National Aeronautics and
Space Administration

**Goddard Space Flight Center**
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NASA

Reply to Attn of:

# *DISTRIBUTION of TABLES & FORMS*

18 January, 1990

Dear MODIS Team Member:

Enclosed are a number of tables which you may find helpful in your deliberations in preparation for the upcoming MODIS Science Team meeting. These tables summarize specifications on MODIS At Launch data products and MODIS Post Launch data products. Also included for your review are tables of current specifications on Eos products -- grouped so that you can make a comparison of products among instruments, and determine where possible "holes" in data requirements/products exist.

It is important that we understand your MODIS data needs, and we appreciate your conscientious input, which allowed us to prepare these tables. Also enclosed with this package are forms for each individual At Launch or Post Launch product. Please take some time before the meeting to examine the form, and fill in any information that you consider important on Interim, Ancillary, and Derivative products. Undoubtedly these forms can be improved, and will have to be expanded upon as we enter the algorithm development phase. Any suggestions you have regarding improving the information content of the form should be addressed to me (Tel: 301-286-5411). The forms should be returned to me at the end of the meeting.

Thanks again for your expert input, which enabled us to prepare the tables; we are looking forward to seeing you at our January 31 - February 2 meeting.

Locke Stuart

Locke Stuart

cc:
V. Salomonson/600

MODIS AT-LAUNCH DATA PRODUCTS

These are products that it is conservatively believed can be provided shortly after launch, based on prelaunch experience with precursor airborne and spaceborne sensors. Many other products are expected to be developed as a result of postlaunch research.

## I. OCEAN AT-LAUNCH DATA PRODUCT ANALYSES

| PRODUCT/PARAMETER | MEASUREMENT | ABSOLUTE ACCURACY (std. error) | PRECISION (RELATIVE ACCURACY) | RESOLUTION (SPATIAL or VERTICAL) | PRODUCT TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| A. Chlorophyll-A Concentration (Case I) | mg/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Locl/Reg/Glob | Evans/Clark/Gordon | Typical conditions. |
| B. Chlorophyll-A Concentration (Case II) | mg/m^3 | ±50% | ±10% | 1, 20 km | Daily/Weekly | Regionl/Global | Carder/Clark/Hoge | Parslow also. Based on simulated lab data. |
| C. Chlorophyll Fluorescence (Line Height) | mW/cm2/sr/µm | ±30% | ±10% | 1, 20 km | Daily/Wk/Mo. | Regionl/Global | Gordon/Abbott/Evans | Hoge also. Probably >> error at low concent. |
| D. Pigment Concentration (CZCS) | mg/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Locl/Reg/Glob | Clark/Gordon | Anc: OWP (Esaias input) |
| E. Sea Surface Temperatures | °K | ±0.3-0.4°K | ±0.1-0.3°K | 1, 20 km | Daily/Wk/Mo. | Regionl/Global | Brown/Barton | Also Season/yr.±4 km positioning on Earth grid. |
| F. Water-Leaving Radiance,Visible Channels | mW/cm2/sr/µm | ±10% | ±5% | 1 km | Daily | Locl/Reg/Glob | Gordon/Evans/Tanre | Typical conditions. |
| G. Attenuation K at 490 nm (Case I Waters) | Per meter | ±25% | ±10% | 1, 20 km | Daily/Weekly | Locl/Reg/Glob | Clark/Gordon | Accuracy based on typical conditions. |
| H. Detached Coccolith Conc. (E. huxleyi) | mg CaCO3/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Locl/Reg/Glob | Gordon | Anc: OWP (Esaias & Gordon inputs) |
| I. Dissolved Organic Matter Concentration | mg/m^3 | ±150% | ±30% | 1, 20 km | Daily/Weekly | Regionl/Global | Carder/ParslowHoge | Anc: OWP. 30% error based on sim. lab data (Parslow) |
| J. Sea Ice (Maximum Total Extent) | km^2 | ±5% or less | ±5% or less | 1, 10 km | Daily/Weekly | Regionl/Global | Salomonson | Accuracy based on March Ice Northern Hemisphere |
| K. Phycoerythrin Pigment Concentration | mg/m^3 | ±200% | ±50% | 1, 20 km | Daily/Weekly | Regionl/Global | Hoge | (Esaias input) |
| L. Single Scattering Aerosol Rad., ta < 0.6 | mW/cm2/sr/µm | ±10% | ±5% | 1, 20 km | Daily/Weekly | Locl/Reg/Glob | Gordon/Tanre | Case I waters w/moderate concentrations. |
| M.Aerosol Angstrom Exp., Optical Depth <.6 | Dimensionless | ±15% | ±5% | 1, 20 km | Daily/Weekly | Locl/Reg/Glob | Gordon/Tanre | Accuracy depends on SNR, pixel averaging. |
| N. Total Suspended Solids | gm/m^3 | ±50% | ±35% | 1, 20 km | Daily/Weekly | Global | Clark | Anc: OWP (Esaias input) |

## II. LAND AT-LAUNCH DATA PRODUCT ANALYSES

| PRODUCT/PARAMETER | MEASUREMENT UNITS | ABSOLUTE ACCURACY (std. error) | PRECISION (RELATIVE ACCURACY) | RESOLUTION (SPATIAL or VERTICAL) | PRODUCT TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| A. Level 2 Land-Leaving Radiances | W/m^2/sr/µm | ±10% | ±5% | 0.5, 1, 10 km | Daily | Regionl/Global | Tanre/Strahler | Kaufman too. (Tanre & Townshend input) |
| B. Land Cover Type/Biome Area | km^2 | ±5% | ±1-5% | 0.5, 1, 10 km | Season/Yearly | Regionl/Global | Strahler/Huete/Just. | Need Land-Leaving+topographic+214m band cloud cor. |
| C. Vegetation Indices | Dimensionless | ±0.01 | ±0.01 | 0.5, 1, 10 km | Daily/Wk/Mo. | Regionl/Global | Justice/Huete/Tanre | Range: 0-1. Need Land-leaving+topo+214m cloud cor. |
| D. Surface Temperature | °C | ±1-3°C | ±1°C | 1, 10 km | Daily/Weekly | Regionl/Global | Wan/Susskind | Range -20 to 50°C. AMSU necessary. |
| E. Snowcover | km^2 | ±5% or less | ±5% or less | 1, 10 km | Daily/Weekly | Regionl/Global | Salomonson | Accuracy based on avr. January snowcover N. Hemis. |
| F. Thermal Anomalies (volcanoes, fires) | °C | ±10°C | ±5°C | 1, 10 km | Daily/Weekly | Regionl/Global | Kaufman | Day & night data required. |

## III.ATMOSPHERE AT-LAUNCH DATA PRODUCT ANALYSIS

| PRODUCT/PARAMETER | MEASUREMENT UNITS | ABSOLUTE ACCURACY (std. error) | PRECISION (RELATIVE ACCURACY) | RESOLUTION (SPATIAL or VERTICAL) | PRODUCT TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| A. Cloud Optical Thickness | Dimensionless | ±20% | ±10% | 5 km | Daily/Monthly | Global | King | Daytime. |
| B. Cloud Fractional Area | per cent. | ±10% | ±5% | 100 km | Twice Day/Mo. | Global | King/Kaufman | Daytime. |
| C. Cloud Effective Emissivity | Dimensionless | ±0.10 | ±0.05 | 50 km | Twice Day/Mo. | Global | Menzel/Susskind | CO2 algorithm. |
| D. Cloud Top Height | meters | ±500 m | ±200 m | 5 km | Daily/Monthly | Global | Menzel/Susskind | AMSU necessary. CO2 algorithm. |
| E. Cloud Top Temperature | °C | ±2°C | ±1°C | 5 km | Twice Day/Mo. | Global | Susskind/Menzel | AMSU necessary. CO2 slicing. |
| F.Cloud Droplet Effective Radius | µm | ±0-40% | ±5% | 5 km | Daily/Monthly | Global | King | Daytime. |
| G. Cloud Water Thermodynamic Phase | Ice or water | | | 5 km | Daily/Monthly | Global | King/Menzel | |
| H. Aerosol Optical Thickness | Dimensionless | ±0.05-0.1 | 0.02-0.05 | 50 km | Week/Monthly | Global | Tanre/Kaufman/King | Accuracies: ocean(greater)-land(lesser). Daytime. |
| I. Columnar Aerosol Size Distribution | no./cm^2/µm | ±10-30% | ±10% | 250 km | Week/Monthly | Global | Tanre/King | For indices 1-5µm. Land & ocean separate |
| J. Aerosol Mass Loading | gm/m^2 | ±30% | ±10% | 50 km | Week/Monthly | Regionl/Global | Kaufman/Tanre | For indices <5µm. Land & ocean separate |
| K. Temperature Profile | °C | ±2°C | ±1°C | 10 km | Twice Daily | Regionl/Global | Susskind/Menzel | AMSU necessary. |
| L. Total Precipitable Water | cm | ±15% | ±5% | 10 km | Daily/Monthly | Global | Kaufman/Menzel | Susskind & Barton also. Daytime |
| M.Total Column Ozone | Dobson Units(DU | 15-20 DU | 10 DU | 10 km | Twice Day/Mo. | Global | Susskind/Menzel | AMSU necessasry. King input. |

OWP=Ancillary data: ozone, winds, sea surface pressure. Updated 16 Jan 90.

