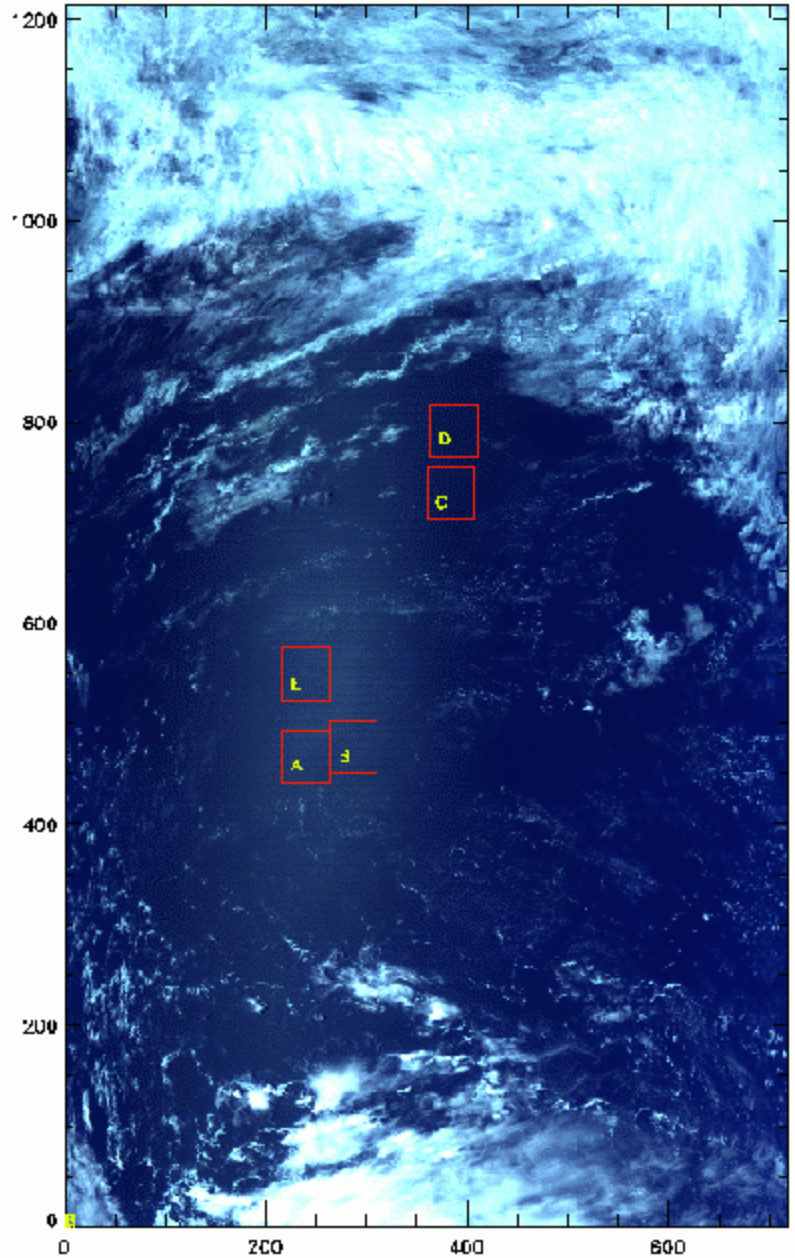
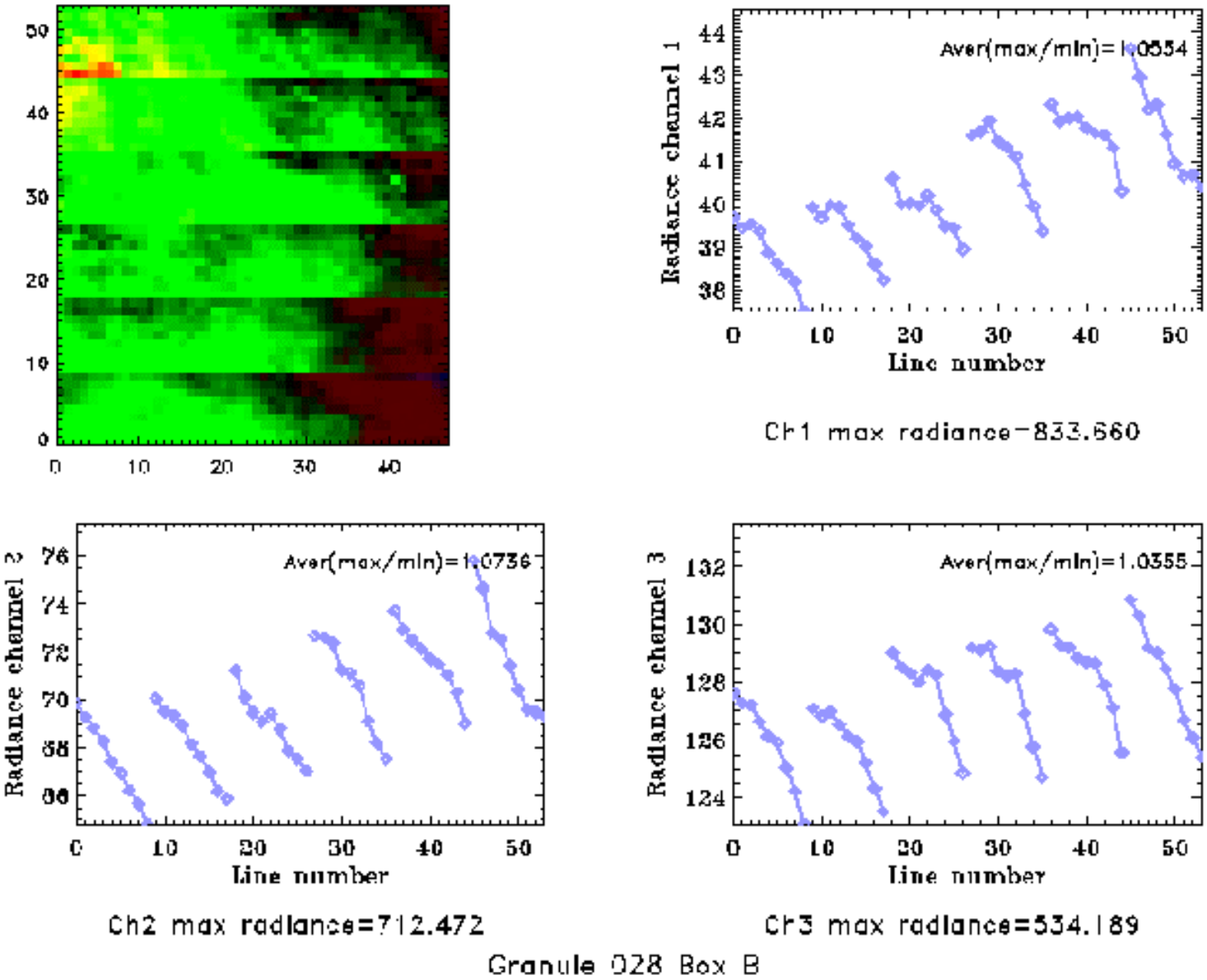
Radiance channel 1
Line number
Ch1 max radiance=594.915
Aver(max/min)=1.0190
Radiance channel 2
Line number
Ch2 max radiance=526.404
Aver(max/min)=1.0130
Radiance channel 3
Line number
Ch3 max radiance=348.745
Granule 150 Box B



Granule 028, there are stripes in sunglint area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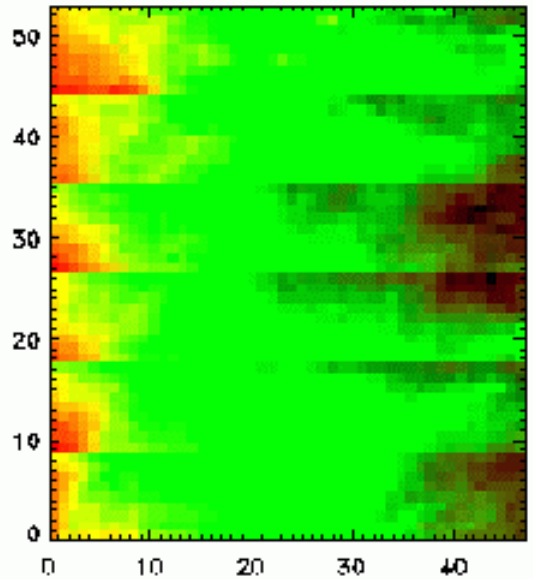
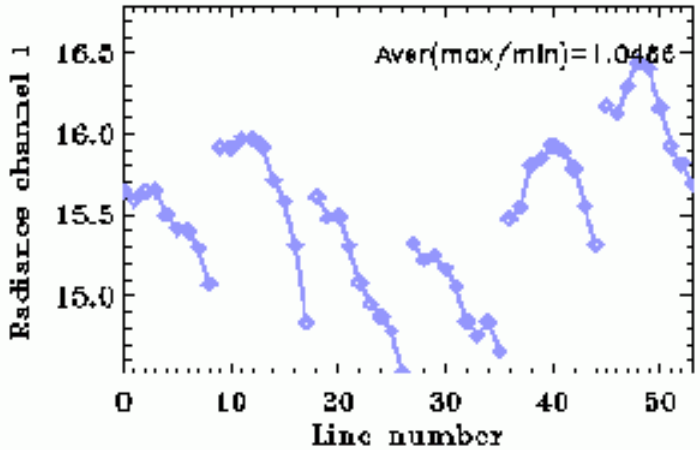
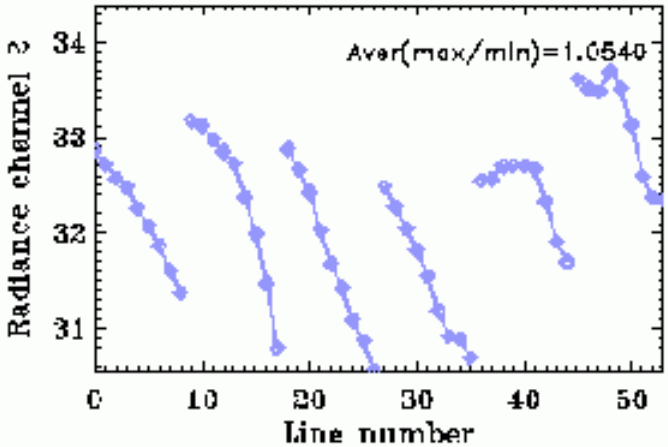
Radiance channel 1
Line number
Ch1 max radiance=833.660
Aver(max/min)=1.0736
Radiance channel 2
Line number
Ch2 max radiance=712.472
Aver(max/min)=1.0355
Radiance channel 3
Line number
Ch3 max radiance=534.189
Granule 028 Box B

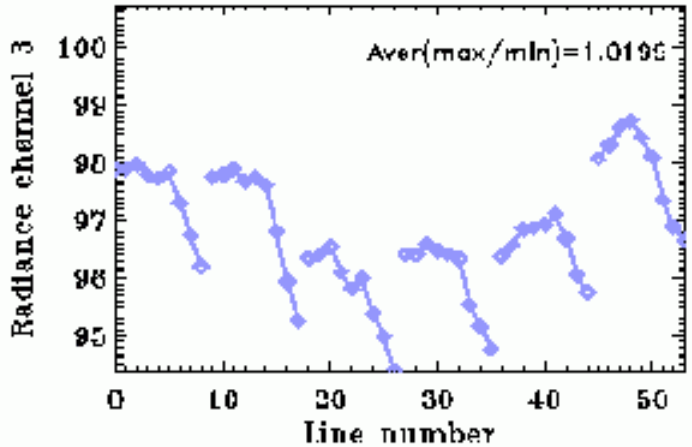




Ch1 max radiance=833.660



Ch2 max radiance=712.472



Ch3 max radiance=534.189

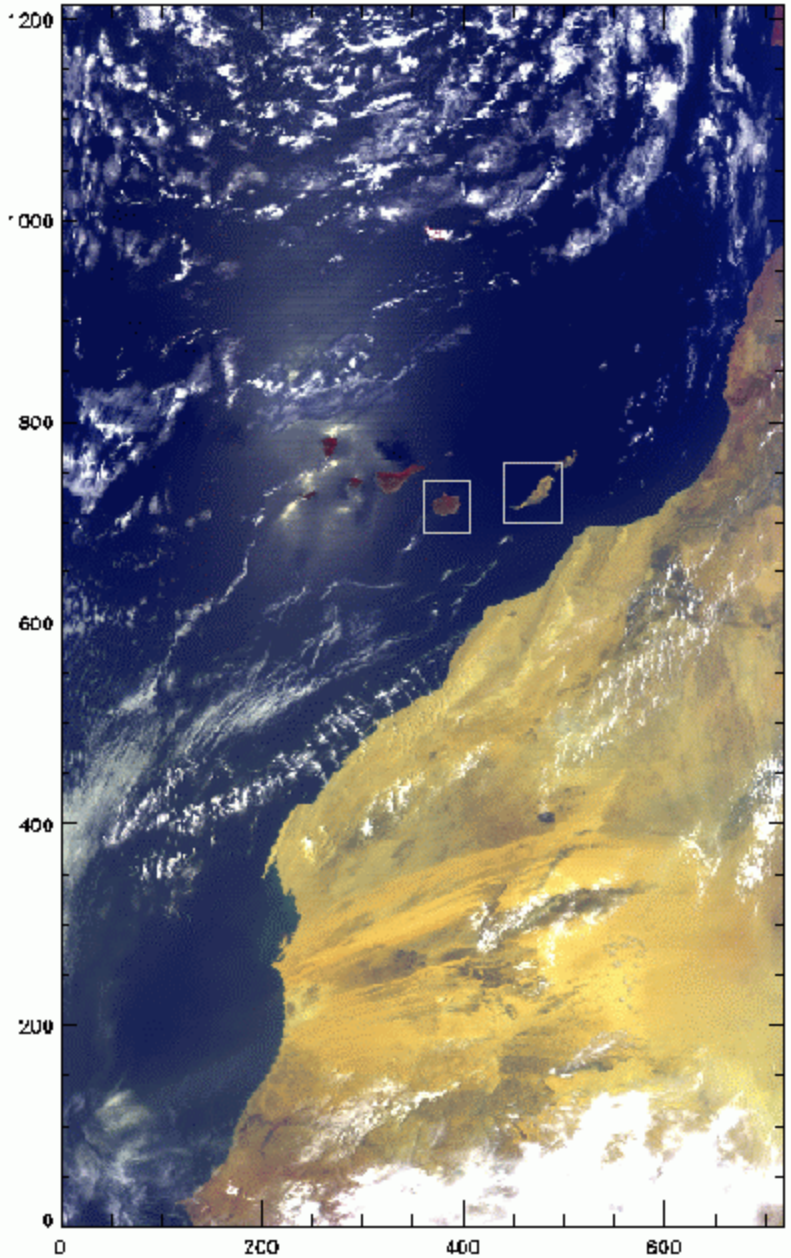
Granule 028 Box D

Stripes Analysis: Preliminary Results

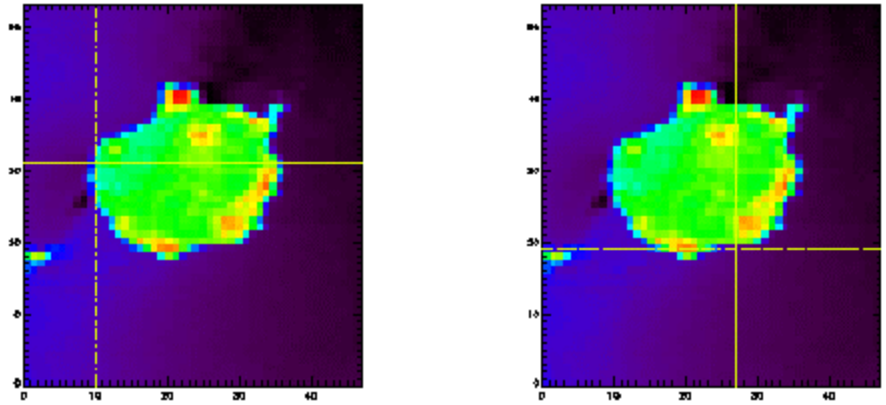
- Suggestion of a non-linear gain and/or BRDF effects due to scanning geometry