MODIS INTERIM/ANCILLARY DATA PRODUCTS

These are products that will be available in the process of producing the at- or post-launch data products, or non-MODIS ancillary products required to produce MODIS data products.

| PRODUCT/PARAMETER | MODIS DATA PRODUCT | MEASUREMENT UNITS | ABSOLUTE ACCURACY (std. error) | PRECISION (RELATIVE ACCURACY) | RESOLUTION (SPATIAL o VERTICAL) | PRODUCT TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| I. MODIS INTERIM DATA PRODUCTS | | | | | (Less than or equal to) | (Less than or equal to) | (Better than or equal to) | | |
| AT LAUNCH | | | | | | | | | |
| A. Cloud Identification | Ocean: Sea Ice | Km^2 | | | 1-10 km | Daily/Weekly | Global/Regionl | | Differentiatn&subtractn importnt. Ardanuy |
| B. Total Scattering Coefficient b | Ocean: | per meter | | ±15% | 1-20 km | Daily/Weekly | Global | | Esaias input. Several bands. |
| C. Phytoplankton Scattering Coefficient b* | Ocean: | per meter | | ±20% | 1-20 km | Daily/Weekly | Global | | Esaias input. Several bands. |
| D. b - b* | Ocean: see previous entries | per meter | | ±20% | 1-20 km | Daily/Weekly | Global | | Esaias input. Several bands. |
| E. Total Absorptance | Ocean: | per meter | | ±115% | 1-20 km | Daily/Weekly | Global | | Esaias input. Several bands. |
| F. Phytoplankton Absorptance (a/p) | Ocean: | per meter | | ±20% | 1-20 km | Daily/Weekly | Global | Carder | Esaias input. Several bands. |
| G. Non-phytoplankton Absorptance(a/other | Ocean: | per meter | | ±20% | 1-20 km | Daily/Weekly | Global | Carder | Esaias input. Several bands. |
| H. Glint Field | Ocean: | dimensionless | | N/A | 1 km | Daily | Global | Evans/Gordon | Esaias input. |
| POST LAUNCH | | | | | | | | | |
| A. Hemispheric Reflectance | Land: BRDF/Albedo | dimensionless | | | 1-10 km | Daily/Weekly | Global/Regionl | Huete? | Huete input. |
| B. Nadir Reflectance | Land: BRDF/Albedo | dimensionless | | | 1-10 km | Daily/Weekly | Global/Regionl | Huete? | Huete input. |
| C. Atmospheric Correction (Transmittance) | Land: BRDF/Albedo | dimensionless | | | 1-10 km | Daily/Weekly | Global/Regionl | Gordn/Susknd? | Huete input. |
| D. Atmospheric Correction (Transmittance) | Land: Level-2 Leaving Rads | dimensionless | | | Pixel size | Daily | Global/Regionl | Gordn/Susknd? | Ardanuy input. |

MODIS INTERIM/ANCILLARY DATA PRODUCTS

| PRODUCT/PARAMETER | MODIS DATA PRODUCT | MEASUREMENT UNITS | ABSOLUTE ACCURACY (std. error) | PRECISION (RELATIVE ACCURACY) | RESOLUTION (SPATIAL o VERTICAL) | PRODUCT TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| II. REQUIRED ANCILLARY (NON-MODIS) DATA | | | | | (Less than or equal to) | (Less than or equal to) | (Better than or equal to) | | |
| AT LAUNCH | | | | | | | | | |
| A. AMSU | Atmos: Total Column Ozone | Dobsn Unit(DU) | | | 10 km | Twice Daily | Global | Susskind? | King input. |
| B. AMSU | Atmos: Temp. Profile | Degrees C | | | 10 km | Twice Daily | Global | Susskind? | King input. |
| C. CO2 Data & Algorithm | Atmos: Cld Eff. Emissivity | | | | 50 km | Daily | Global | Menzel? | Menzel input. |
| D. CO2 Data & Algorithm | Atmos: Cloud Top Pressure | | | | 1-50 km | Daily | Global | Menzel? | Menzel/Ardanuy input. |
| E. AMSU | Atmos: Cloud Top Temp. | | | | 2-50 km | Twice Daily | Global | Susskind? | King input. |
| F. CO2 Data & Algorithm | Atmos: Cloud Top Temp. | | | | 2-50 km | Twice Daily | Global | Menzel? | Ardanuy input. |
| G. AMSU | Land: Surface Temperature | | | | 1-10 km | Daily/Weekly | Global/Regionl | Susskind? | King input. |
| H. In-Situ Validation Observations | Ocean: Sea Surface Temp. | °K | 0.5°K | 0.15°K | 2 km | Pass ±15 min. | | Brown? | Brown input. ±1 km position on Earth grid. |
| In-Situ Validation Observations | Ocean: Sea Surface Temp. | °K | | ±0.1°K | | Daily | Local | Barton? | Barton input. Ship & Buoy measurements. |
| I. Passive Microwave | Ocean: Sea Ice | km sq. | | | 1-10 km | Daily/Weekly | Global/Regionl | D. Hall? | D. Hall input. |
| J. Winds, Sea Surface Pressure | Ocean: Water-Leaving Rad. | m/sec, mb | | | 1 km | Daily | Glob/Reg/Locl | Esaias? | Esaias input. |
| K. Winds, Sea Surface Pressure | Ocean: Chloro. Flourescence | m/sec, mb | | | 1-20 km | Daily | Global/Regionl | Esaias? | Esaias input. |
| In-Situ Validation Observations | Ocean: Chloro. Flourescence | | ±10% | ±2% | Test Site | TBD | Test Site | Hoge? | Hoge input. Mid-Atlantic Bight. |
| L. Winds, Sea Surface Pressure | Ocean: Chlor-A Pig. Conc.-I | m/sec, mb | | | 1-20 km | Daily/Weekly | Glob/Reg/Locl | Esaias? | Esaias input. |
| M. Winds, Sea Surface Pressure | Ocean: Chlor-A Pig. Conc-II | m/sec, mb | | | 1-20 km | Daily/Weekly | Global/Regionl | Esaias? | Esaias input. |
| In-Situ Validation Observations | Ocean: Chlor-A Pig. Conc-II | µg/liter | ±10% | ±2% | Test Site | TBD | Test Site | Hoge? | Hoge input. Mid-Atlantic Bight. |
| N. Winds, Sea Surface Pressure | Ocean: Attenua K @ 490 nm | m/sec, mb | | | 1-20 km | Daily/Weekly | Glob/Reg/Locl | Esaias? | Esaias input. |
| O. Winds, Sea Surface Pressure | Ocean: Aerosol Angstr. Exp. | m/sec, mb | | | 1-20 km | Daily/Weekly | Glob/Reg/Locl | Esaias? | Esaias input. |
| P. Winds, Sea Surface Pressure | Ocean:Sngl Scttrng Aero Rad | m/sec, mb | | | 1-20 km | Daily/Weekly | Glob/Reg/Locl | Esaias? | Esaias input. |
| Q. Winds, Sea Surface Pressure | Ocean: Tot Scatterng Coeff b | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| R. Winds, Sea Surface Pressure | Ocean: Phytoplankton Scatt. | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| S. Winds, Sea Surface Pressure | Ocean: b - b* | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| T. Winds, Sea Surface Pressure | Ocean: Total Absorptance, a | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| U. Winds, Sea Surface Pressure | Ocean: Phytoplank. Absorpt | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| V. Winds, Sea Surface Pressure | Ocean: Non-Phyto Absorpt. | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| W. Winds | Ocean: Glint Field | m/sec, mb | | | 1 km | Daily | Global | Esaias? | Esaias input. Ancill. prod. for interim prod. |
| POST LAUNCH | | | | | | | | | |
| A. AMSU | Atmos: Longwv Eff Cld Fract | | | | 2 km | Twice Daily | Global | Susskind? | King input. |
| B. AMSU | Atmos: Cloud Top Height | | | | 2 km | Twice Daily | Global | Susskind? | King input. |
| C. AMSU | Atmos: Moisture Profile | | | | 10 km | Twice Daily | Global | Susskind? | King input. |
| D. AIRS | Atmos: Moisture Profile | | | | 10 km | Twice Daily | Global | Susskind? | Ardanuy input. |
| E. Winds, Sea Surface Pressure | Ocean: Detach Cocco Concent | m/sec, mb | | | 1-20 km | Daily/Weekly | Glob/Reg/Locl | Esaias? | Esaias input. |
| F. Winds, Sea Surface Pressure | Ocean: Surface Incident PAR | m/sec, mb | | | 1-100 km | Daily | Global | Esaias? | Esaias input. |
| G. AVHRR (NOAA) | Ocean: Surface Incident PAR | | | | 1-100 km | Daily | Global | Esaias? | Esaias input. |
| H. GOES (NOAA) | Ocean: Surface Incident PAR | | | | 1-100 km | Daily | Global | Esaias? | Esaias input. |
| I. Winds, Sea Surface Pressure | Ocean: Attenuation of PAR | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. |
| J. Winds, Sea Surface Pressure | Ocean: Primary Prod,Case I | m/sec, mb | | | 1-50 km | Day/Week/Yr | Global/Regionl | Esaias? | Esaias input. |
| K. In-Situ Validation Observations | Ocean: Dissolved Org. Mattr | µg/liter | ±10% | ±2% | Test Site | TBD | Test Site | Hoge? | Hoge input. Mid-Atlantic Bight. |
| Winds, Sea Surface Pressure | Ocean: Dissolved Org. Mattr | m/sec, mb | | | 1-20 km | Daily/Weekly | Global/Regionl | Esaias? | Esaias input. |
| L. In-Situ Validation Observations | Ocean: Phycoerythrin Conc. | µg/liter | ±10% | ±2% | Test Site | TBD | Test Site | Hoge? | Hoge input. Mid-Atlantic Bight. |
| M. Winds, Sea Surface Pressure | Ocean: Beam Attenuat. Coeff | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. |
| N. Winds, Sea Surface Pressure | Ocean: Pigmnt Conc. (CZCS) | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. |
| O. Winds, Sea Surface Pressure | Ocean: Pig. Conc. (Curvat.) | m/sec, mb | | | 1-20 km | Daily/Weekly | Regional | Esaias? | Esaias input. |
| P. Winds, Sea Surface Pressure | Ocean: Chlor-A Conc.-Fluor | m/sec, mb | | | 1-20 km | Daily/Weekly | Global/Regionl | Esaias? | Esaias input. |
| Q. Winds, Sea Surface Pressure | Ocean: Total Suspend. Solids | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. |
| R. Winds, Sea Surface Pressure | Ocean: Organic Fraction | m/sec, mb | | | 1-20 km | Daily/Weekly | Global | Esaias? | Esaias input. |

**ATMOSPHERE - Cloud Measurements**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Cloud 3-Dimensional Structure | ITIR* | | | | 15-90 m | 16 Days | Local | Welch | |
| Cloud Fractional Area | HIRIS* | Dimensionless | ±3% | ±3% | 30 m | 2-16 Days | | Welch | Using water vapor bands. |
| Fractional Cloud Cover (0 - 1.0) | AIRS* | Dimensionless | ±0.05 | ±0.025 | 50 km | Twice Daily | Global | Chahine | IR/VIS |
| Cloud Fractional Area | MODIS* | Per cent. | ±10% | ±5% | 100 km | Twice Day/Mo. | Global | King/Kaufman | Daytime |
| Cloud Fractional Area | ITIR* | Dimensionless | ±3% | ±3% | 15-30 m | 16 Days | Local | Welch | |
| Cloud Field Size Distribution | ITIR* | Dimensionless | | | 15-90 m | 16 Days | Local | Welch | |
| Cirrus Distribution | LAWS* | /m/sr | TBD | | 100 km (s) | Daily Avr. | Global | Hardesty | Res: 0.5 km vert. Cirr. undetect. by passiv tech. |
| Cloud Optical Thickness | HIRIS* | Dimensionless | ±3% | ±3% | 30 m | 2-16 Days | | Welch | |
| Cloud Optical Thickness | AIRS* | Dimensionless | TBD | TBD | 50 km | Daily | Global | Gautier?/Smith? | VIS |
| Cloud Optical Thickness | MODIS* | Dimensionless | ±20% | ±10% | 5 km | Daily/Monthly | Global | King | Daytime |
| Cloud Optical Thickness | ITIR* | Dimensionless | ±3% | ±3% | 30 m | 16 Days | Local | Welch | National Research Lab. of Metrology help. |
| Cloud Optical Thickness | GLRS* | Dimensionless | 0.1 | | 200 m (s) | | | Spinhirn/Shiply | Vertical resolution N/A. |
| Polar Stratospheric Cloud Optical Thickness | GLRS* | Dimensionless | 0.1 | | 200 m (s) | | | Spinhirn/Shiply | Vertical resolution N/A. |
| Cloud Top Height | HIRIS* | Meters | 300 m | 100m | 30 m | 2-16 days | | Welch/Goetz | From precipitable water vapor. |
| Cloud Top Height | GLRS* | Meters | 75 m | | 200 m (s) | | | Spinhirn/Shiply | 75m vertical resolution. |
| Cloud Top Height | MODIS* | Meters | ±500 m | ±200 m | 5 km | Daily/Monthly | Global | Menzel/Susskind | AMSU necessary. CO2 algorithm. |
| Cloud Top Height | AIRS* | km | 0.5 km | 0.25 km | 50 km | Twice Daily | Global | Chahine | IR |
| Cloud Top Height | ITIR* | Meters | ±300 m | ±300 m | 90 m | 16 Days | Local | Welch | |
| Tropopause Height | AIRS* | km | 0.5 km | 0.25 km | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin too. IR/microwave. |
| Tropopause Height (cirrus located) | GLRS* | Meters | 300 m | | 10 km (s) | | | Spinhirn/Shiply | 300 m vertical resolution. |
| Cirrus Height | LAWS* | Meters | ±500 m | | 50 km (s) | Twice Daily | Global | Hardesty | |
| Stratopause Height | AIRS* | km | 1 km | 0.5 km | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin too. IR/microwave. |
| Stratoform Cloud Height | LAWS* | Meters | ±50 m | | 50 km (s) | Twice Daily | Global | Hardesty | |
| Polar Stratospheric Cloud (PSC) Heights | GLRS* | Meters | 75 m | | 2-50 km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Mixed Layer Height | GLRS* | Meters | 75 m | | 2-200km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Cloud Base Height | HIRIS* | Meters | 100 m | 100m | 30 m | 2-16 Days | | Welch | From cloud shadows; surface elevation required. |
| Cloud Base Height | ITIR* | Meters | ±100 m | ±100 m | 90 m | 16 Days | Local | Welch | |
| Cloud Base Height | GLRS* | Meters | 75 m | | 200 m (s) | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Cloud Droplet Effective Radius | HIRIS* | µm | ±40% | ±40% | 30 m | 2-16 Days | | Welch | |
| Cloud Droplet Effective Radius | MODIS* | µm | 0-40% | ±5% | 5 km | Daily/Monthly | Global | King | Daytime. |
| Cloud Particle Effective Radius | ITIR* | µm | ±10 µm | | 90 m | 16 Days | Local | Welch | |
| Cloud Droplet Size Distributions | HIRIS* | no./cm^2/µm | ±20% | ±10% | 30 m | 2-16 Days | | Welch | |

**ATMOSPHERE - Cloud Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Water Thermodynamic Phase | HIRIS* | Ice or Water | | | 30 m | 2-16 Days | | Welch | From cloud spectra and BRDF measurements. |
| Cloud Water Thermodynamic Phase | AIRS* | ice or water | Ice/liquid | Ice/liquid | 50 km | Twice Daily | Global | Staelin/Rosencrn | microwave. |
| Cloud Water Thermodynamic Phase | MODIS* | ice or water | | | 5 km | Daily/Monthly | Global | King/Menzel | Ice/water/snow |
| Cloud Thermodynamic Phase | ITIR* | Dimensionless | Water/ice | | 90 m | 16 Days | Local | Welch | |
| Cloud Top Temperature | AIRS* | Degrees K | 1°K | 0.5°K | 50 km | Twice Daily | Global | Chahine/Rizzi | IR |
| Cloud Top Temperature | MODIS* | °C | ±2°C | ±1°C | 5 km | Twice Day/Mo. | Global | Susskind/Menzel | AMSU necessary. CO2 slicing. |
| Cloud Top Temperature | ITIR* | Degrees K | ±2°K | ±2°K | 90 m | 16 Days | Local | Welch | |
| Cloud IR Spectral Emissivity (3 -17µm) | AIRS* | Dimensionless | 0.05 | 0.025 | 50 km | Twice Daily | Global | Chahine | IR |
| Cloud Effective Emissivity | MODIS* | Dimensionless | ±0.10 | ±0.05 | 50 km | Twice Day/Mo. | Global | Menzel/Susskind | CO2 algorithm. |
| Cloud Emissivity | ITIR* | Dimensionless | ±5% | | 90 m | 16 Days | Local | Welch | |



17-Jan-90

Comparisons based on nearest relationships among products. Similar products are grouped. OWP=Ancillary data: ozone, winds, sea surface pressure. s: horizontal resolution. *: At launch product.

**ATMOSPHERE - Aerosols**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Aerosol Optical Depth | HIRIS* | Dimensionless | ±0.05 | ±0.01 | 100 m | 2-16 Days | | Gerstl | Using multiple view angles. |
| Aerosol Optical Depth | AIRS* | Dimensionless | TBD | TBD | 50 km | Daily | Global | Gautier? | VIS |
| Aerosol Optical Thickness | MODIS* | Dimensionless | ±0.05-0.1 | 0.02-0.05 | 50 km | Week/Monthly | Global | Tanre/Kauf/King | Accuracy:ocean(greater)-land(lesser).Daytime. |
| Aerosol Layer Optical Thickness | GLRS* | Meters | 75 m | | 2-200km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Aerosol Layer Boundary Heights | GLRS* | Meters | 75 m | | 2-200km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Tropopause Height (Aerosol Located) | GLRS* | Meters | 75 m | | 200 m (s) | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Aerosol Distribution | LAWS* | /m/sr | TBD | | 100 km (s) | Few Days Avr. | Global | Post | 1km v. res:0.5km in hi aeros. regs. Wvlngth dep |
| Columnar Aerosol Size Distribution | MODIS* | no./cm^2/µm | ±10-30% | ±10% | 250 km | Week/Monthly | Global | Tanre/King | For indices 1-5 µm. Land and ocean separate. |
| Aerosol Mass Loading | MODIS* | gm/m^2 | ±30% | ±10% | 50 km | Week/Monthly | Regionl/Global | Kaufman/Tanre | For indices <5µm. Land and ocean separate. |

**ATMOSPHERE - Moisture**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Precipitable Water | HIRIS* | cm | ±10% | ±3% | 30 m | 2-16 Days | | Goetz | Using 0.94 and 1.14 µm water vapor bands. |
| Total Precipitable Water | AIRS* | mm | 5% | 3% | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin. IR/microwave. |
| Total Precipitable Water | MODIS* | cm | ±15% | ±5% | 10 km | Daily/Monthly | Global | Kaufman/Menzel | Susskind and Barton also. Daytime. |
| Tropospheric Precipitable Water | HIRIS* | cm | ±10% | ±3% | 30 m | 2-16 Days | | Goetz | With MODIS data troposph. water can be derived. |
| Cloud Water Content | AIRS* | mm | TBD | TBD | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Precipitation Estimate | AIRS* | mm/day | 2mm/day | 1mm/day | 50 km | Twice Daily | Global | Susskind | IR/microwave. |
| Humidity Profile | AIRS* | gm/kg | 10% | 5% | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin. IR/µwave. 2 km vert. resolutn. |

**ATMOSPHERE - Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Temperature Profile | AIRS* | Degrees K | 1°K | 0.4°K | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin. IR/µwave. 1 km vert. resolutn |
| Temperature Profile | MODIS* | °C | ±2°C | ±1°C | 10 km | Twice Daily | Regionl/Global | Susskind/Menzel | AMSU necessary. |
| Outgoing Longwave Spectral Radiation | AIRS* | W/m^2/µm | TBD | TBD | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin. IR. |
| Surface Scalar Wind Speed (to 30m/sec) | AIRS* | m/sec | TBD | TBD | 50 km | Twice Daily | Global | Aumann | Microwave. AIRS lists under oceans. |
| Surface Wind Field | SAR* | m/sec | ±10% | ±10% | 1 km | Daily(Regiona | Global/Ocean | Johanesen/Plant | Range 0-30m/sec. Useful. SCAT needed. |
| Horizontal Vector Wind Profiles | LAWS* | m/sec | ±1 to 5m/sec | | 100 km (s) | Twice Daily | Global | Emmitt | 1km vert. res; 0.5 km in high aerosol regions. |
| Along-Track Wind Speed | ALTIMETER* | meters/sec | 2 m/sec(rms) | | 7 km | 1 Second | | L.-L. Fu | |



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Comparisons based on nearest relationships among products. Similar products are grouped. OWP=Ancillary data: ozone, winds, sea surface pressure. s: horizontal resolution. *: At launch product.