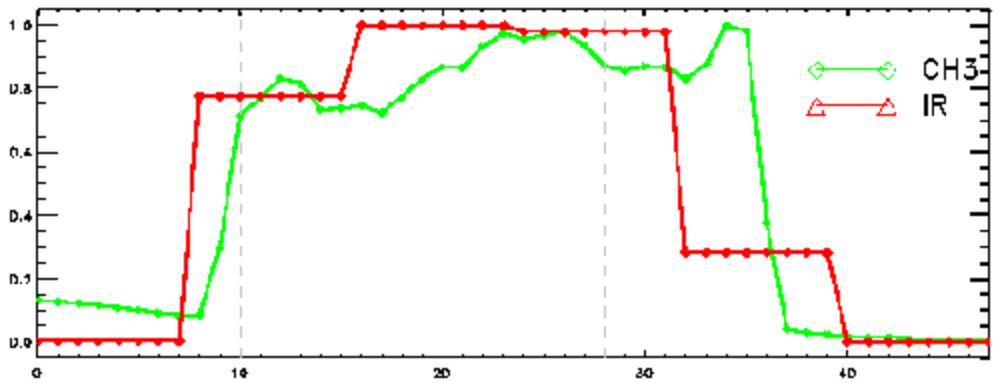
Registration between Vis/NIR and IR

- Use transition targets to evaluate quality of Vis/IR alignment/co-registration
- Investigated E-W and N-S alignment