**ATMOSPHERE - Chemistry**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Column Ozone | HIRIS* | Dobson Units-DU | ±10% | ±5% | 500 m | 2-16 Days | | Goetz | Using the chappius band. |
| Total Ozone Burden | AIRS* | Dobson (DU) | 5% | 3% | 50 km | Twice Daily | Global | Strow/Revercmb | Susskind also. IR. |
| Total Column Ozone | MODIS* | Dobson Unit(DU) | 15-20 DU | 10 DU | 10 km | Twice Day/mo. | Global | Susskind/Menzel | AMSU necessary. King input. |
| Mapping of Total Methane Burden | AIRS* | ppm | TBD | TBD | 250 km | Twice Daily | Global | Strow/Revercmb | IR. |
| Mapping of Total Carbon Monoxide Burden | AIRS* | ppm | TBD | TBD | 250 km | Twice Daily | Global | Strow/Revercmb | IR. |
| Mapping of Total Nitrous Oxide Burden | AIRS* | ppm | TBD | TBD | Zonal avg. | Twice Daily | Global | Strow/Revercmb | IR. |
| Carbon Dioxide Mixing Ratio | AIRS* | ppm | 5 ppm | 3 ppm | 50 km | Twice Daily | Global | Strow/Revercmb | IR. |

**LAND - Vegetation**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Chlorophyll Concentration | HIRIS* | gms/ha | ±30% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | Using vegetation cover,APAR, & light path length |
| Leaf Area Index | SAR* | Areal Fraction | TBD | TBD | 60 m | Seasonal | Global (Land) | Kasischke | Range: 0-20(?). Required. HIRIS needed. |
| Canopy Cellulose Concentration | HIRIS* | gms/ha | ±40% | ±20% | 30 m | 2-16 Days | | Wessman/Aber | Using veg. cvr,cellu. abs. depth,& light pth lngth |
| Canopy Lignin Concentration | HIRIS* | gms/ha | ±40% | ±20% | 30 m | 2-16 Days | | Wessman/Aber | Using veg. cvr,lignin abs. depth & light pth lngth |
| Vegetation Indices | HIRIS* | Dimensionless | ±0.01 | ±0.005 | 30 m | 2-16 Days | | Ustin/Wessman | Aber also. Range from 0 to 1. |
| Vegetation Indices | MODIS* | Dimensionless | ±0.01 | ±0.01 | 0.5,1,10km | Day/Week/Mo | Regionl/Global | Justc/Huet/Tanr | Range:0-1. Need Lnd-Lvng+topo+214m cld corr |
| Vegetation Indices | ITIR* | Dimensionless | | | 15-30 m | | Local/Regional | | |
| Crown Spacing and Variance | HIRIS* | Meters | ±50% | ±20% | 30 m | 2-16 Days | | Ustin | For crown sizes/spacings >3 m. |
| Canopy Geometry | SAR* | Degrees, meters | ±45°, TBD | ±45°, TBD | 60 m | Semiannually | Global (land) | Kasischke/Ulaby | Range: 0-180°, 0-X m. Required. |
| Canopy Light Path Length | HIRIS* | mm | ±75% | ±20% | 30 m | 2-16 Days | | Ustin | Using spectral un-mixing&canopy shading char. |
| Crown Height | HIRIS* | Meters | ±50% | ±20% | 30 m | 2-16 Days | | Ustin | Based on veg. cvr, aspect & crown spacing & var. |
| Chlorophyll Stress Index | HIRIS* | Dimensionless | ±5% | ±2% | 30 m | 2-16 Days | | Ustin | Using slope of Chlor. conc. to Chlor. bw function. |
| Land Cover Type/Biome Area | MODIS* | km^2 | ±5% | ±1-5% | 0.5,1,10km | Season/Yearly | Regionl/Global | Strahler/Huete | Justice too. Need Lnd-Lvng+topo+214m cld corr |
| Land Cover | HIRIS* | km^2 | ±4% | ±2% | 30 m | 2-16 Days | | Wessman | Using spectral un-mixing & canopy architecture |
| Fractional Vegetation Cover | HIRIS* | Dimensionless | ±20% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | Using spectral un-mixing. |
| Landform Patterns | SAR* | m^2 (Area) | ±60 m X 60 m | ±30mX30m | 60 m | 5 Years | Regional | Schaber/Evans | Elachi also.Range:0-Xm^2.Required.HIRIS needed |
| Forest Surface Cover State | SAR* | m^2(Extent,type | N/A | N/A | 60 m | Monthly | Global (Land) | Ulaby | Required. |
| Forest Boundaries/Deforestation | SAR* | m^2 (Extent) | ±60 X 60 m | ±60mX60m | 60 m | Monthly | Regional | Way | Critical. |
| Surficial Material Boundaries | SAR* | m^2 (Extent) | ±30 X 30 m | ±30 X 30 m | 60 m | 5 Years | Regional | Evans | Range: 0-X m^2. Required. HIRIS needed. |
| Dead Biomass | HIRIS* | kg/ha | ±40% | ±15% | 30 m | 2-16 Days | | Ustin/Wessman | Using un-mixing: for grass & semiarid shrub. |
| Green Biomass | HIRIS* | kg/ha | ±40% | ±15% | 30 m | 2-16 Days | | Ustin/Wessman | Using vegetation cover, APAR,& light path length |
| Biomass | SAR* | kg/km^2 | TBD | TBD | 60 m | Annually | Global (Land) | Ranson/Kasischk | Ulaby also. Critical. |
| Seasonal Growth Patterns | ITIR* | Dimensionless | | | 15-30 m | | Local/Regional | | |
| Phenologic State | SAR* | None | N/A | N/A | 60 m | Weekly | Global (Land) | Way | Critical. HIRIS needed. |

**LAND - Soils**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Erosion | SAR* | m^2 (Area) | ±60 X 60 m | ±30X30 m | 60 m | Semiannually | Regional | Schaber/Evans | Elachi also. Required. HIRIS/ITIR needed. |
| Soil Moisture | SAR* | % (by Volume) | 5%hi/10%Glo | 10%/25%G | 60hi/100m | 3 D hi/Wk Glo | Local/Global | Engman/Ulaby- | Evans also. Range: 5-50%. Critical. High/Global |
| Soil/Bedrock Surface Mineralogy | ITIR* | None | | | 15-90 m | | Local/Regional | ERSDAC/Kahle | CO3, clays, silicates, Gypsum. See Stereo Pairs. |
| Relative Abund of Fe, CO3, SO4, OH Minerals | HIRIS* | Dimensionless | ±10% | ±5% | 30 m | | | Rowan/Clark | Fe+3 variations, calcite/dolomite ratio. |
| Sand Depth | SAR* | Meters (Depth) | ±0.5 m | ±0.5 m | 50-75 m | Twice Yearly | Regional | Schaber | Range: 0-4 m. Required. |

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Comparisons based on nearest relationships among products. Similar products are grouped. OWP=Ancillary data: ozone, winds, sea surface pressure. s: horizontal resolution. *: At launch product.

**LAND - Use/Maps/Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Land Use Pattern | ITIR* | None | | | 15-30 m | | Local/Regional | | |
| Surface Albedo | AIRS* | Dimensionless | TBD | TBD | 50 km | Daily | Global | Susskind | VIS. |
| Spectral Reflectivity | ITIR* | Dimensionless | ±4% | ±0.5-1.3% | 15-30 m | | Local/Regional | GSJ/Slater | GSJ: Geological Survey of Japan. |
| Surface Bidirectional Reflectance Dist. Funct | HIRIS* | Dimensionless | ±5% | ±5% | 30 m | 16 Days | | Gerstl | Corrected for variable atmospheric path length |
| Skin Surface Temperature | AIRS* | Degrees K | 1°K | 0.5°K | 50 km | Twice Daily | Global | Revercomb --- | Susskind/Smith/Fleming/Chedin also. IR/µwave |
| Surface Temperature | MODIS* | °C | ±1-3°C | ±1°C | 1, 10 km | Daily/Weekly | Regionl/Global | Wan/Susskind | Range -20 to 50°C. AMSU necessary. |
| Spectral Brightness Temperature | ITIR* | °K | ±1-2°K | ±0.3°K | 90 m | | Local/Regional | GSJ/Kahle/Slatr | GSJ: Geological Survey of Japan. |
| Temperature and Extent of Volcanic Activity | HIRIS* | °C, m^2 | ±10°C | ±5°C | 30 m | 2-16 Days | | Rowan/Goetz | Day & night detectn of volcanc activity by MODIS |
| Thermal Anomalies (Volcanoes, Fires) | MODIS* | °C | ±10°C | ±5°C | 1, 10 km | Daily/Weekly | Regionl/Global | Kaufman | Day & night data required. |
| Thermal Anomalies (Volcanoes, Fires) | ITIR* | | | | 90 m | | Local/Regional | Tokyo University | |
| Surface Kinetic Temperature | ITIR* | °K | ±1-6°K | ±0.3°K | 90 m | | Local/Regional | Tokyo Unv/Kahle | National Research Lab. of Metrology help. |
| Thermal History | HIRIS* | | | | 30 m | | | Rowan | crystallinity, therm. matur. of org. mattr |
| Day-Night Land Surface Temperature Diff. | AIRS* | Degrees K | 0.5°K | 0.25°K | 50 km | Twice Daily | Global | Revercomb --- | Susskind/Smith/Fleming/Chedin also. IR/µwave |
| Day-Night Surface Temperature Difference | ITIR* | Degrees K | ±1-2°K | ±0.3°K | 90 m | | Local/Regional | Tokyo Unv/Kahle | National Research Lab. of Metrology Assistance. |
| Upward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Spectral Emissivity (3-17µm/microwave) | AIRS* | Dimensionless | 0.05 | 0.025 | 50 km | Twice Daily | Global | Revercomb---- | Fleming also. IR/microwave. |
| Spectral Emissivity | ITIR* | Dimensionless | ±0.015-0.03 | ±0.005 | 90 m | | Local/Regional | JGI/Kahle | 8 to 12 µm. Rel. em. JAPEX Geoscience Inst |
| Relative Spectral Emissivity | ITIR* | None | ±0.005-0.01 | ±0.005 | 90 m | | Local/regional | GSJ/Kahle | GSJ: Geological Survey of Japan. |
| Emissivity Indices | ITIR* | Dimensionless | | | 90 m | | Local/Regional | Becker/Kahl/JGI | JGI: JAPEX Geoscience Institute, etc. |
| Non-Vegetative Absorbed PAR | HIRIS* | W/m^2/sr | ±30% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | PAR absorbed by other than green vegetation. |
| Vegetative Absorbed PAR | HIRIS* | W/m^2/sr | ±30% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | PAR absorbed by green vegetation. |
| Upward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Level 2 Land Leaving Radiances | MODIS* | W/m^2/sr/µm | ±10% | ±5% | 0.5,1,10km | Daily | Regionl/Global | Tanre/Strahler | Kaufman too. |
| Downward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Downward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Stereo Pairs | ITIR* | Dimensionless | | | 15-30 m | | Local/Regional | ERSDAC | Earth Res. Satellite Data Analysis Center. |

**LAND - Surface & Subsurface State**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Vertical Site Positions | GLRS* | mm | 5 mm (vert.) | | | | | Cohen/Schutz,etc | Many other supporting scientists. |
| Digital Elevation Models | ITIR* | Meters | | ±50 m | 15-30 m | | Local/Regional | JGI | JGI: JAPEX Geoscience Institute, etc. |
| Topography | SAR* | Meters (Height) | ±60 m | ±10 m | 30 m | Once | Global (Land) | Zebker | Range: 0-7 km. Critical. |
| Lineament Pattern | ITIR* | None | | | 15-30 m | | Local/Regional | ERSDAC | ERSDAC: Earth Res. Satellite Data Analysis Centr |
| Geomorphic Features | GLRS* | mm | 100-500 mm | | .1-10 km s | Weeks/Years | | Cohen/Schutz,etc | 100-500 mm vertical resolution. |
| Surface Roughness | SAR* | cm (height rms) | ±2 cm | ±1 cm | 60 m | Semiannually | Regional | Evans/Zebker-- | Engman also. Range: 0-2 m. Critical. |
| Horizontal Site Positions | GLRS* | mm | 3 mm | | | | | Cohen/Schutz,etc | Many other supporting scientists. |
| Secular Three-Dimensional Site Velocities | GLRS* | mm/yr | 1mm/yr | | 1000s km s | Years | | Cohen/Schutz,etc | 1000s kms horizontal resolution. |
| Episodic Three-Dimensional Site Velocities | GLRS* | mm/month | 5 mm/month | | 100s km s | Months | | Cohen/Schutz,etc | 100s kms horizontal resolution. |
| Post Seismic 3-D Site Velocities | GLRS* | mm/week | 10 mm/week | | 100s km s | Weeks | | Cohen/Schutz,etc | 100s kms horizontal resolution. |
| Crustal Strain Rates | GLRS* | µstrain/year | 0.1 µstain/yr | | 1-100km s | Years | | Cohen/Schutz,etc | 1-100 km horizontal resolution. |
| Volcanic Inflation and Deflation Rates | GLRS* | mm/day-mm/yr | 100mm/dy# | | | Days to Years | | Cohen/Schutz,etc | #: to 5 mm/yr. |
| Intersite Distance Rates of Change | GLRS* | mm/wk-mm/yr | 10mm/wk# | | | | | Cohen/Schutz,etc | #: to 1mm/yr. |
| Height Rates | GLRS* | mm/day-mm/yr | 100 mm/day# | | 100s kms s | Years | | Cohen/Schutz,etc | #: to 5 mm/yr. 100s kms horizontal resolution. |
| Subsurface Scattering | SAR* | m^2 (Area) | ±60 X 60 m | ±30X30 m | 50-75 m | Twice Yearly | Regional | Schaber | Range: 0-X m^2. Required. HIRIS needed. |

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Comparisons based on nearest relationships among products. Similar products are grouped. OWP=Ancillary data: ozone, winds, sea surface pressure. s: horizontal resolution. *: At launch product.

**LAND - Snow**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Snow Covered Area | HIRIS* | km^2 | ±5% | ±5% | 30 m | 2-16 Days | | Dozier | |
| Snow/Ice Cover | AIRS* | Dimensionless | | | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Snow Cover | MODIS* | km^2 | ±5% or less | ±5% or less | 1, 10 km | Daily/Weekly | Regionl/Global | Salomonson | Accuracy based on avr. Jan. snowcover N. Hemis. |
| Snow Area | ITIR* | km^2 | | | 15-30 m | 16 Days | 60 km Swath | | |
| Snow Extent (Wet or Dry) | SAR* | m^2 (Areal Xtnt) | 0.5km hi/2km | Less thn 5% | 30 m | TBD | Local | Ulaby/Elachi | Range: 0-X m. Required. HIRIS needed. |
| Snow Surface Spectral Reflectance | HIRIS* | Dimensionless | ±5% | ±5% | 30 m | 2-16 Days | | Dozier | |
| Snow Surface Grain Size | HIRIS* | µm | ±200% | ±200% | 30 m | 2-16 Days | | Dozier | Using shortwave IR bands. |
| Snow Particulate Content | HIRIS* | gm/m^3 | ±500% | ±500% | 30 m | 2-16 Days | | Dozier | Using visible bands. |
| Snow Water Equivalent | SAR* | cm (Height) | ±20% | ±20% | 30 m | TBD | Local | Ulaby/Elachi | Range: 0-3 km. Critical. |

**LAND - Water/Ice**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Surface Water Area | ITIR* | km^2 | | | 15-30 m | 16 Days | 60 km Swath | | |
| Land - Water Boundaries/Floods | SAR* | m^2 (Area) | ±30 X 30 m | ±10% (?) | 30 m | Var:3d-Season | Local | Engman | Range: 0-X km^2. Critical. HIRIS needed. |
| Ice Sheet, Lake and River Ice Extent | SAR* | Latitude/Long. | ±60 m | ±60 m | 60 m | Week(Winter) | Regional | Carsey | Range: 40-80°N/S. Required. |
| Leaf Tissue Water Content | HIRIS* | gm/cm^3 | ±50% | ±20% | 30 m | 2-16 Days | | Wessman/Goetz | Using veg. cvr, water band dpth,& light pth lngth |
| Canopy Water Content | SAR* | % (By Volume) | TBD | TBD | 60 m | Biweekly | Global (Land) | Way/Ulaby | Range: 0-90%. Critical. |
| Canopy Water Potential | SAR* | Bars | TBD | TBD | 60 m | Biwk/Diurnal | Global (Land) | Way/Ulaby | Range: 0- -40 bars. Critical. |
| Evapotranspiration | ITIR* | mm/day | ±1 mm/day | 0.5 mm/day | 90 m | | Local/Regional | Schmugge | Requires ancillary data. |
| Drainage Patterns | SAR* | Meter (Lin. Xtnt) | ±20 m | ±20 m | 30 m | Once | Regional | Engman | Range: 0-10 km. Required. MODIS needed. |

**OCEAN - Ice**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Sea Ice Type | SAR* | Frct.(5-10types | 5%hi;10%Glob | 5hi;10%Glo | 5 km | 5 Days | Global | Carsey | Range: 0-100% each. Required. AMSR needed. |
| Sea Ice Concentration | SAR* | Fraction | 5 hi;10%Glob | 5%hi;10Glo | 5 km | 5 Days | Global | Carsey | Range: 0-100%. Required. AMSR needed. |
| Sea Ice Cover (Open Water) | AIRS* | Dimensionless | 0.1 | 0.05 | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Sea Ice (Maximum Total Extent) | MODIS* | km^2 | ±5% or less | ±5% or less | 1, 10 km | Daily/Weekly | Regionl/Global | Salomonson | Accuracy based on March Ice N. Hemisphere |
| Ocean Ice Area | ITIR* | km^2 | | | 15-30 m | | | | |
| Sea Ice Extent | SAR* | Latitude/Long. | ±1 km | ±1 km | 5 km | 5 Days | Global | Carsey | Range: 50-80°N/S. Required. AMSR needed. |
| Open Water Area | ITIR* | km^2 | | | 15-30 m | | | | |
| Ice Sheet Mass Balance | GLRS* | TBD | TBD | | | | | | |
| Ice Sheet Height Profiles | GLRS* | mm | 100 mm | | | | | | |
| Sea Ice Height Profiles | GLRS* | mm | 100 mm | | | | | Bentley | |
| Ice Sheet Topography Maps | ALTIMETER* | cm(h), km(d) | ±50 cm; 5 m# | | 15 km | 1 year | | Zwally | #50 cm (flat regions); 5 m (steep regions) |
| Ice Sheet Surface Roughness Profiles | GLRS* | mm | 100 mm | | | 3 months | | Bufton | |
| Sea Ice Surface Roughness Profiles | GLRS* | mm | 100 mm | | | | | Thomas | |
| Ice Sheet Displacement and Velocity | GLRS* | mm/day | 100 mm/day | | | months | | Zwally | |
| Sea Ice Motion | SAR* | km/day (velocity | ±0.5 km/day | ±0.5km/day | 5 km | 5 Days | Global | Carsey | Range: 0-40 km/day. Critical. |
| Ice Sheets and Shelf Dynamics | SAR* | m/year (velocity | ±0.2 km/year | ±0.2 km/yr | 30 m | 2 maps/Wintr | Regional | Carsey | Range: 60-90° N/S. Required. |
| Ice Sheet Strain Rates | GLRS* | µstrain/year | 1 µstrain/yr | | | | | | |

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Comparisons based on nearest relationships among products. Similar products are grouped. OWP=Ancillary data: ozone, winds, sea surface pressure. s: horizontal resolution. *: At launch product.