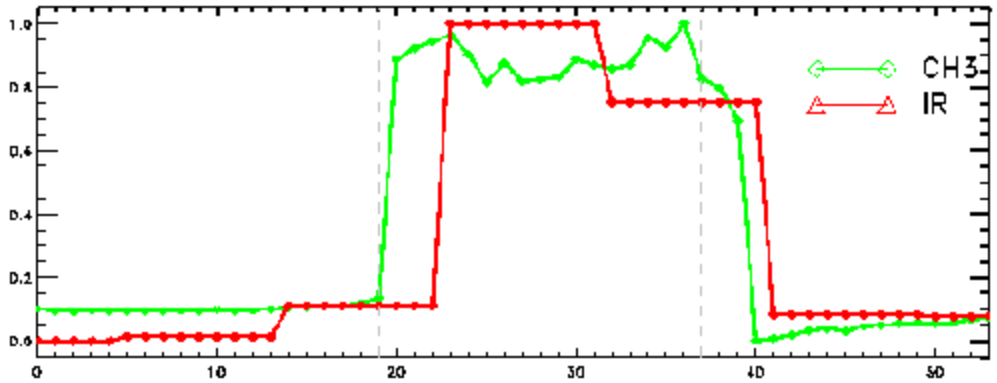


Granule 143, July 20, 2002

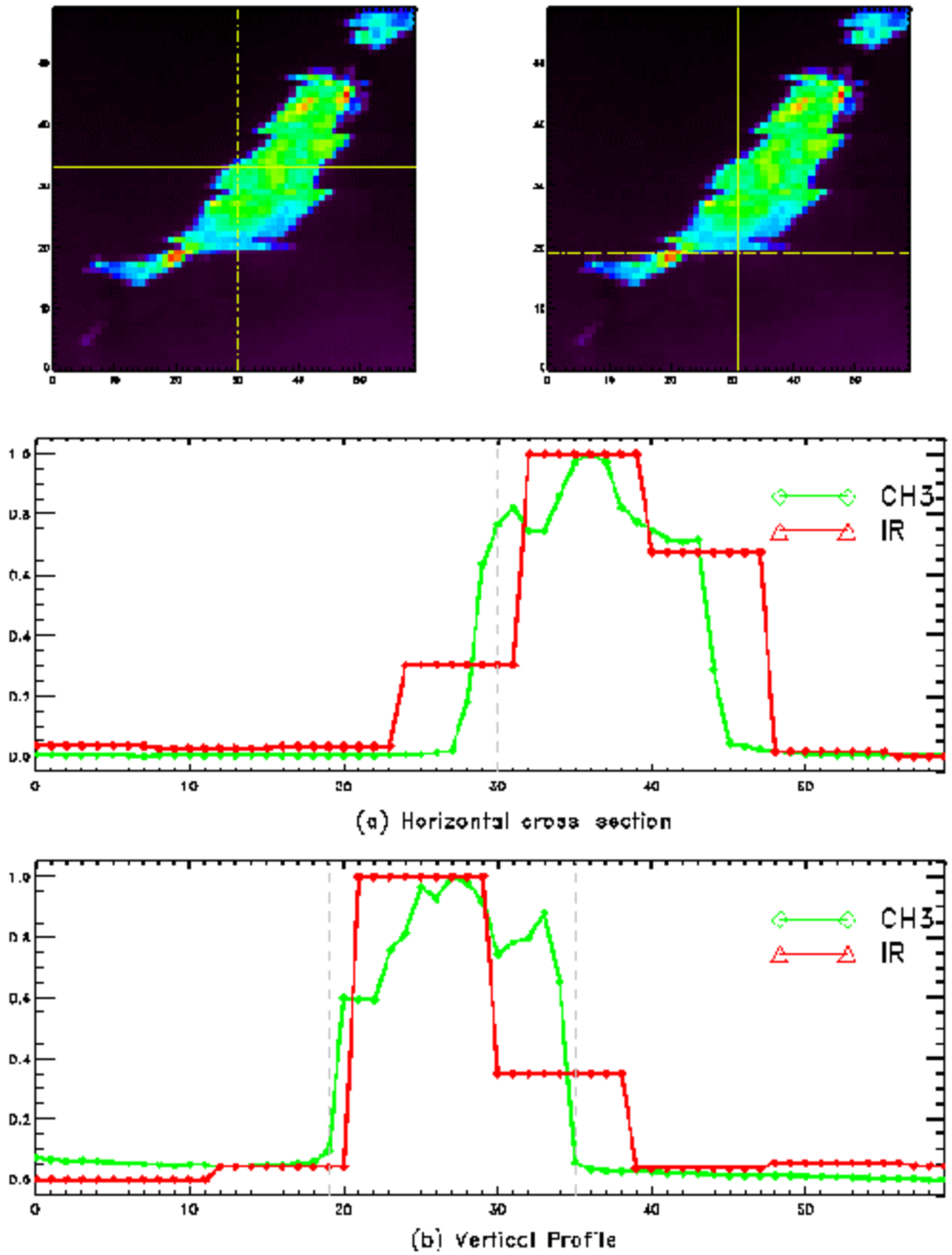


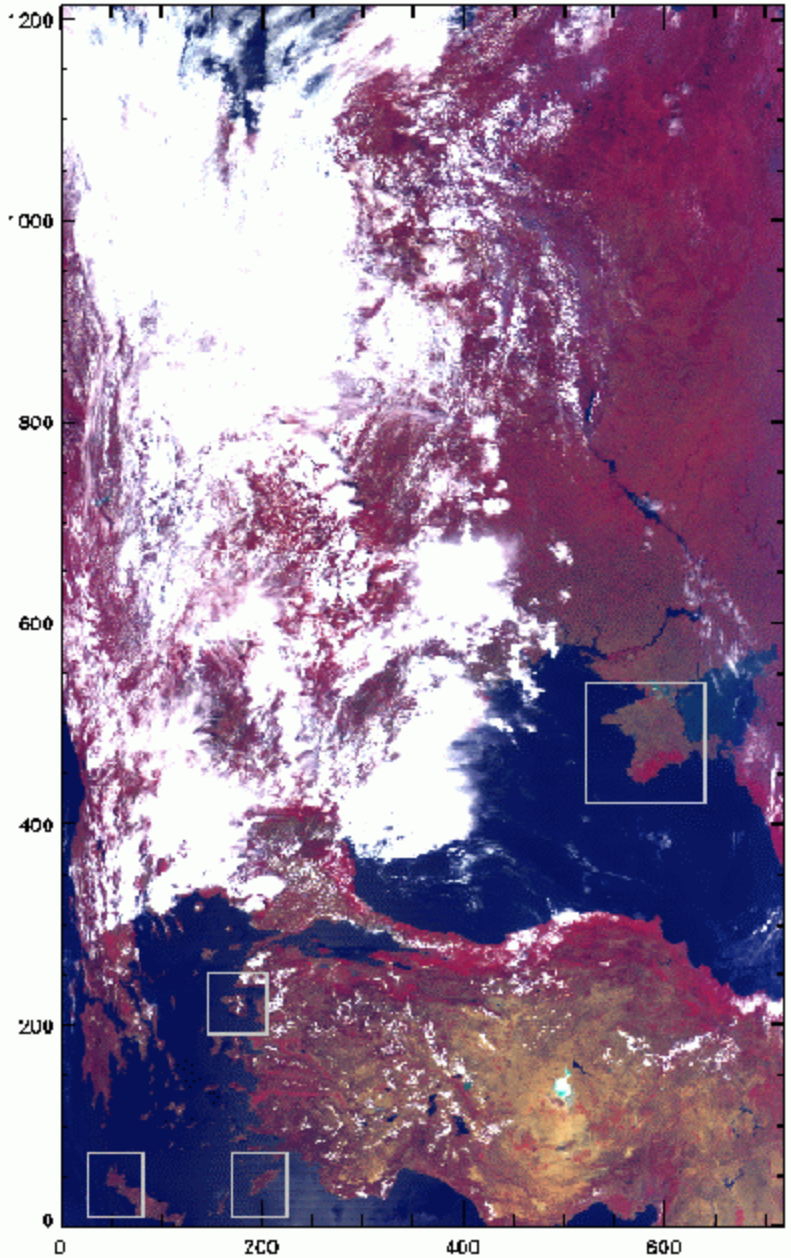


(a) Horizontal cross section

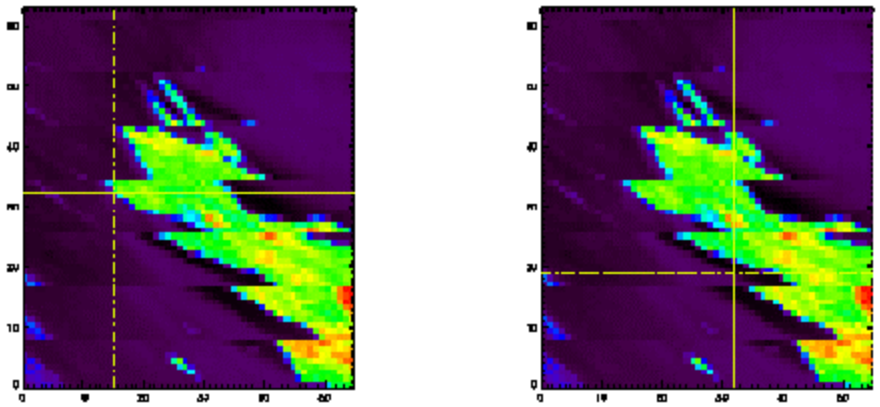


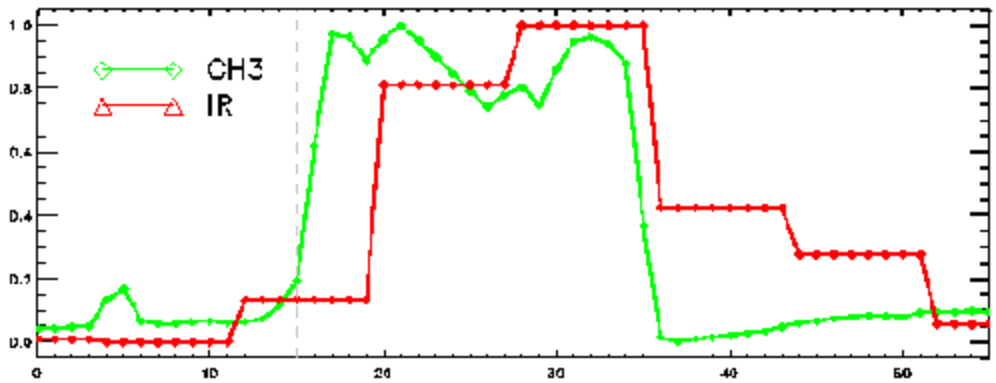
(b) Vertical Profile


CH3
IR
(a) Horizontal cross section
CH3
IR
(b) Vertical Profile

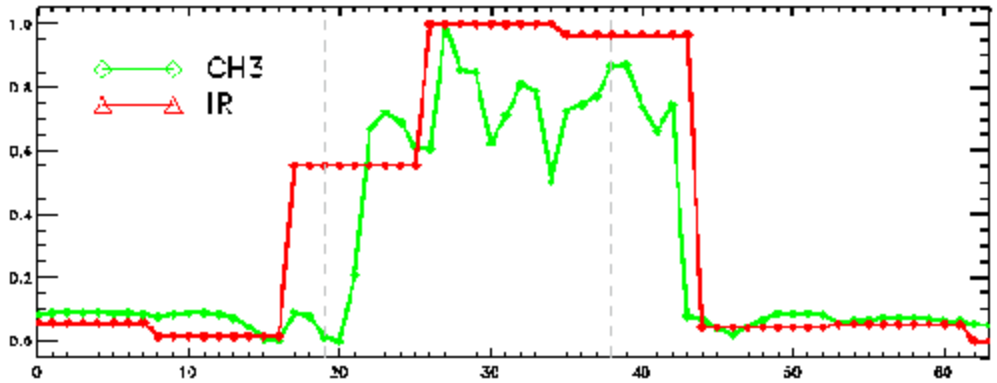


Granule 111, July 20, 2002

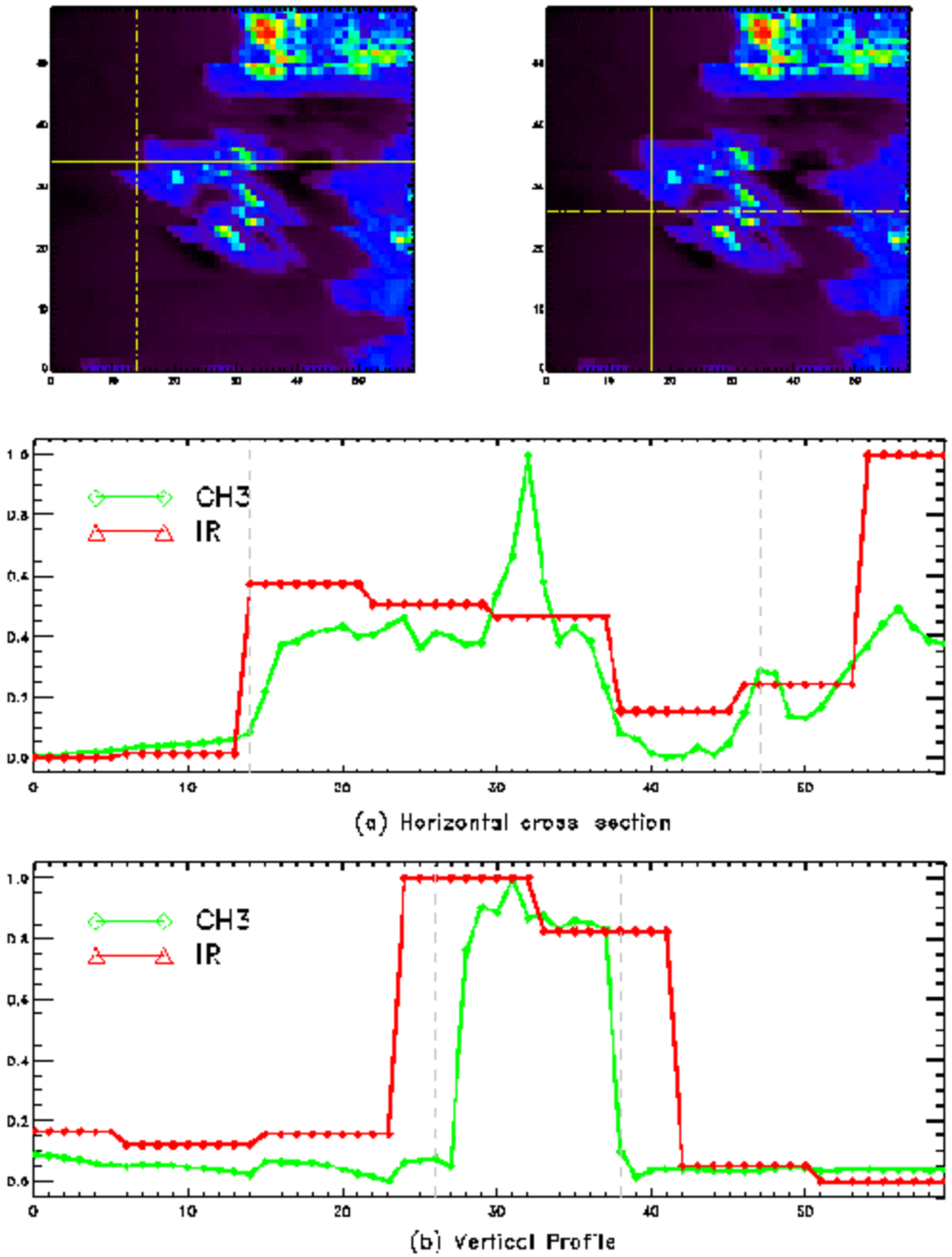


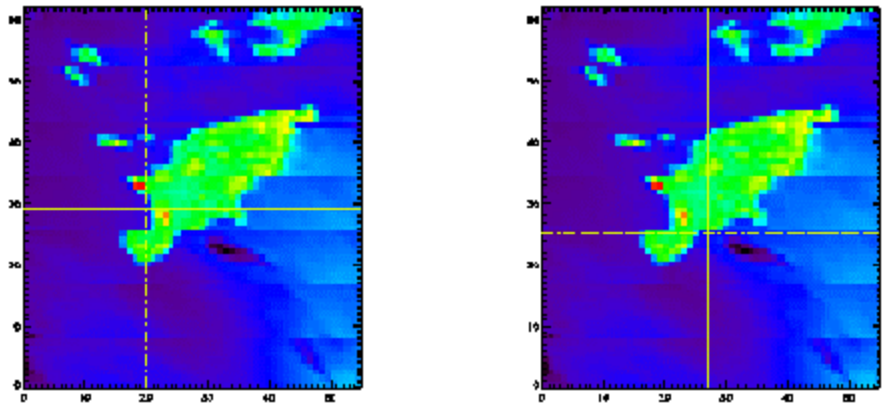


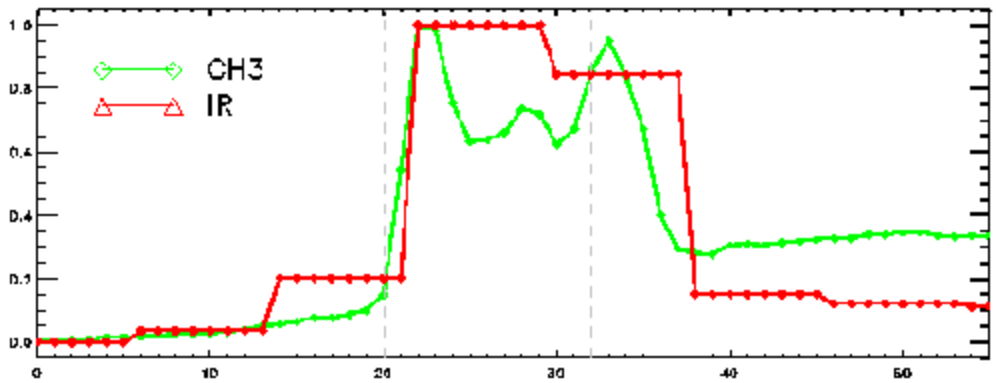
(a) Horizontal cross section



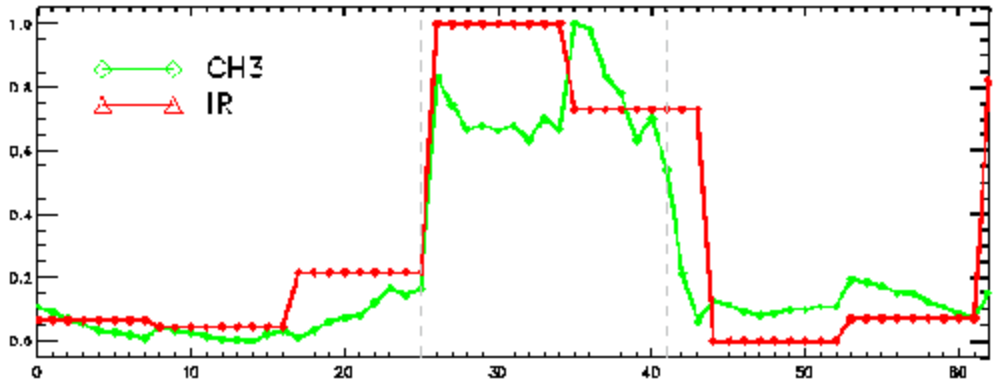
(b) Vertical Profile


CH3
IR
(a) Horizontal cross section
CH3
IR
(b) Vertical Profile

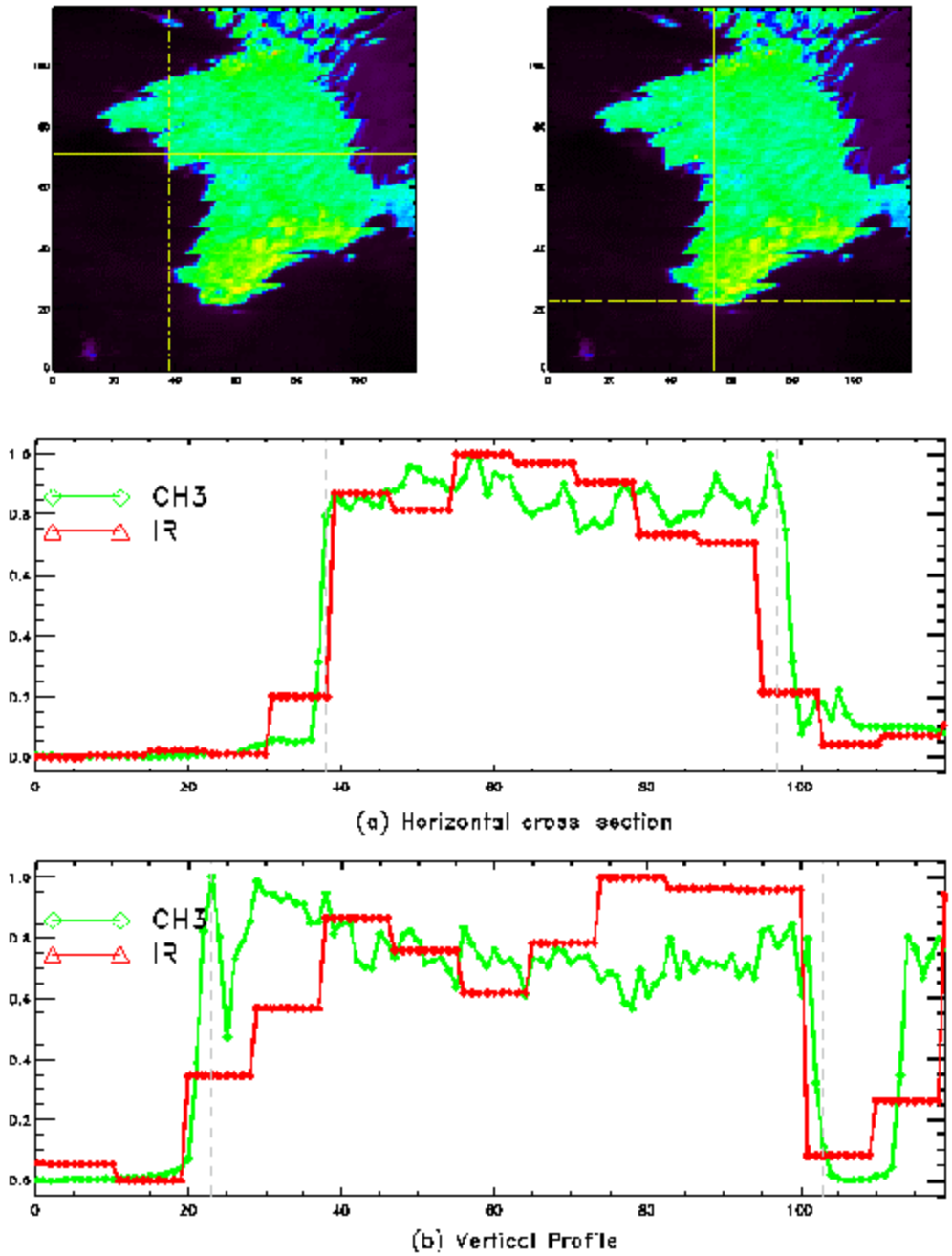




(a) Horizontal cross section



(b) Vertical Profile


CH3
IR