Eos Facility Instruments At Launch Data Product Comparison

**OCEAN - Surface & Subsurface State**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Surface Wave Height | SAR* | Meters (Height) | ±20% | ±20% | 5 km | Daily (regionl | Global (Oceans) | Plant | Range: 0-20 m. Required. ALTIMETER needed. |
| Along-Track Wave Height | ALTIMETER* | meters | ±0.5m or 10% | | 7 km | 1 second | | L.-L. Fu | Abs. accuracy (rms) the greater of the two. |
| Surface Waves | SAR* | m(length),°(dir | ±10%, 10° | ±10%, 10° | 5 km | Daily (Regnl) | Global (oceans) | Plant | Range: 100-500 m; 0-360°. Critical. |
| Along-Track Sea Surface Height | ALTIMETER* | cm | ±10 cm(rms) | | 7 km | 1 second | | L.-L. Fu | Requiring GGI & AMSR (or HIMS) |
| Sea Surface Topography Maps | ALTIMETER* | cm(h), km(d) | ±5 cm (rms)# | | 25 km | 16 days | | L.-L. Fu | #Grnd trk to 25% of std. dev. of var. in void regs |
| Skin Surface Temperature | AIRS* | Degrees K | 0.5°K | 0.4°K | 50 km | Twice Daily | Global | Revercomb---- | Susskind/Smith/Fleming/Chedin also. IR/µwave |
| Sea Surface Temperatures | MODIS* | °K | ±0.3-0.4°K | ±0.1-0.3°K | 1, 20 km | Daily/Wk/Mo. | Regionl/Global | Brown/Barton | Also Season/yr. ±4 km positioning on Earth grid |
| Sea Surface Temperature | ITIR* | Degrees K | ±1-2°K | ±0.3°K | 90 m | | | | |
| Spectral Brightness Temperature | ITIR* | Degrees K | ±1-2°K | ±0.3°K | 90 m | | | | National Research Lab. of Metrology help. |
| Water Temperature Pattern | ITIR* | Degrees K | ±0.5°K | ±0.3°K | 90 m | | | | National Research Lab. of Metrology Assistance. |
| Ocean Tide Model | ALTIMETER* | cm | ±2 cm (rms) | | 100 km | 15 mins | | Sanchez | |
| Crustal Def. Contr. to Appar. Sea Level Chnge | GLRS* | mm/year | 1 mm/year | | 100s kms s | Years | | Bevis/Cohen--- | Schutz also. 100s kms horizontal resolution. |
| Currents, Fronts, Eddies | SAR* | Latitude/Long. | ±120 m | ±120 m | 60 m | Biweekly | Global (Oceans) | Johannessen | Useful. MODIS needed. |
| Currents, Fronts, Eddies | SAR* | m/s (bndry vel.) | ±20% | ±20% | 60 m | Biweekly | Global (Oceans) | Johannessen | Range: 0-3 m/sec. Required. |
| Internal Waves | SAR* | Latitude/Long. | ±60 m | ±60 m | 60 m | Biweekly | Global (Oceans) | Johannessen | Required. |

**OCEAN - Organics and Inorganics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Suspended Solids | MODIS* | g/m^3 | ±50% | ±35% | 1, 20 km | Daily/Weekly | Global | Clark | Anc: OWP |
| Gelbstoff Absorption Coefficient (410nm) | HIRIS* | Per meter^2 | ±50% | ±25% | 90 m | 2-16 Days | | Carder | Used to infer humic and fulvic acid conc.(±75%) |
| Chlorophyll-a, Case I Waters | HIRIS* | mg/m^3 | ±50% | ±25% | 90 m | 2-16 Days | | Carder/Davis | Melack too. Acc. impvd by using larger res. elem. |
| Chlorophyll-A Concentration (Case I) | MODIS* | mg/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Evns/Clrk/Gordn | Typical conditions. |
| Chlorophyll-a, Case II Waters | HIRIS* | mg/m^3 | ±70% | ±35% | 90 m | 2-16 Days | | Carder | Non-turbid environments. |
| Chlorophyll-a, Turbid Case II Waters | HIRIS* | mg/m^3 | ±100% | ±50% | 90 m | 2-16 Days | | Carder | Somewhat site specific. |
| Chlorophyll-A Concentration (Case II) | MODIS* | mg/m^3 | ±50% | ±10% | 1, 20 km | Daily/Weekly | Regionl/Global | Cardr/Clrk/Hoge | Parslow also. Based on simulated lab data. |
| Chlorophyll Fluorescence (Line Height) | MODIS* | mW/cm2/sr/µm | ±30% | ±10% | 1, 20 km | Day/Week/Mo | Regionl/Global | Gordn/Abot/Evan | Hoge also. Probably >>error at low concent. |
| Accessory Pigments, Case I Waters | HIRIS* | mg/m^3 | ±70% | ±35% | 90 m | 2-16 Days | | Davis (marine) | Melack (fresh) also. Somewhat site specific. |
| Pigment Concentration (CZCS) | MODIS* | mg/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Clark/Gordon | Anc: OWP |
| Phycoerythrin Pigment Concentration | MODIS* | mg/m^3 | ±200% | ±50% | 1, 20 km | Daily/Weekly | Regionl/Global | Hoge | |
| Dissolved Organic Matter Concentration | MODIS* | mg/m^3 | ±150% | ±30% | 1, 20 km | Daily/Weekly | Regionl/Global | Carder/Parslow | Hoge also.Anc:OWP.30% error simu.data(Parsl) |
| Detached Coccolith Concentratn (E. huxleyi) | MODIS* | mg CaCO3/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Gordon | Anc: OWP |
| Backscattering Coefficient (560 nm) | HIRIS* | Per meter^2 | ±50% | ±25% | 90 m | 2-16 Days | | Carder | Used to infer suspnded particulats (org.&inorg.) |
| Attenuation K at 490 nm (Case I Waters) | MODIS* | Per meter | ±25% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Clark/Gordon | Accuracy based on typical conditions. |

**OCEAN - Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Downward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Downward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Upward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Upward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Water-Leaving Radiance, Visible Channels | MODIS* | mW/cm2/sr/µm | ±10% | ±5% | 1 km | Daily | Local/Reg/Glob | Gordn/Evns/Tan | Typical conditions. |
| Aerosol Angstrom Exp., Optical Depth <0.6 | MODIS* | Dimensionless | ±15% | ±5% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Gordon/Tanre | Accuracy depends upon SNR, pixel averaging. |
| Single Scattering Aerosol Radiance, ta < 0.6 | MODIS* | mW/cm2/sr/µm | ±10% | ±5% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Gordon/Tanre | Case I waters w/moderate concentrations. |
| Spectral Reflectivity | ITIR* | Dimensionless | ±4% | ±0.5-1.3% | 15-30 m | | | | |

Comparisons based on nearest relationships among products. Similar products are grouped. OWP=Ancillary data: ozone, winds, sea surface pressure. s: horizontal resolution. *: At launch product.

**ATMOSPHERE - Cloud Measurements**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Cloud 3-Dimensional Structure | ITIR* | | | | 15-90 m | 16 Days | Local | Welch | |
| Cloud Fractional Area | HIRIS* | Dimensionless | ±3% | ±3% | 30 m | 2-16 Days | | Welch | Using water vapor bands. |
| Fractional Cloud Cover (0 - 1.0) | AIRS* | Dimensionless | ±0.05 | ±0.025 | 50 km | Twice Daily | Global | Chahine | IR/VIS |
| Cloud Fractional Area | MODIS* | Per cent. | ±10% | ±5% | 100 km | Twice Day/Mo. | Global | King/Kaufman | Daytime |
| Cloud Fractional Area | ITIR* | Dimensionless | ±3% | ±3% | 15-30 m | 16 Days | Local | Welch | |
| Cloud Area and Perimeter | MODIS | km^2, km | TBD | TBD | 5 km | Week/Monthly | Global | Kaufman | |
| Cloud Field Size Distribution | ITIR* | Dimensionless | | | 15-90 m | 16 Days | Local | Welch | |
| Cirrus Distribution | LAWS* | /m/sr | TBD | | 100 km (s) | Daily Avr. | Global | Hardesty | Res: 0.5 km vert. Cirr. undetect. by passiv tech. |
| Cloud Optical Thickness | HIRIS* | Dimensionless | ±3% | ±3% | 30 m | 2-16 Days | | Welch | |
| Cloud Optical Thickness | AIRS* | Dimensionless | TBD | TBD | 50 km | Daily | Global | Gautier?/Smith? | VIS |
| Cloud Optical Thickness | MODIS* | Dimensionless | ±20% | ±10% | 5 km | Daily/Monthly | Global | King | Daytime |
| Cloud Optical Thickness | ITIR* | Dimensionless | ±3% | ±3% | 30 m | 16 Days | Local | Welch | National Research Lab. of Metrology help. |
| Cloud Optical Thickness | GLRS* | Dimensionless | 0.1 | | 200 m (s) | | | Spinhirn/Shiply | Vertical resolution N/A. |
| Polar Stratospheric Cloud Optical Thickness | GLRS* | Dimensionless | 0.1 | | 200 m (s) | | | Spinhirn/Shiply | Vertical resolution N/A. |
| Thickness | HIRIS | | | 200m | | | | | |
| Cloud Top Height | HIRIS* | Meters | 300 m | 100 m | 30 m | 2-16 days | | Welch/Goetz | From precipitable water vapor. |
| Cloud Top Height | GLRS* | Meters | 75 m | | 200 m (s) | | | Spinhirn/Shiply | 75m vertical resolution. |
| Cloud Top Height | MODIS* | Meters | ±500 m | ±200 m | 5 km | Daily/Monthly | Global | Menzel/Susskind | AMSU necessary. CO2 algorithm. |
| Cloud Top Height | AIRS* | km | 0.5 km | 0.25 km | 50 km | Twice Daily | Global | Chahine | IR |
| Cloud Top Height | ITIR* | Meters | ±300 m | ±300 m | 90 m | 16 Days | Local | Welch | |
| Tropopause Height | AIRS* | km | 0.5 km | 0.25 km | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin too. IR/microwave. |
| Tropopause Height (cirrus located) | GLRS* | Meters | 300 m | | 10 km (s) | | | Spinhirn/Shiply | 300 m vertical resolution. |
| Cirrus Height | LAWS* | Meters | ±500 m | | 50 km (s) | Twice Daily | Global | Hardesty | |
| Stratopause Height | AIRS* | km. | 1 km | 0.5 km | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin too. IR/microwave. |
| Stratoform Cloud Height | LAWS* | Meters | ±50 m | | 50 km (s) | Twice Daily | Global | Hardesty | |
| Polar Stratospheric Cloud (PSC) Heights | GLRS* | Meters | 75 m | | 2-50 km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Mixed Layer Height | GLRS* | Meters | 75 m | | 2-200km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Cloud Base Height | HIRIS* | Meters | 100 m | 100m | 30 m | 2-16 Days | | Welch | From cloud shadows; surface elevation required. |
| Cloud Base Height | ITIR* | Meters | ±100 m | ±100 m | 90 m | 16 Days | Local | Welch | |
| Cloud Base Height | GLRS* | Meters | 75 m | | 200 m (s) | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Cloud Droplet Effective Radius | HIRIS* | µm | ±40% | ±40% | 30 m | 2-16 Days | | Welch | |
| Cloud Droplet Effective Radius | MODIS* | µm | ±0-40% | ±5% | 5 km | Daily/Monthly | Global | King | Daytime. |
| Cloud Particle Effective Radius | ITIR* | µm | ±10 µm | | 90 m | 16 Days | Local | Welch | |
| Cloud Droplet Size Distributions | HIRIS* | no./cm^2/µm | ±20% | ±20% | 30 m | 2-16 Days | | Welch | |



Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS. Coupled Sim. modl. s: Horiz. res. *: At launch prod

Eos Facility Instruments Data Product Comparison

**ATMOSPHERE - Cloud Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Bidirectional Reflectance Distribution Funct | HIRIS | | 5% | 0.50% | | | | | |
| Water Thermodynamic Phase | HIRIS* | Ice or Water | | | 30 m | 2-16 Days | | Welch | From cloud spectra and BRDF measurements. |
| Cloud Water Thermodynamic Phase | AIRS* | ice or water | Ice/liquid | Ice/liquid | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Cloud Water Thermodynamic Phase | MODIS* | ice or water | | | 5 km | Daily/Monthly | Global | King/Menzel | Ice/water/snow |
| Cloud Thermodynamic Phase | ITIR* | Dimensionless | Water/ice | | 90 m | 16 Days | Local | Welch | |
| Cloud Top Temperature | AIRS* | Degrees K | 1°K | 0.5°K | 50 km | Twice Daily | Global | Chahine/Rizzi | IR |
| Cloud Top Temperature | MODIS* | °C | ±2°C | ±1°C | 5 km | Twice Day/Mo. | Global | Susskind/Menzel | AMSU necessary. CO2 slicing. |
| Cloud Top Temperature | ITIR* | Degrees K | ±2°K | ±2°K | 90 m | 16 Days | Local | Welch | |
| Cloud IR Spectral Emissivity (3 -17μm) | AIRS* | Dimensionless | 0.05 | 0.025 | 50 km | Twice Daily | Global | Chahine | IR |
| Cloud Effective Emissivity | MODIS* | Dimensionless | ±0.10 | ±0.05 | 50 km | Twice Day/Mo. | Global | Menzel/Susskind | CO2 algorithm. |
| Cloud Emissivity | ITIR* | Dimensionless | ±5% | | 90 m | 16 Days | Local | Welch | |
| Cloud Spectral Reflectance (0.4 - 2.5μm) | ITIR | | | | | | | | 15 - 30m resolution |

**ATMOSPHERE - Aerosols**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Aerosol Optical Depth | HIRIS* | Dimensionless | ±0.05 | ±0.01 | 100 m | 2-16 Days | | Gerstl | Using multiple view angles. |
| Aerosol Optical Depth | AIRS* | Dimensionless | TBD | TBD | 50 km | Daily | Global | Gautier? | VIS |
| Aerosol Optical Thickness | MODIS* | Dimensionless | ±0.05-0.1 | 0.02-0.05 | 50 km | Week/Monthly | Global | Tanre/Kauf/King | Accuracy:ocean(greater)-land(lesser).Daytime. |
| Aerosol Layer Optical Thickness | GLRS* | Meters | 75 m | | 2-200km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Aerosol Layer Boundary Heights | GLRS* | Meters | 75 m | | 2-200km s | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Tropopause Height (Aerosol Located) | GLRS* | Meters | 75 m | | 200 m (s) | | | Spinhirn/Shiply | 75 m vertical resolution. |
| Aerosol Distribution | LAWS* | /m/sr | TBD | | 100 km (s) | Few Days Avr. | Global | Post | 1km v. res:0.5km in hi aeros. regs. Wvlngth dep |
| Columnar Aerosol Size Distribution | MODIS* | no./cm^2/μm | ±10-30% | ±10% | 250 km | Week/Monthly | Global | Tanre/King | For indices 1-5 μm. Land and ocean separate. |
| Aerosol Mass Loading | MODIS* | gm/m^2 | ±30% | ±10% | 50 km | Week/Monthly | Regionl/Global | Kaufman/Tanre | For indices <5μm. Land and ocean separate. |
| Aerosol Single Scattering Albedo | MODIS | dimensionless | ±0.06 | ±0.03 | 50 km | Week/Monthly | Regionl/Global | Tanre/Kaufman | Separate over land & oceans. Daytime. |
| Angstrom Exponent ? | MODIS | | | ±15% | | | | | |
| Single Scattering Aerosol Radiance ? | MODIS | | ±10% | ±10% | | | | | Eos: Case I waters w/moderate concentrations |

**ATMOSPHERE - Moisture**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Precipitable Water | HIRIS* | cm | ±10% | ±3% | 30 m | 2-16 Days | | Goetz | Using 0.94 and 1.14 μm water vapor bands. |
| Total Precipitable Water | AIRS* | mm | 5% | 3% | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin also. IR/microwave. |
| Total Precipitable Water | MODIS* | cm | ±15% | ±5% | 10 km | Daily/Monthly | Global | Kaufman/Menzel | Susskind and Barton also. Daytime. |
| Tropospheric Precipitable Water | HIRIS* | cm | ±10% | ±3% | 30 m | 2-16 Days | | Goetz | With MODIS data troposph. water can be derived |
| Cloud Water Content | AIRS* | mm | TBD | TBD | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Precipitation Estimate | AIRS* | mm/day | 2mm/day | 1mm/day | 50 km | Twice Daily | Global | Susskind | IR/microwave. |
| Humidity Profile | AIRS* | gm/kg | 10% | 5% | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin. IR/μwave. 2 km vert. resolutn. |
| Moisture Profile | MODIS | g/kg | ±25% | ±20% | 10 km | Twice Daily | Global/Regionl | Susskind/Menzel | AMSU/AIRS necessary. |

17-Jan-90



Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod.

**ATMOSPHERE - Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Lifted Index | MODIS | °K ? | ±25% ? | ±20% ? | 10 km | Twice Daily | Global/Regionl | Menzel | Stability index. Moisture & Temp. Profile rqd? |
| Temperature Profile | AIRS* | Degrees K | 1°K | 0.4°K | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin. IR/μwave. 1 km vert. resolutn |
| Temperature Profile | MODIS* | °C | ±2°C | ±1°C | 10 km | Twice Daily | Regionl/Global | Susskind/Menzel | AMSU necessary. |
| Outgoing Longwave Spectral Radiation | AIRS* | W/m^2/μm | TBD | TBD | 50 km | Twice Daily | Global | Susskind/Smith | Fleming/Chedin also. IR. |
| Surface Scalar Wind Speed (to 30m/sec) | AIRS* | m/sec | TBD | TBD | 50 km | Twice Daily | Global | Aumann | Microwave. AIRS lists under oceans. |
| Surface Wind Field | SAR* | m/sec | ±10% | ±10% | 1 km | Daily(Regiona | Global/Ocean | Johanesen/Plant | Range 0-30m/sec. Useful. SCAT needed. |
| Horizontal Vector Wind Profiles | LAWS* | m/sec | ±1 to 5m/sec | | 100 km (s) | Twice Daily | Global | Emmitt | 1km vert. res; 0.5 km in high aerosol regions. |
| Along-Track Wind Speed | ALTIMETER* | meters/sec | 2 m/sec(rms) | | 7 km | 1 Second | | L.-L. Fu | |

**ATMOSPHERE - Chemistry**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Column Ozone | HIRIS* | Dobson Units-DU | ±10% | ±5% | 500 m | 2-16 Days | | Goetz | Using the chappius band. |
| Total Ozone Burden | AIRS* | Dobson (DU) | 5% | 3% | 50 km | Twice Daily | Global | Strow/Revercmb | Susskind also. IR. |
| Total Column Ozone | MODIS* | Dobson Unit(DU) | 15-20 DU | 10 DU | 10 km | Twice Day/mo. | Global | Susskind/Menzel | AMSU necessary. |
| Dust Cloud Iron Content | HIRIS | | N/A | 120% | | | | | |
| Mapping of Total Methane Burden | AIRS* | ppm | TBD | TBD | 250 km | Twice Daily | Global | Strow/Revercmb | IR. |
| Mapping of Total Carbon Monoxide Burden | AIRS* | ppm | TBD | TBD | 250 km | Twice Daily | Global | Strow/Revercmb | IR. |
| Mapping of Total Nitrous Oxide Burden | AIRS* | ppm | TBD | TBD | Zonal avg. | Twice Daily | Global | Strow/Revercmb | IR. |
| Carbon Dioxide Mixing Ratio | AIRS* | ppm | 5 ppm | 3 ppm | 50 km | Twice Daily | Global | Strow/Revercmb | IR. |



Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod.