(a) Horizontal cross section
CH3
IR
(b) Vertical Profile

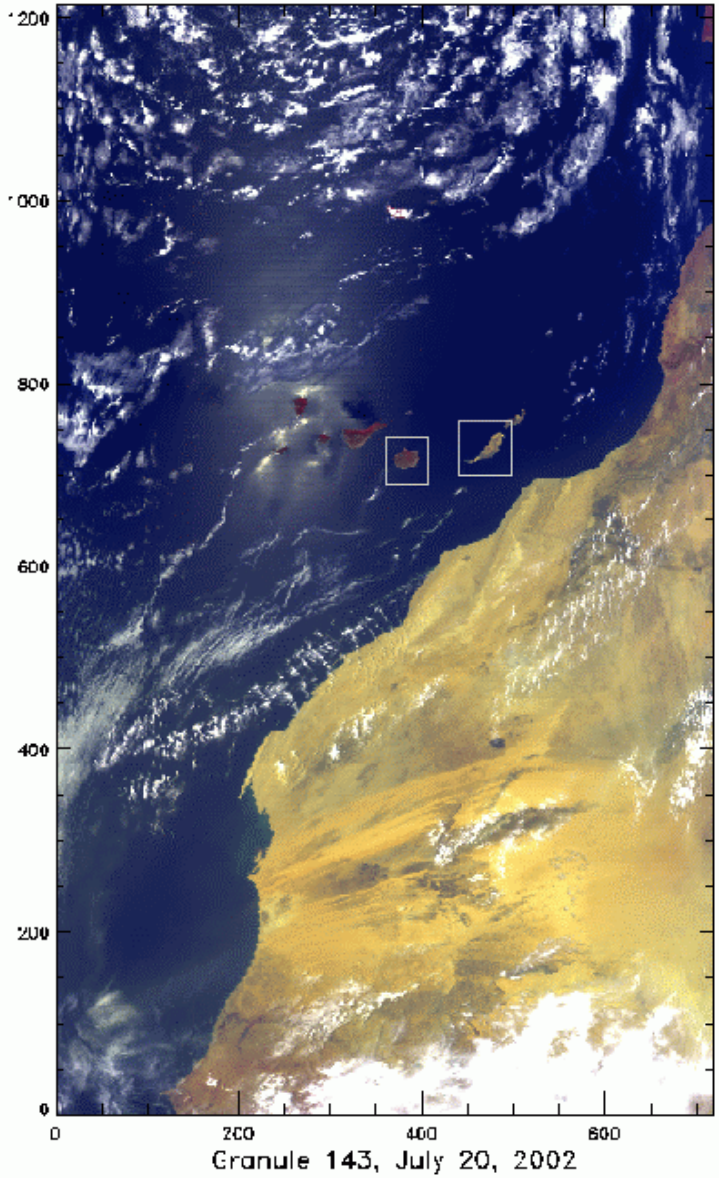
Preliminary Results

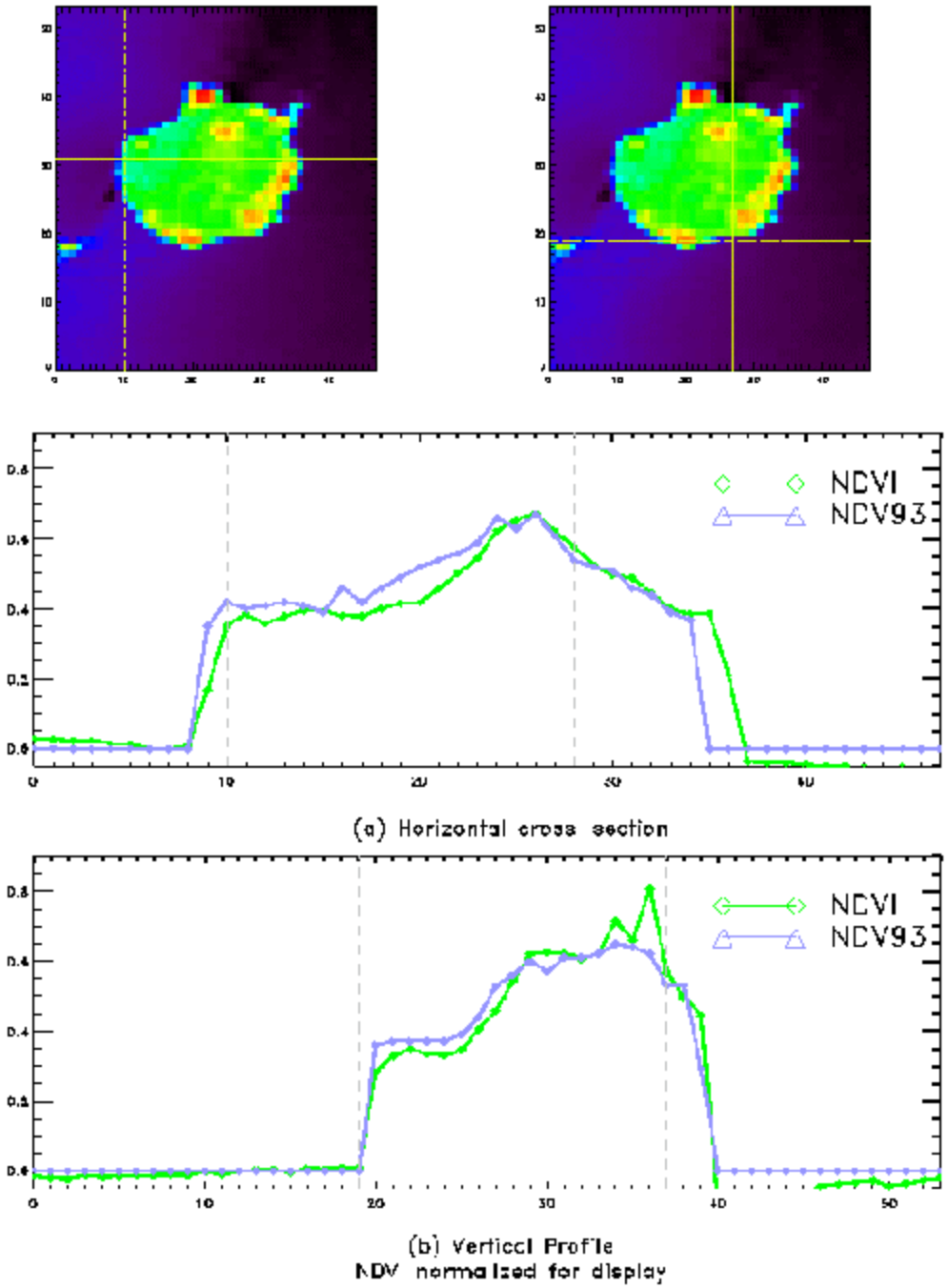
- Very good within accuracy of approach
- Need longer data set over same transition targets to quantitatively evaluate alignment

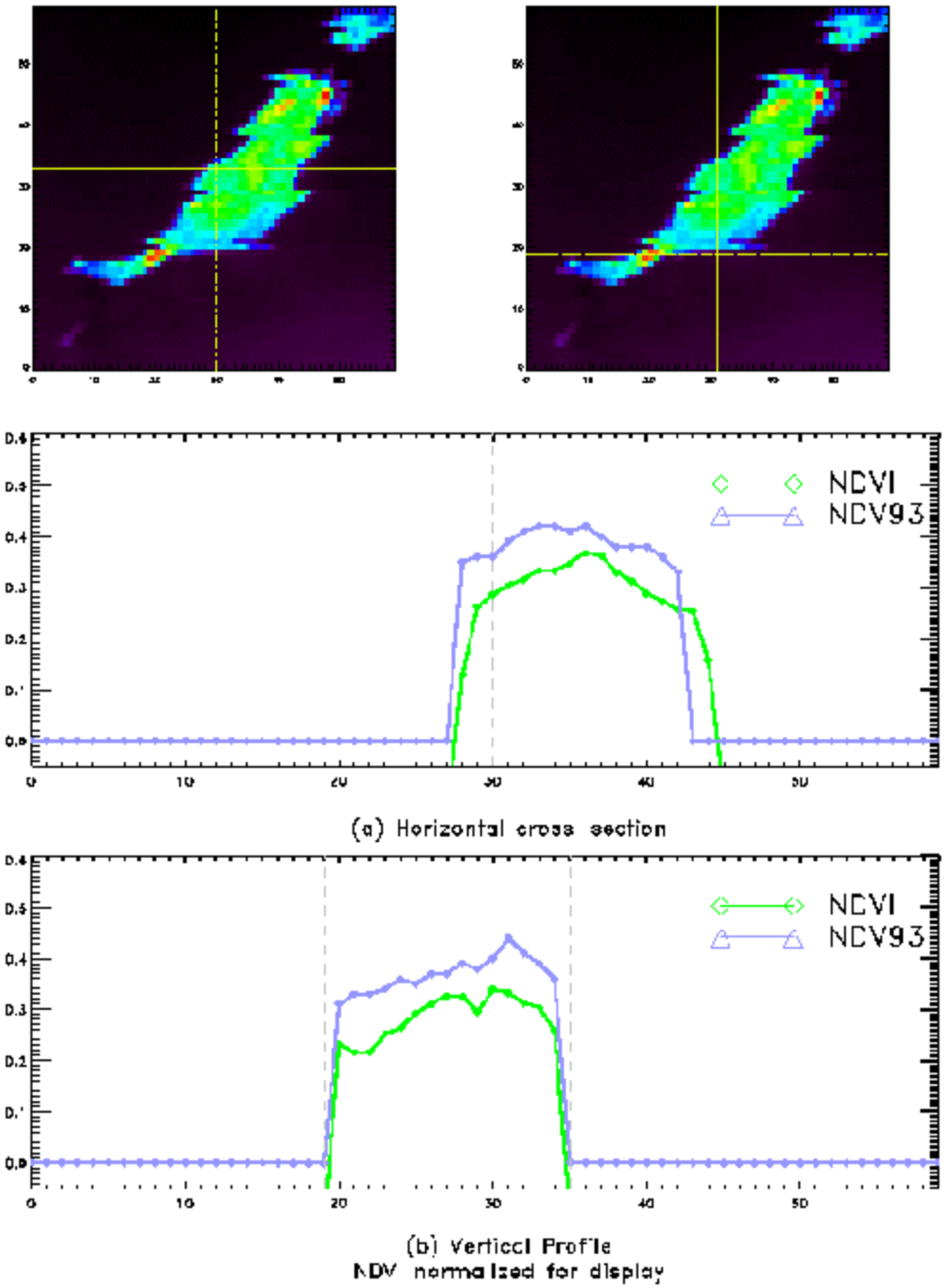
Registration between Vis/NIR and 1993 NDVI

- 1993 NDVI used in computation of cloud threshold as a surface type (reflectance) indicator
- Preliminary analysis=>mis-alignment between NDVI 1993 and AIRS Vis/NIR NDVI
- Use transition targets to evaluate Vis/IR alignment/co-registration
- Investigate E-W and N-S alignment

Selection of Transition Targets



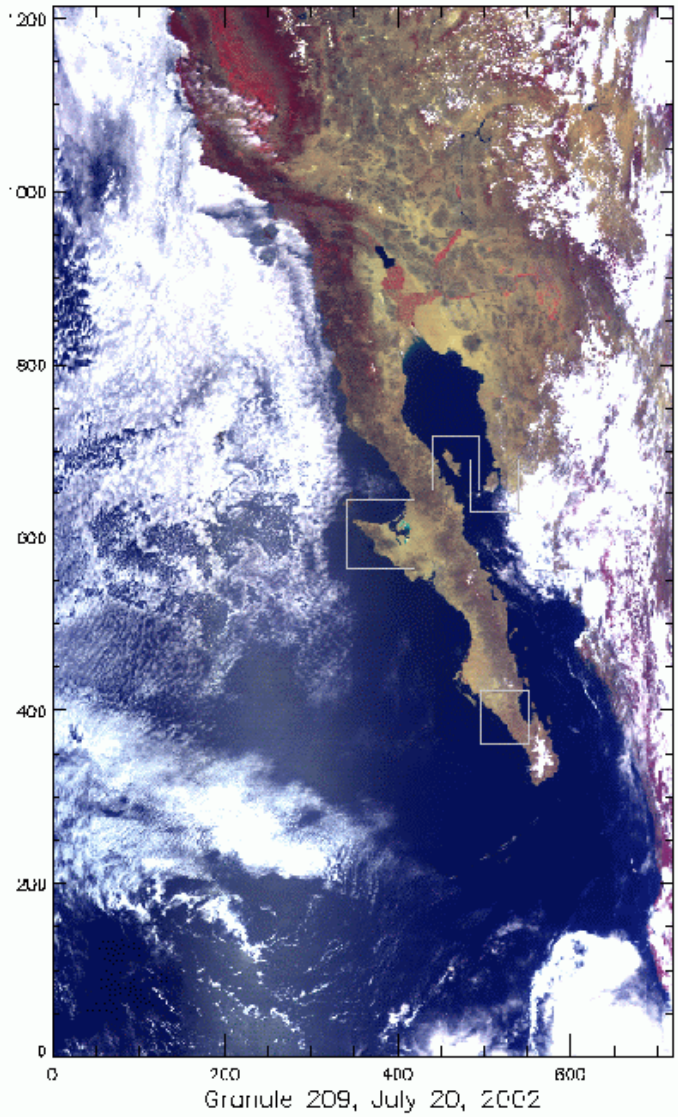

NDVI
NDV93
(a) Horizontal cross section
NDVI
NDV93
(b) Vertical Profile
NDV normalized for display

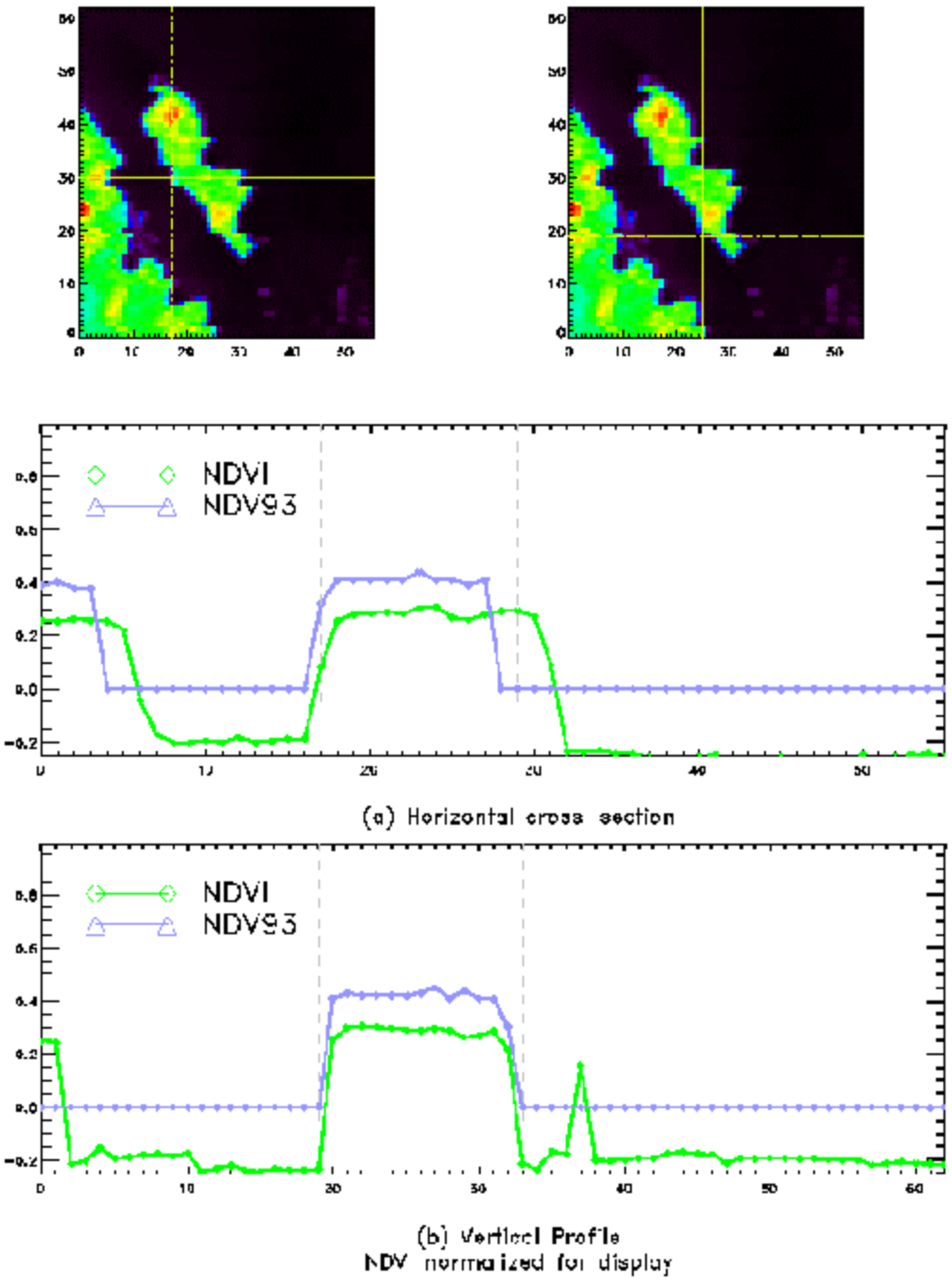


(a) Horizontal cross section

(b) Vertical Profile
NDV normalized for display

Selection of Transition Targets

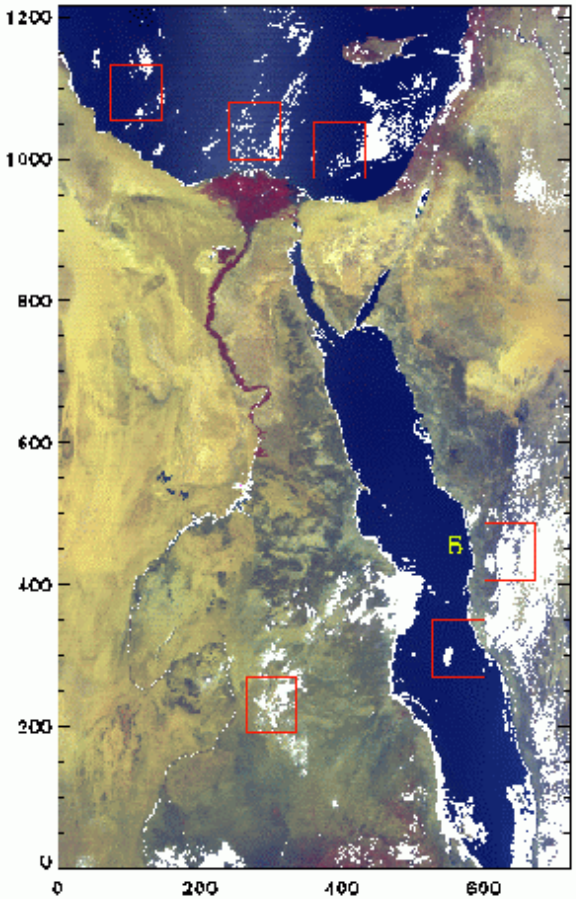


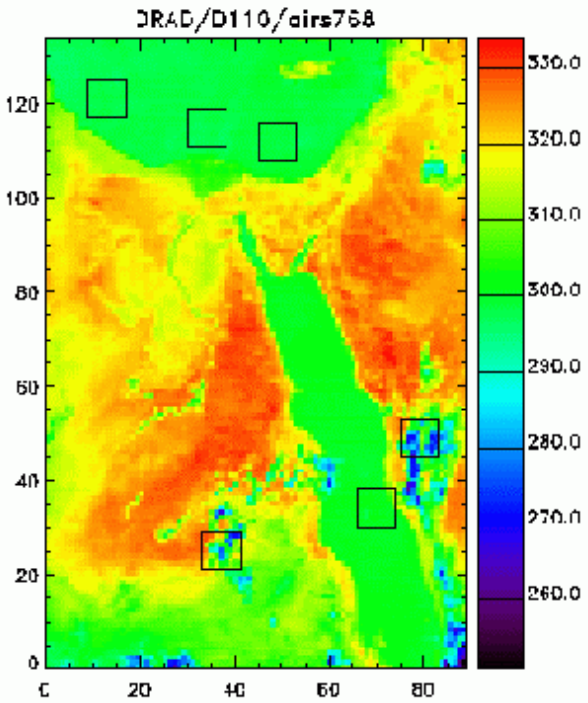


(a) Horizontal cross section

(b) Vertical Profile
NDV normalized for display

Impact on Cloud Detection





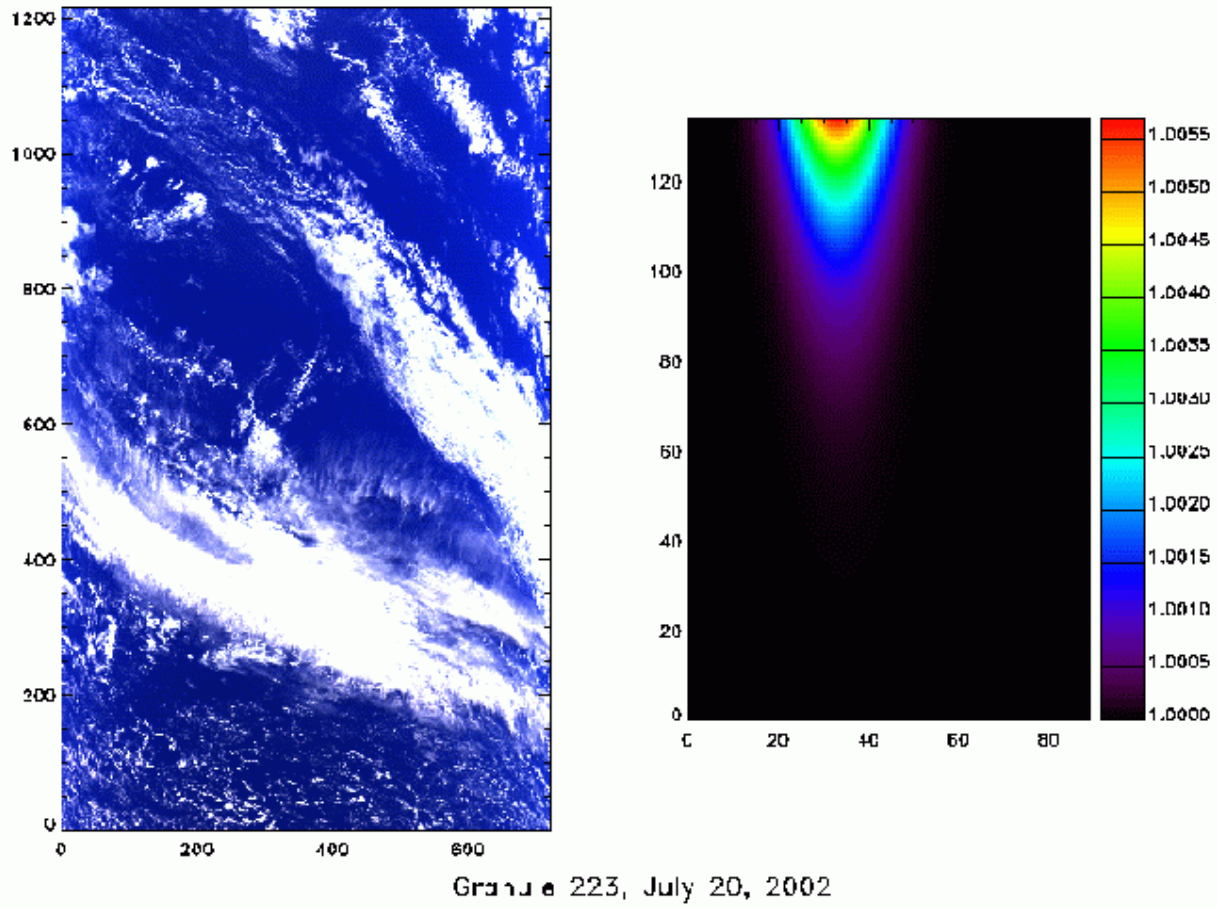
Registration between Vis/NIR and 1993 NDVI : Preliminary Results

- Very good N-S alignment
- 1-2 Vis/NIR pixel E-W misalignment
- Found some changes related to time difference between 2002 and 1993
- Will be developing AIRS NDVI soon

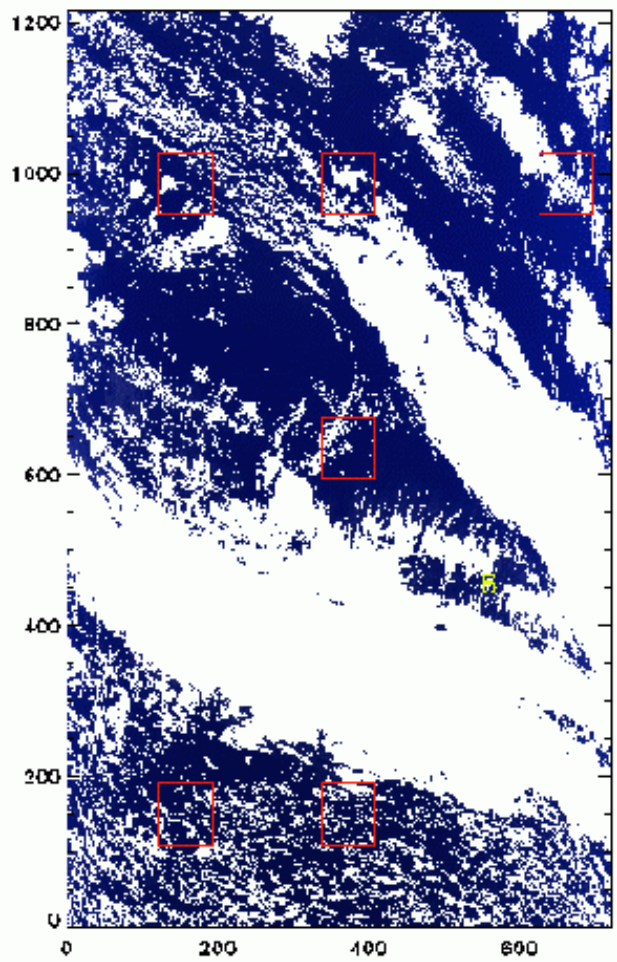
Vis/NIR Cloud Detection

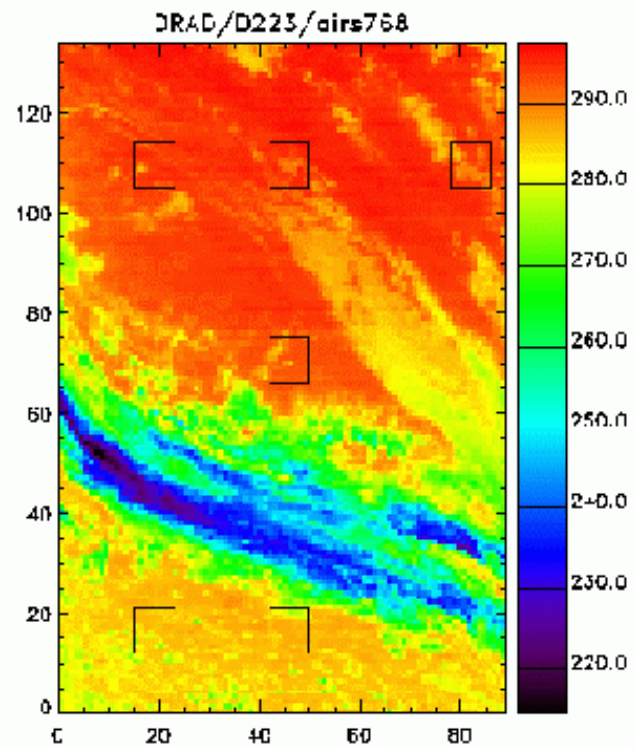
- Based on cloud threshold
- Cloud threshold: parameters adjusted to preliminary calibration
  - Visual assessment of cloud detection very good
- Some issues due to 1993 NDVI
- Comparison with spatial inhomogeneity approach results

Ocean Conditions: Sunglint

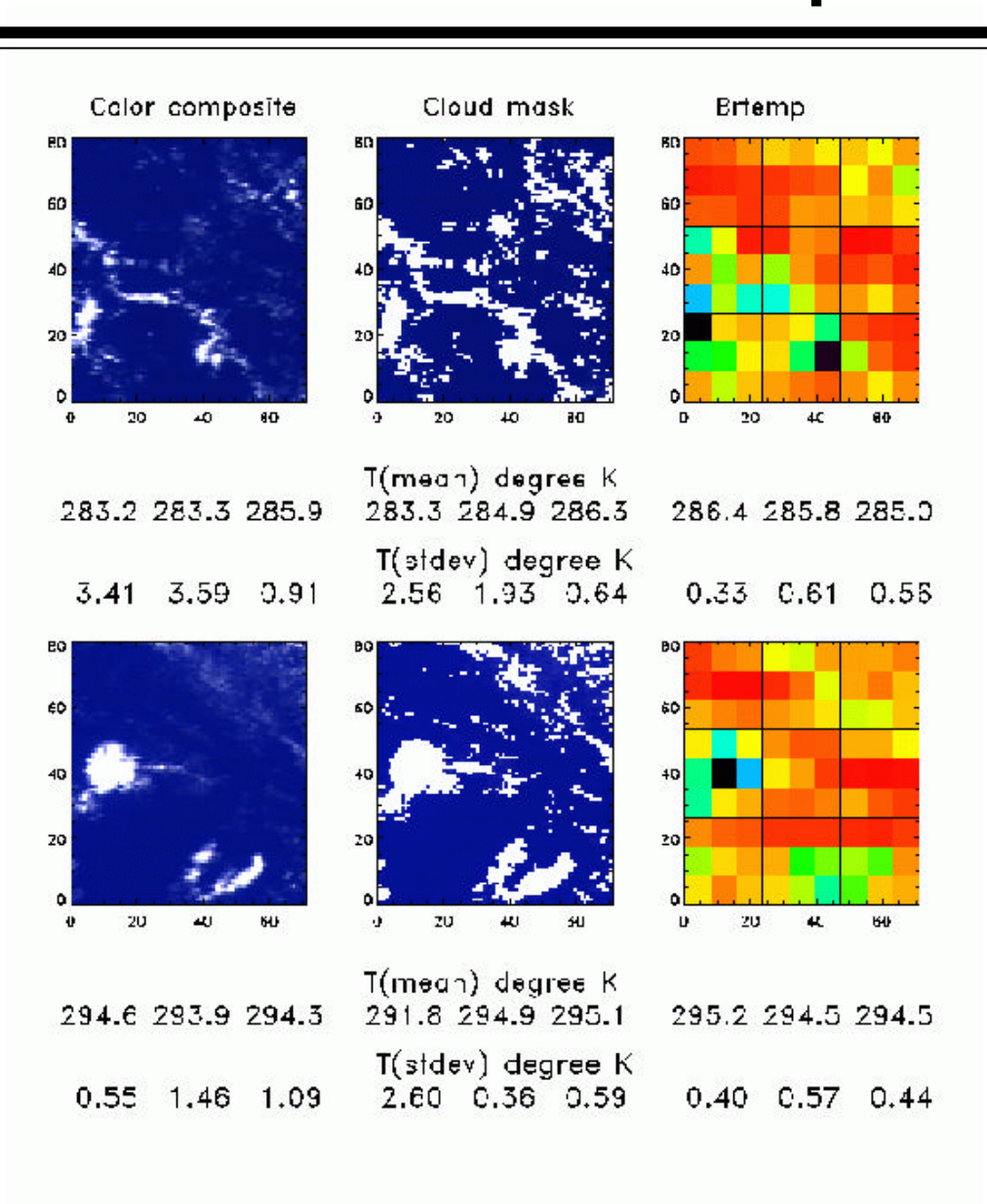


Ocean Conditions: scene selection

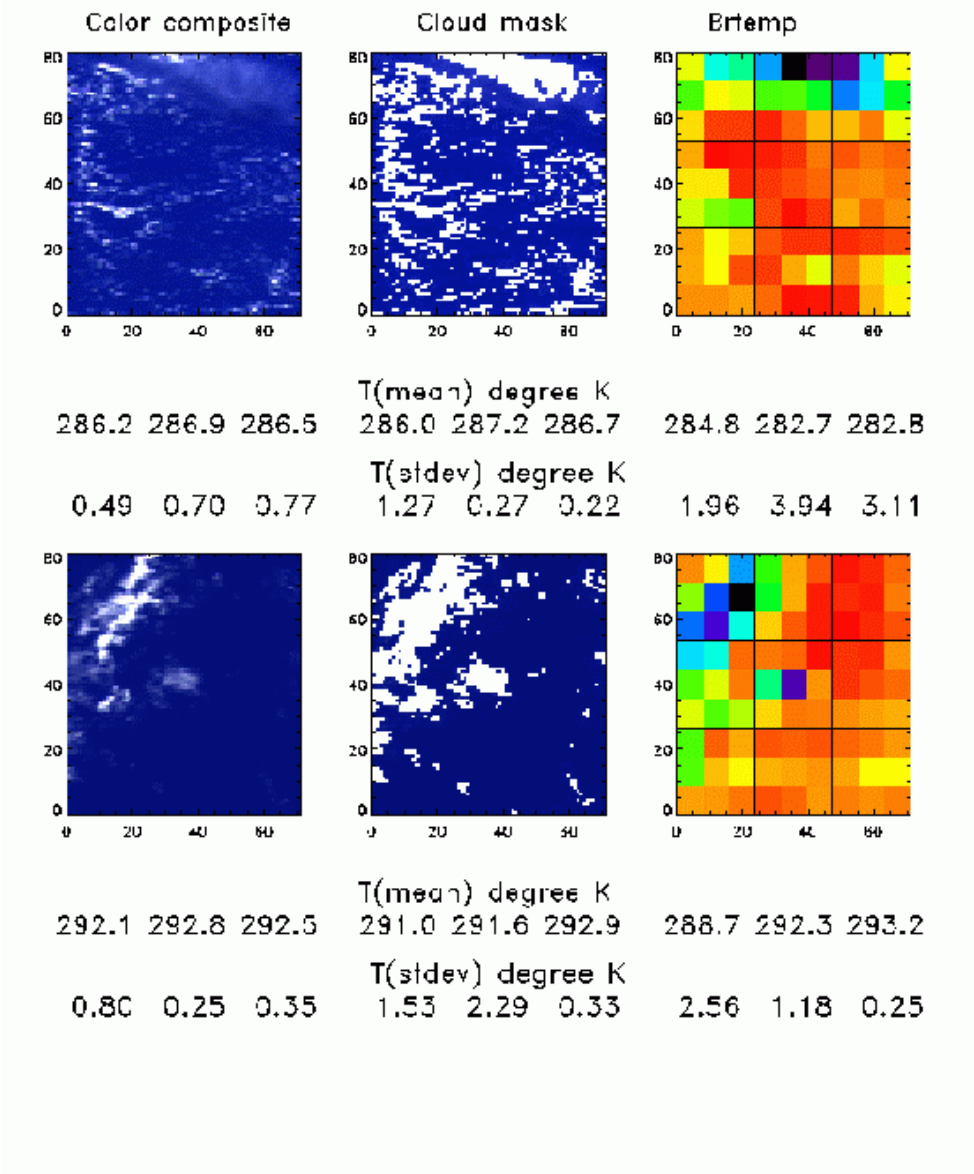




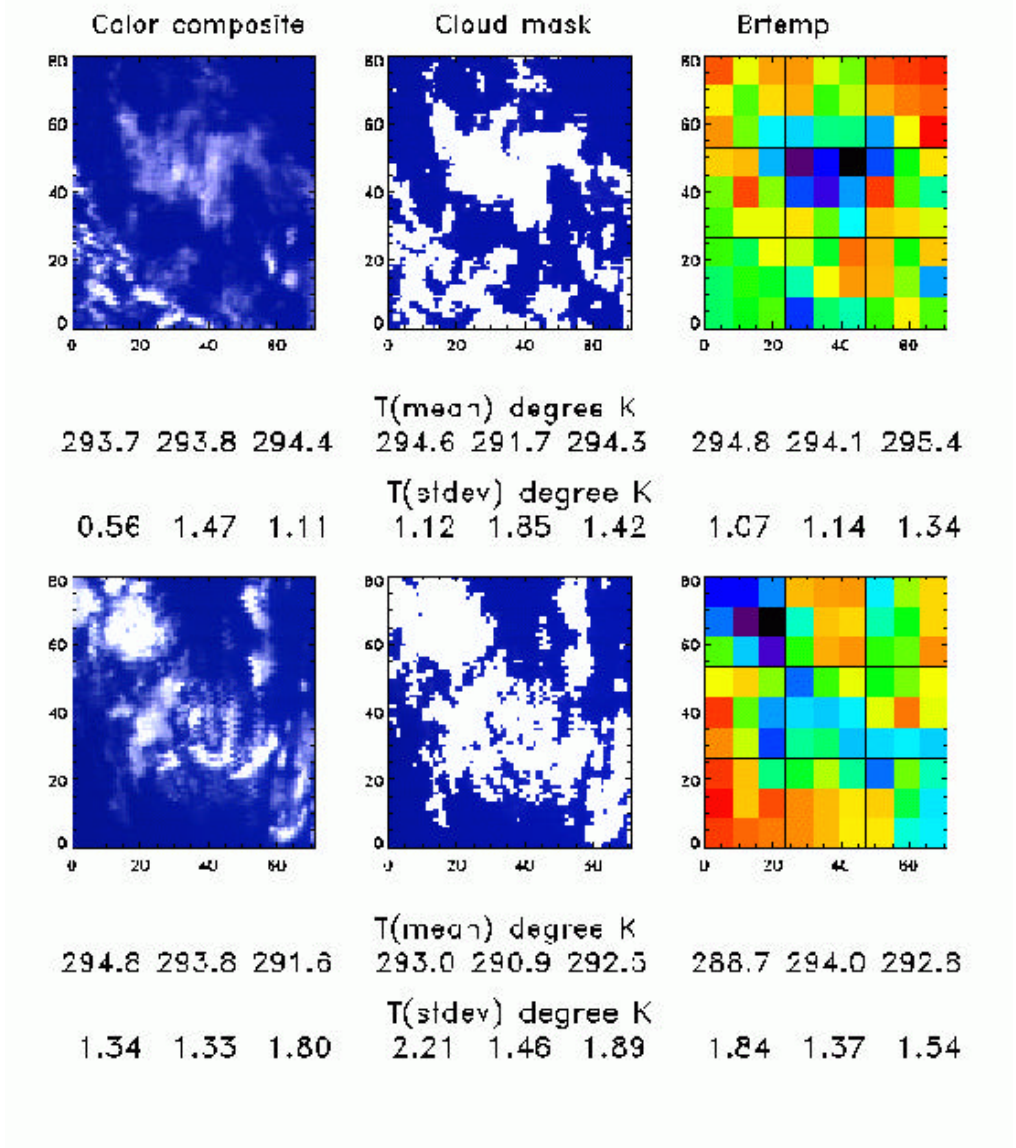
Vis/IR cloud mask vs. spatial homo



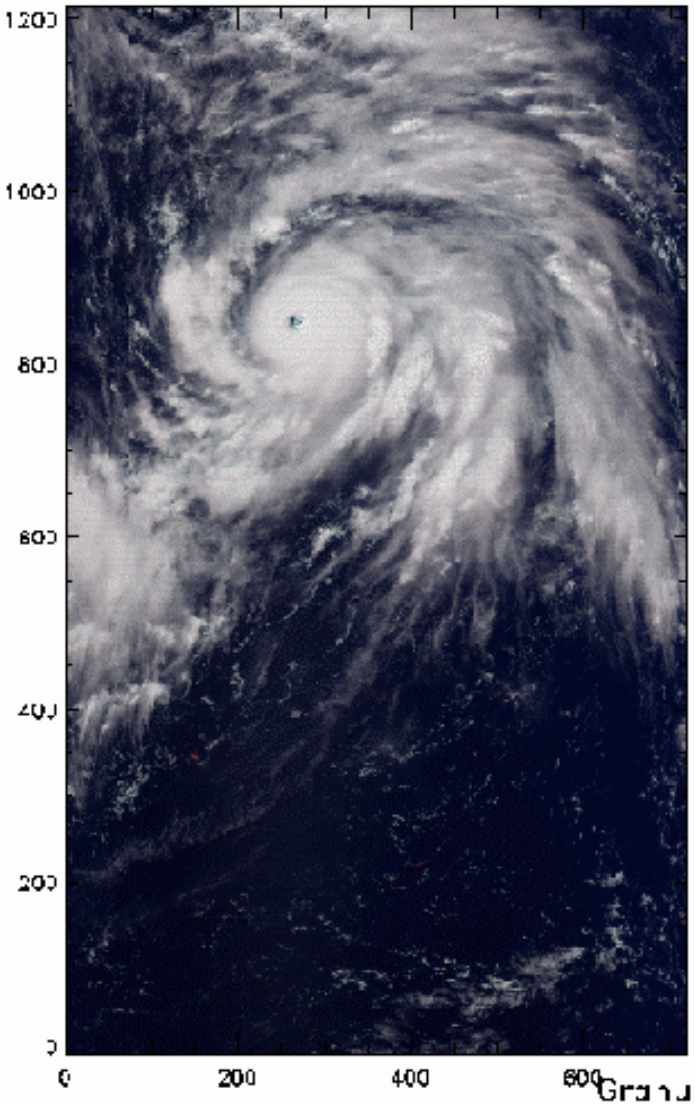
Vis/IR cloud mask vs. spatial homo

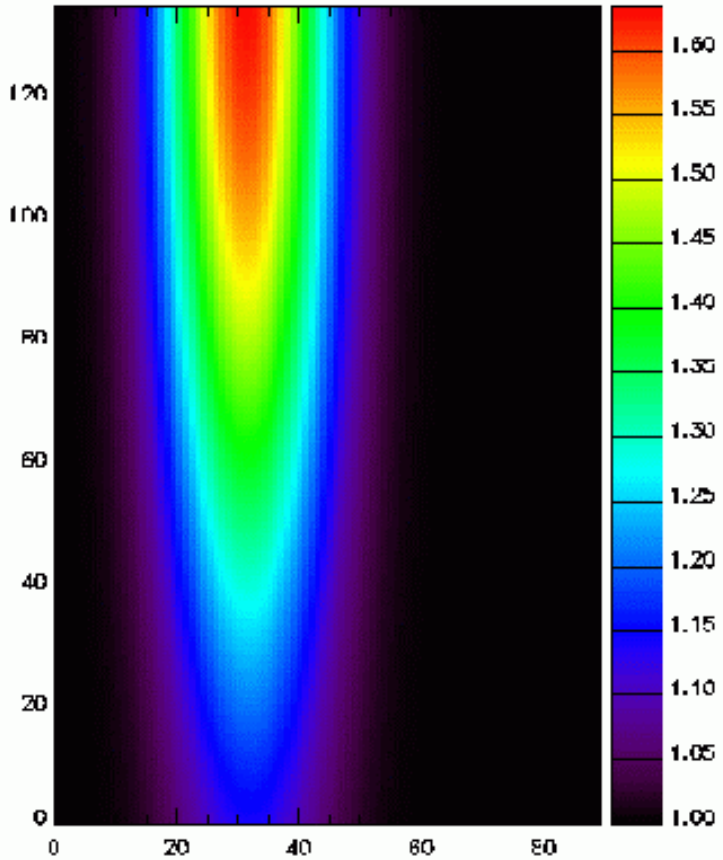


Vis/IR cloud mask vs. spatial homo



Ocean conditions: hurricane

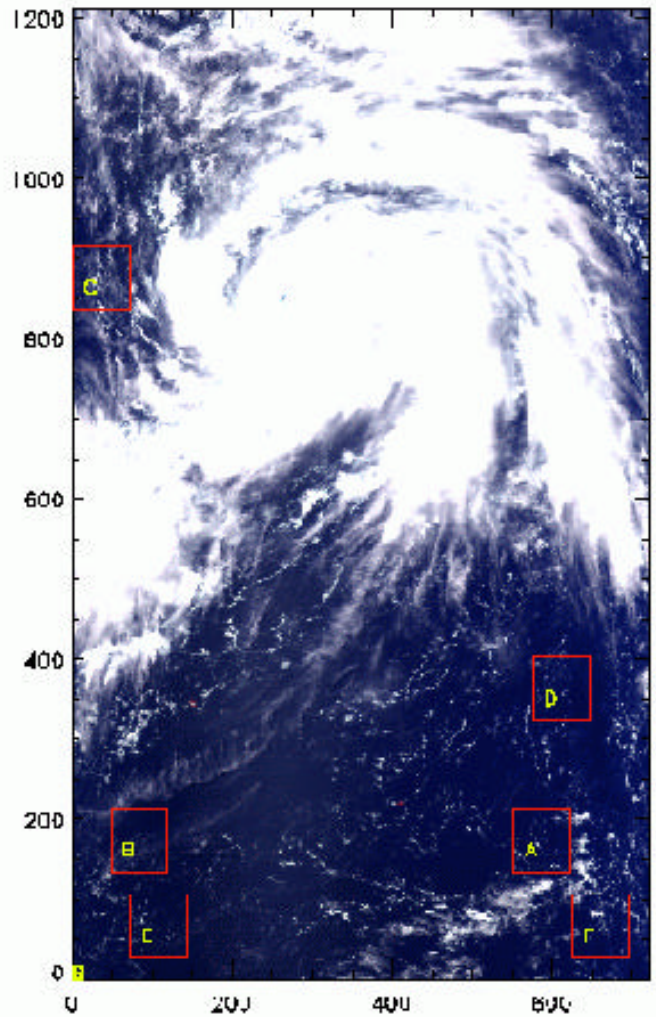


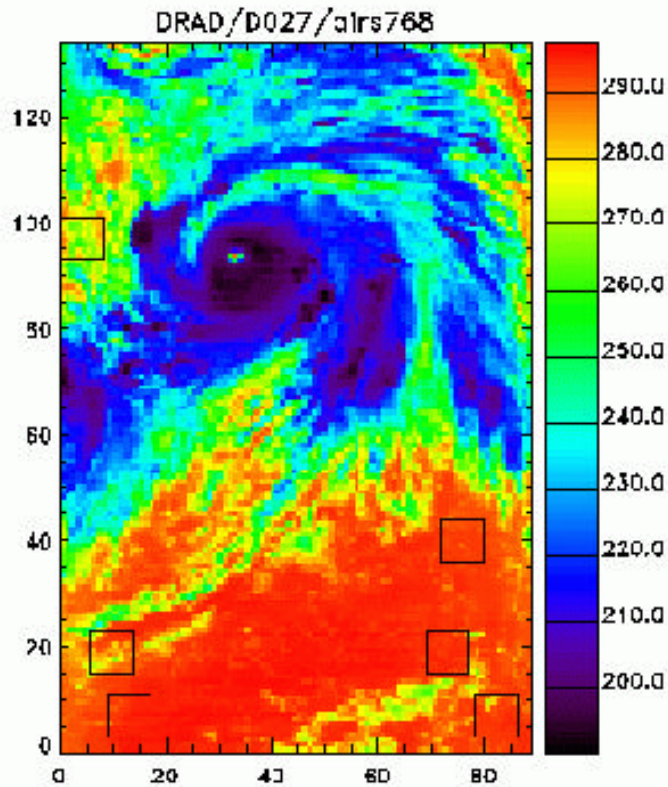


Ga

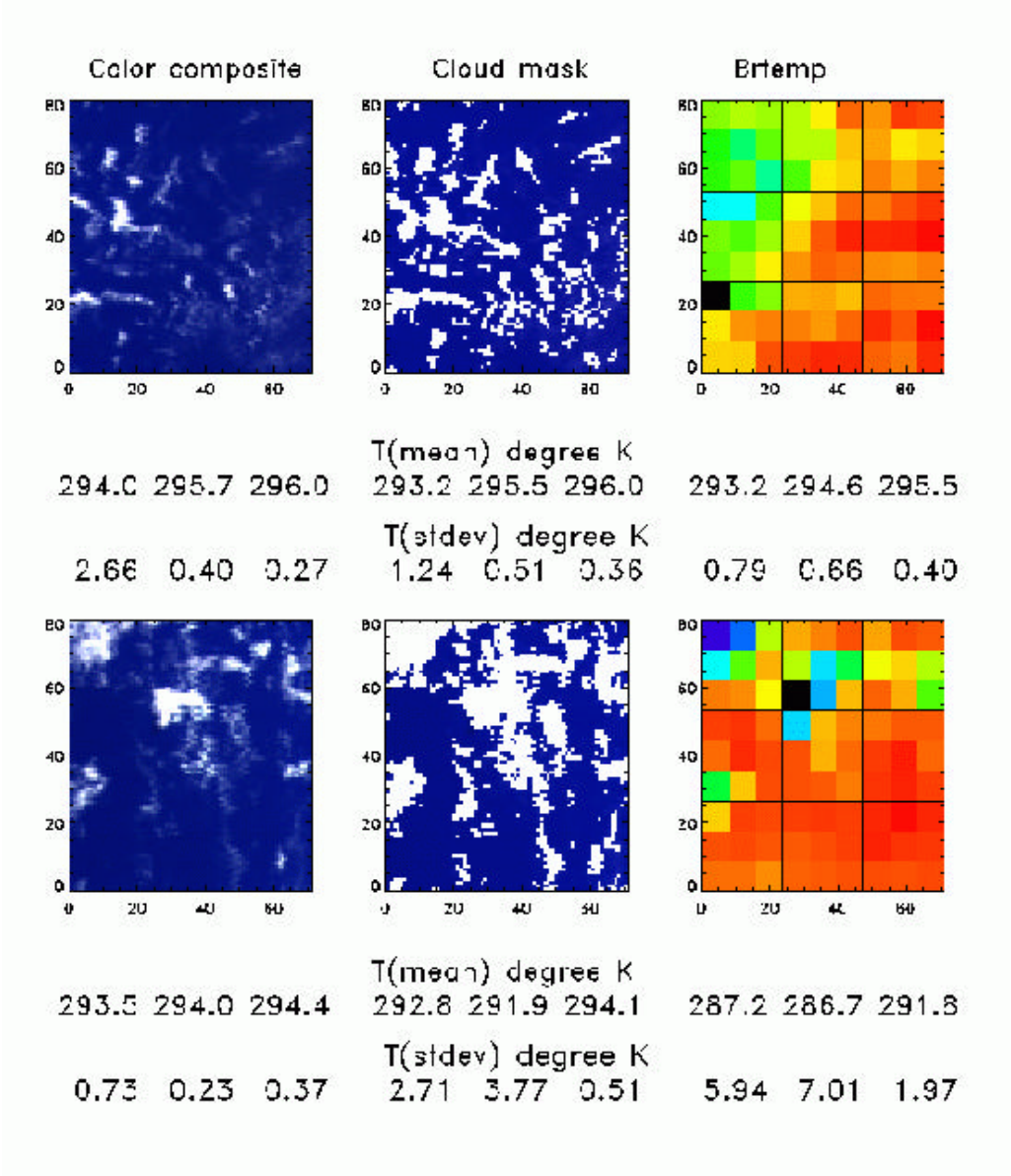
Granule 027, July 20, 2002

Ocean Conditions: scene selection

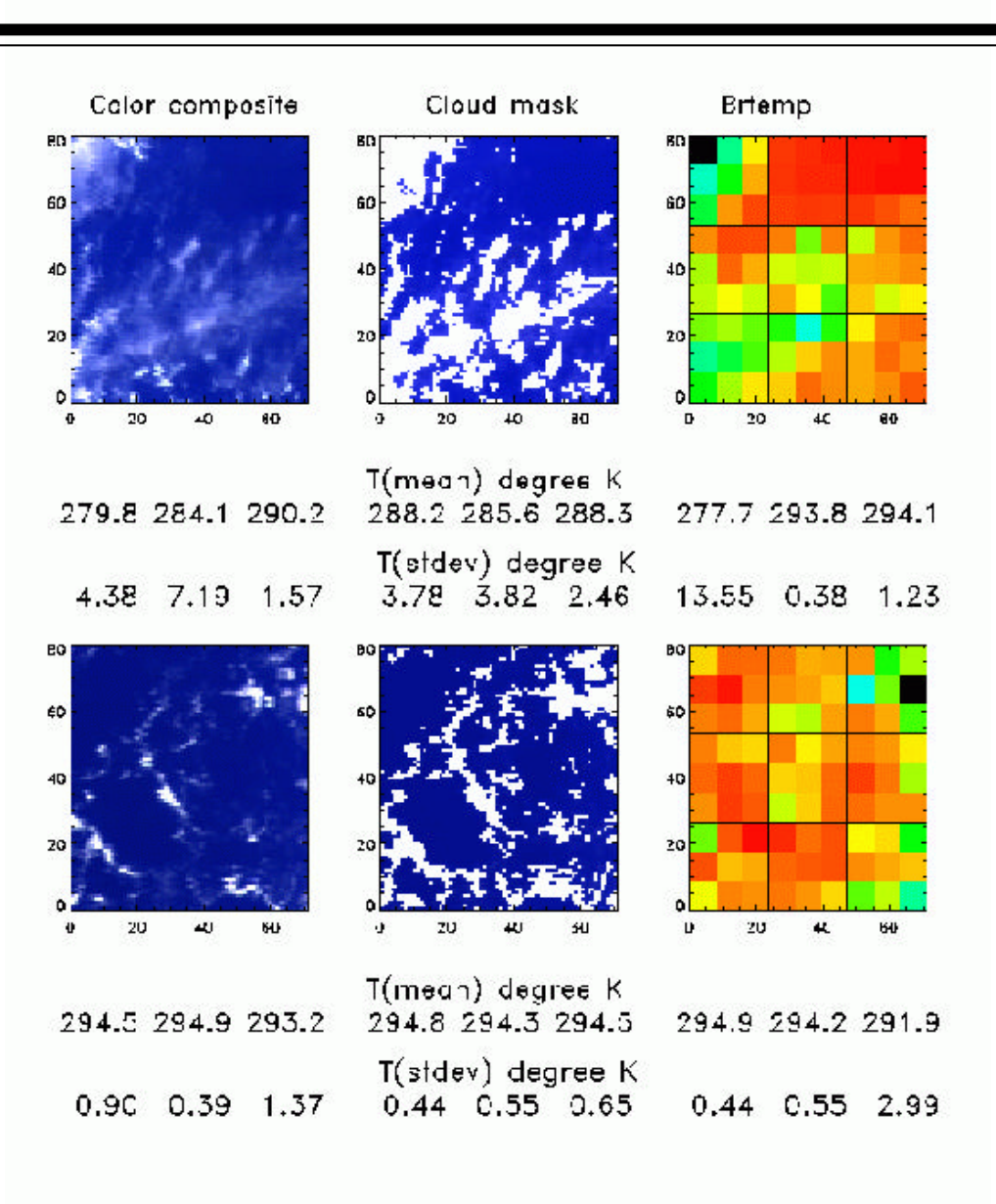




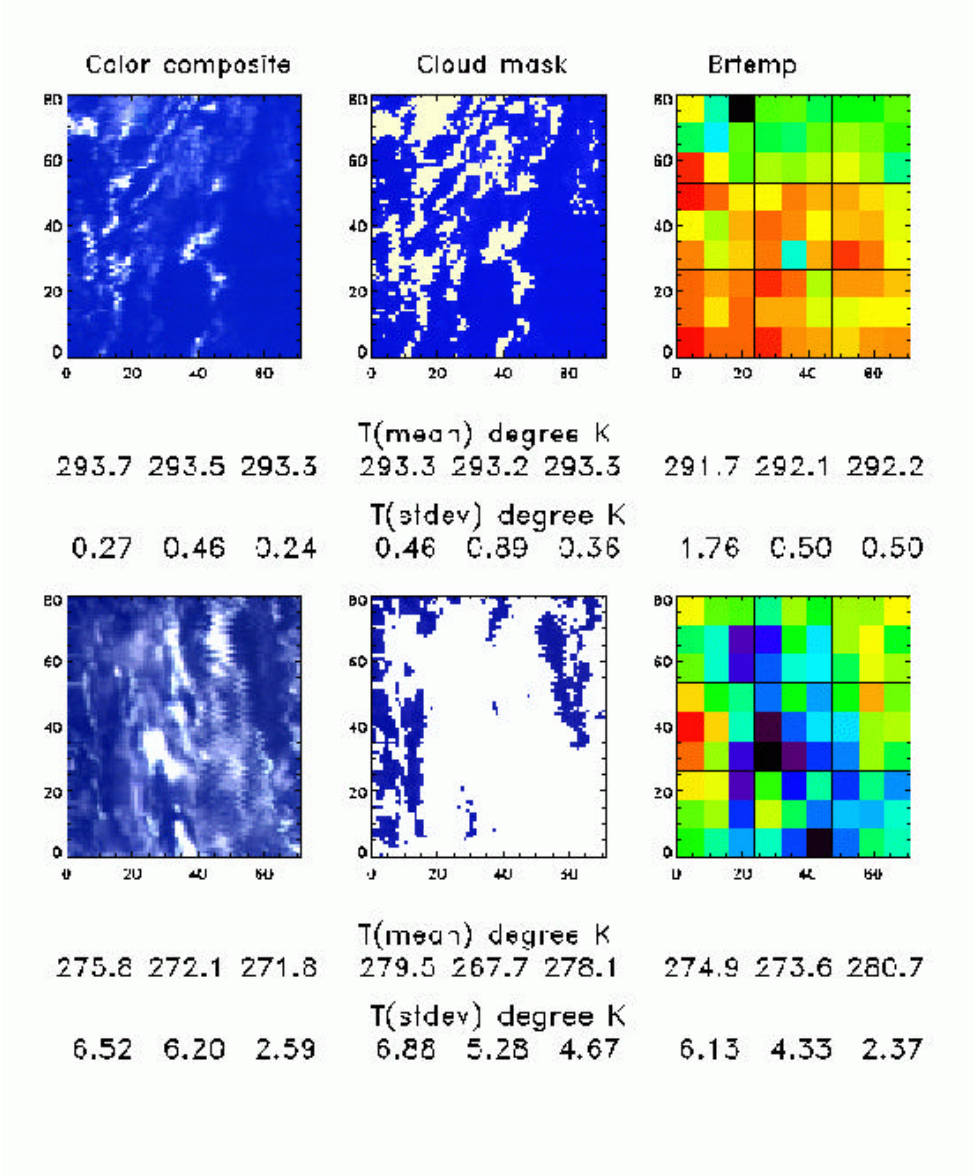
Vis/IR cloud mask vs. spatial homo



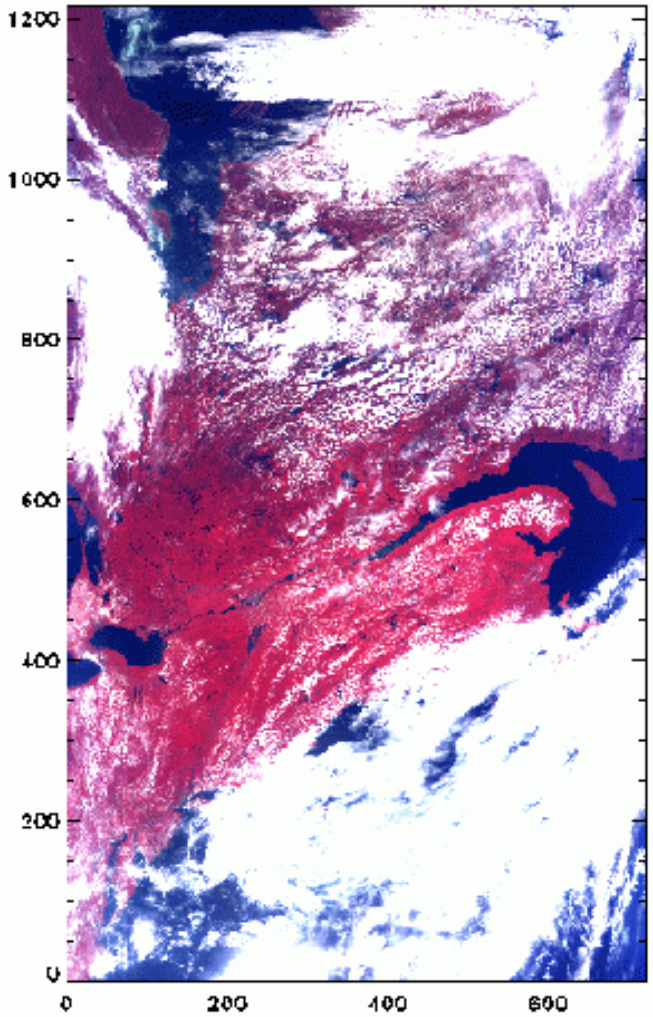
Vis/IR cloud mask vs. spatial homo

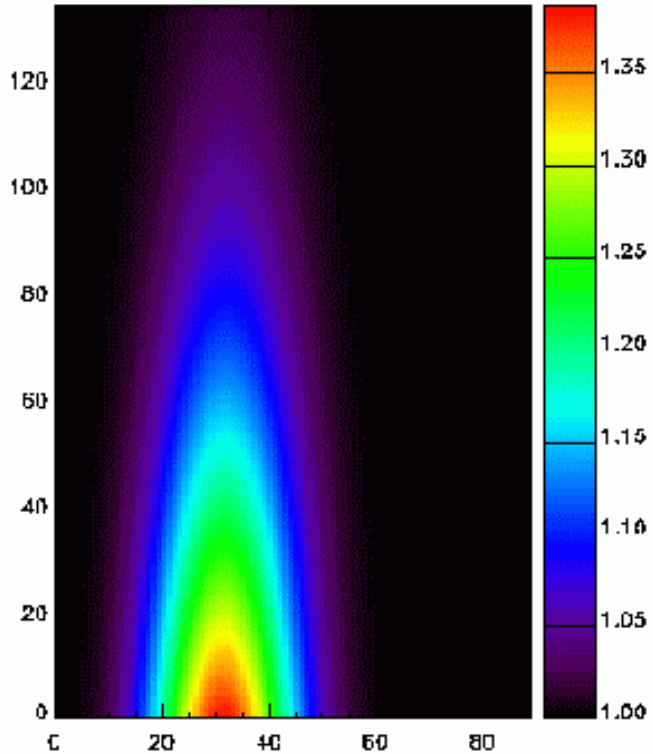


Vis/IR cloud mask vs. spatial homo



Land Conditions

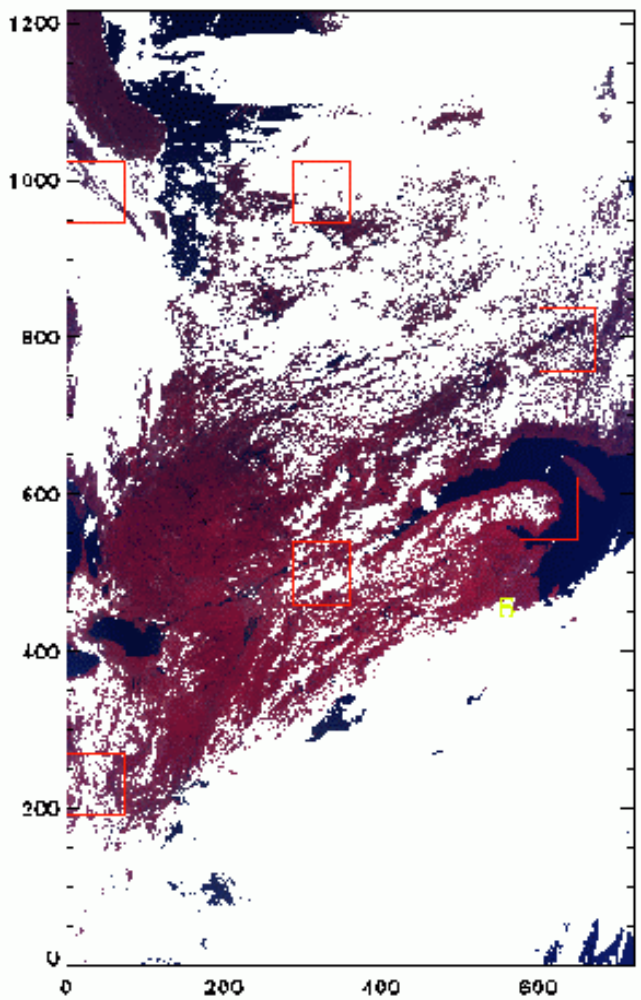


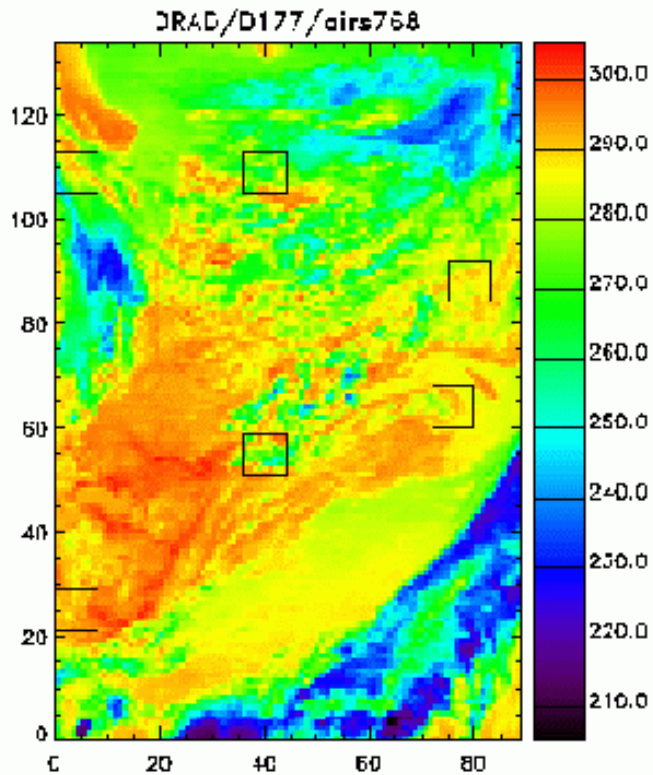


Gau

Granule 177, July 20, 2002

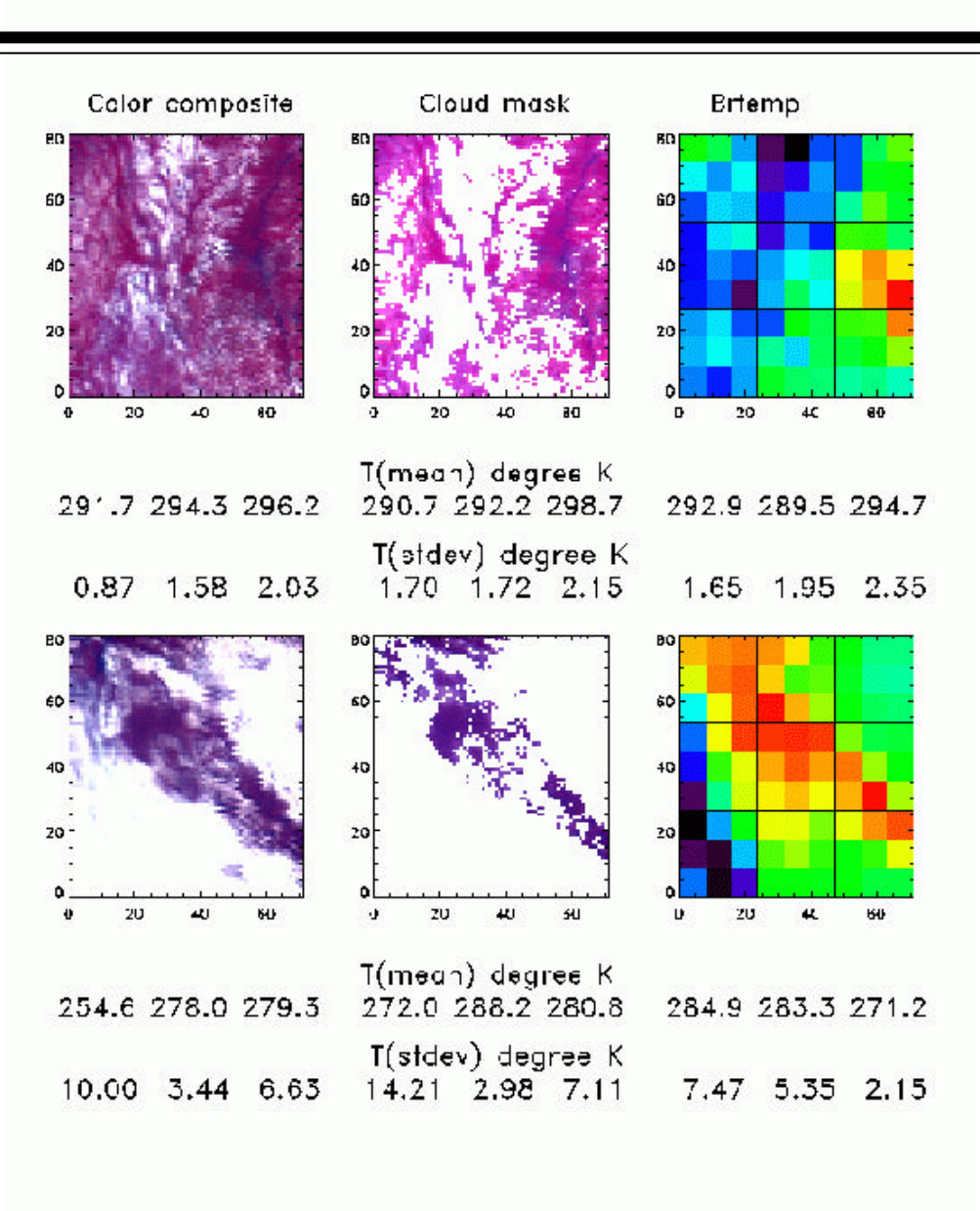
Land Conditions: scene selection



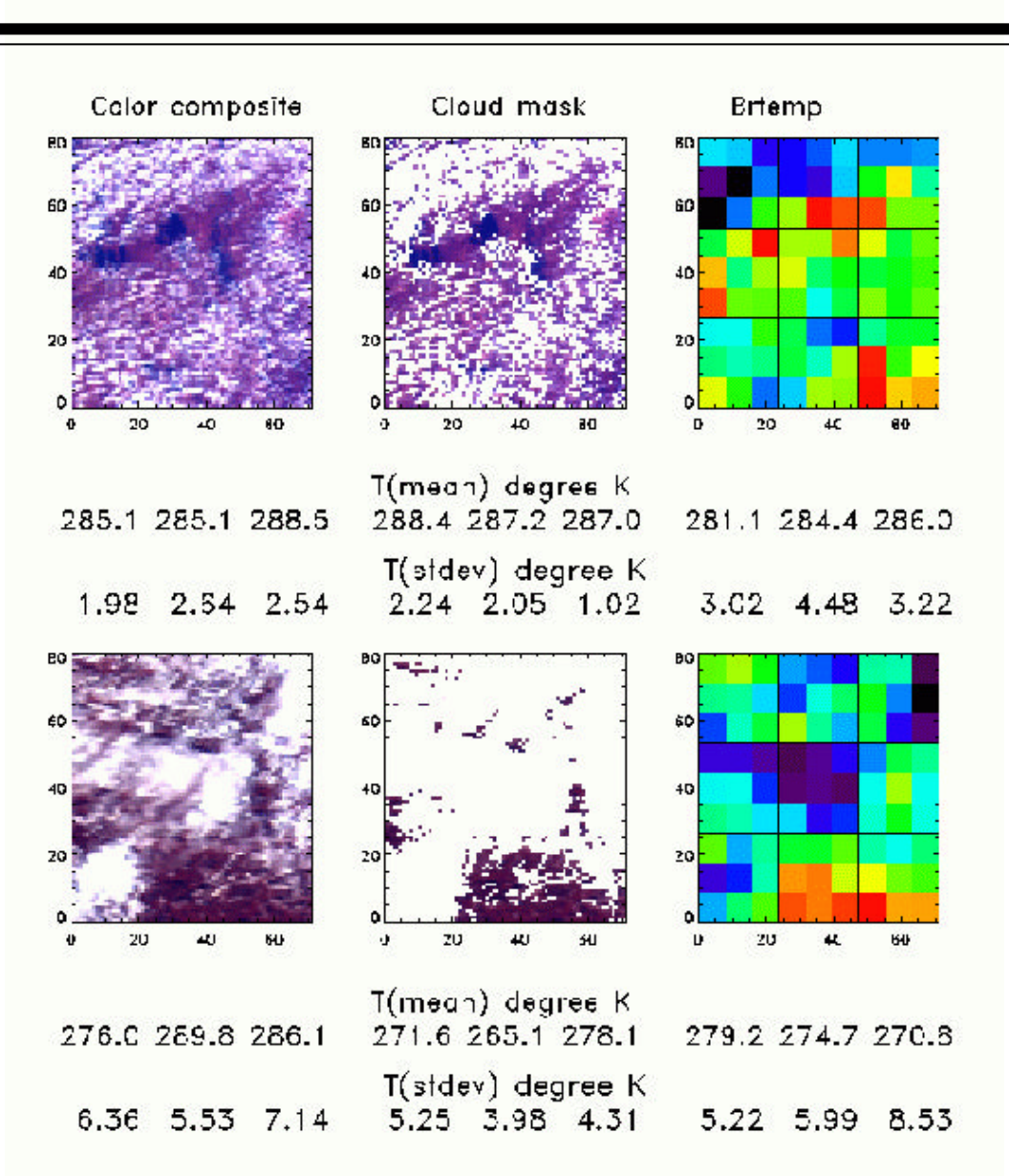


Gautie

Vis/IR cloud mask vs. spatial homo



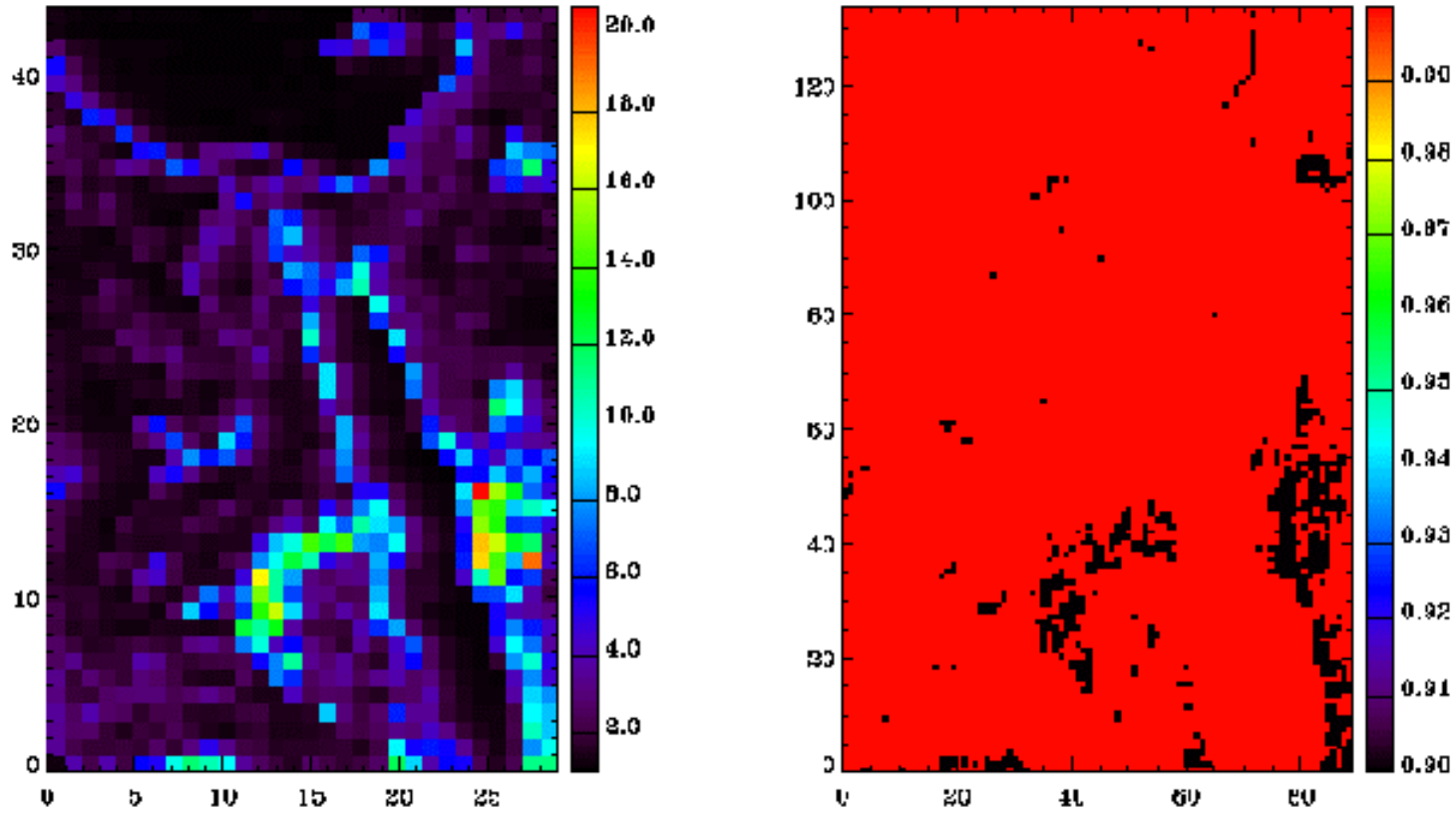
Vis/IR cloud mask vs. spatial homo



Cloud Detection : Preliminary Results

- Very good visual agreement
- Impact of 1-2 Vis/NIR pixel E-W misalignment and changes related to time difference between 2002 and 1993 will be addressed by AIRS NDVI soon
- Improvements based on spatial homogeneity approach

Granule 110



Left – standard deviation of brtemp in an AMSU footprint (inhomogeniety)
Right – inhomogeniety corrected (threshold reduction) area (black)

Near-term Activities

- Cloud flag over land evaluation
- Validation of cloud detection against local meteorological data and ARM/CART data
- Improved validation of geo-location and co-registration
- Vicarious calibration

Vicarious Calibration

- Surface observation-based calibration suggests some surface BRDF effects that need to be taken into account
- Development of BRDF model based on satellite observations
- Adaptation of UCSB RTM BRDF model to Railroad Valley surface conditions

Longer-term Activities

- Use combined Vis/NIR and IR channels for low cloud detection
- IR Spatial Inhomogeneity vs. Vis/NIR cloud threshold
- Cloud fraction comparisons
- Vis/NIR spectral response function
- Surface radiation budget modeling
- Land surface spectral emissivity