**LAND - Vegetation**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Chlorophyll Concentration | HIRIS* | gms/ha | ±30% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | Using vegetation cover,APAR, & light path length |
| Leaf Area Index | HIRIS | | 10% | 5% | | | | | |
| Leaf Area Index | MODIS | dimensionless | ±0.1-0.25 | ±5-20% | Pixel Size | Daily/Weekly | Locl/Reg/Globl | Running | 0.04-0.39 SE Ranges. |
| Leaf Area Index | SAR* | Areal Fraction | TBD | TBD | 60 m | Seasonal | Global (Land) | Kasischke | Range: 0-20(?). Required. HIRIS needed. |
| Leaf Angle Distribution | HIRIS | | N/A | 10% | | | | | |
| Canopy Cellulose Concentration | HIRIS* | gms/ha | ±40% | ±20% | 30 m | 2-16 Days | | Wessman/Aber | Using veg. cvr,cellu. abs. depth,& light pth lngth |
| Canopy Lignin Concentration | HIRIS* | gms/ha | ±40% | ±20% | 30 m | 2-16 Days | | Wessman/Aber | Using veg. cvr,lignin abs. depth & light pth lngth |
| Vegetation Indices | HIRIS* | Dimensionless | ±0.01 | ±0.005 | 30 m | 2-16 Days | | Ustin/Wessman | Aber also. Range from 0 to 1. |
| Vegetation Indices | MODIS* | Dimensionless | ±0.01 | ±0.01 | 0.5,1,10km | Day/Week/Mo | Regionl/Global | Justc/Huet/Tanr | Range: 0-1. Need Lnd-Lvng+topo+214m cld cor |
| Vegetation Indices | ITIR* | Dimensionless | | | 15-30 m | | Local/Regional | | |
| Crown Spacing and Variance | HIRIS* | Meters | ±50% | ±20% | 30 m | 2-16 Days | | Ustin | For crown sizes/spacings >3 m. |
| Canopy Geometry | SAR* | Degrees, meters | ±45°, TBD | ±45°, TBD | 60 m | Semiannually | Global (land) | Kasischke/Ulaby | Range: 0-180°, 0-X m. Required. |
| Canopy Light Path Length | HIRIS* | mm | ±75% | ±20% | 30 m | 2-16 Days | | Ustin | Using spectral un-mixing & canopy shading char |
| Crown Height | HIRIS* | Meters | ±50% | ±20% | 30 m | 2-16 Days | | Ustin | Based on veg. cvr, aspect & crown spacing & var. |
| Chlorophyll Stress Index | HIRIS* | Dimensionless | ±5% | ±2% | 30 m | 2-16 Days | | Ustin | Using slope of Chlor. conc. to Chlor. bw function. |
| Vegetation Stress | MODIS | sec/m | ±200-1000 | ±5-30% | Pixel Size | Daily/Weekly | Locl/Reg/Globl | Running/Huete | |
| Community Structure | HIRIS | | 10% | 5% | | | | | |
| Land Cover Type/Biome Area | MODIS* | km^2 | ±5% | ±1-5% | 0.5,1,10km | Season/Yearly | Regionl/Global | Strahler/Huete | Justice too. Need Lnd-Lvng+topo+214m cld corr |
| Land Cover | HIRIS* | km^2 | ±4% | ±2% | 30 m | 2-16 Days | | Wessman | Using spectral un-mixing & canopy architecture |
| Fractional Vegetation Cover | HIRIS* | Dimensionless | ±20% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | Using spectral un-mixing. |
| Phenologic State | SAR* | None | N/A | N/A | 60 m | Weekly | Global (Land) | Way | Critical. HIRIS needed. |
| Landform Patterns | SAR* | m^2 (Area) | ±60 m X 60 m | ±30mX30m | 60 m | 5 Years | Regional | Schaber/Evans | Elachi also.Range:0-Xm^2.Required.HIRIS needed |
| Forest Surface Cover State | SAR* | m^2(Extent,type | N/A | N/A | 60 m | Monthly | Global (Land) | Ulaby | Required. |
| Ecotone Edge/Structure | HIRIS | | 10% | 5% | | | | | |
| Ecosystem Interfaces | HIRIS | | 60m | 60m | | | | | |
| Forest Boundaries/Deforestation | SAR* | m^2 (Extent) | ±60 X 60 m | ±60mX60m | 60 m | Monthly | Regional | Way | Critical. |
| Surficial Material Boundaries | SAR* | m^2 (Extent) | ±30 X 30 m | ±30 X 30 m | 60 m | 5 Years | Regional | Evans | Range: 0-X m^2. Required. HIRIS needed. |
| Primary Productivity | HIRIS | | N/A | 10% | | | | | |
| Primary Production | MODIS | Mg/km^2/year | ±100 | ±5-30% | 1 km | Week/Mo./Yr. | Regionl/Global | Running | Need veg. indices & Land Cover Type/Biome Area |
| Dead Biomass | HIRIS* | kg/ha | ±40% | ±15% | 30 m | 2-16 Days | | Ustin/Wessman | Using un-mixing: for grass & semiarid shrub. |
| Green Biomass | HIRIS* | kg/ha | ±40% | ±15% | 30 m | 2-16 Days | | Ustin/Wessman | Using vegetation cover, APAR,& light path length |
| Biomass | SAR* | kg/km^2 | TBD | TBD | 60 m | Annually | Global (Land) | Ranson/Kasischk | Ulaby also. Critical. |
| Seasonal Growth Patterns | SAR | | | 60mX60m | | | | | |
| Seasonal Growth Patterns | ITIR* | Dimensionless | | | 15-30 m | | Local/Regional | | |
| Length of Growing Season | MODIS | Days | ±10 Days | | 1, 10 km | Annual | Global | Justice | Need NDVI. |

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Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod.

**LAND - Soils**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Soil Erosion Rates | HIRIS | | 20% | 10% | | | | | |
| Erosion | SAR* | m^2 (Area) | ±60 X 60 m | ±30X30 m | 60 m | Semiannually | Regional | Schaber/Evans- | Elachi also. Required. HIRIS/ITIR needed. |
| Soil Moisture | SAR* | % (by Volume) | 5%hi/10%Glo | 10%/25%G | 60hi/100m | 3 D hi/Wk Glo | Local/Global | Engman/Ulaby- | Evans also. Range: 5-50%. Critical. High/Global |
| Soil Mineralogy and Organic Content | HIRIS | | N/A | N/A | | | | | |
| Soil/Bedrock Surface Mineralogy | ITIR* | None | | | 15-90 m | | Local/Regional | ERSDAC/Kahle | CO3, clays, silicates, Gypsum. See Stereo Pairs. |
| Relative Abund of Fe, CO3, SO4, OH minerals | HIRIS* | Dimensionless | ±10% | ±5% | 30 m | | | Rowan/Clark | Fe+3 variations, calcite/dolomite ratio. |
| SO4 Mineralization | HIRIS | | N/A | N/A | | | | | |
| Surface Aeolian Mineralogy | HIRIS | | N/A | N/A | | | | | |
| Soil Brightness Index | MODIS | Dimensionless | ±0.09 ? | ±10% ? | 1 km | Weekly | Regional (Arid) | Huete | For vegetation index refinement. |
| Sand Depth | SAR* | Meters (Depth) | ±0.5 m | ±0.5 m | 50-75 m | Twice Yearly | Regional | Schaber | Range: 0-4 m. Required. |

**LAND - Water/Ice**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Surface Water Cover Mapping ? | MODIS | | TBD | TBD | | | | | |
| Surface Water Area | ITIR* | km^2 | | | 15-30 m | 16 Days | 60 km Swath | | |
| Land - Water Boundaries/Floods | SAR* | m^2 (Area) | ±30 X 30 m | ±10% (?) | 30 m | Var:3d-Season | Local | Engman | Range: 0-X km^2. Critical. HIRIS needed. |
| Meltpond Fractional Area | HIRIS | | | 10% | | | | | |
| Meltpond: Onset of Melt/Time of Refreeze | HIRIS | | | N/A | | | | | |
| Ice Sheet, Lake and River Ice Extent | SAR* | Latitude/Long. | ±60 m | ±60 m | 60 m | Week(Winter) | Regional | Carsey | Range: 40-80°N/S. Required. |
| Leaf Tissue Water Content | HIRIS* | gm/cm^3 | ±50% | ±20% | 30 m | 2-16 Days | | Wessman/Goetz | Using veg. cvr, water band dpth,& light pth lhgth |
| Canopy Water Content | SAR* | % (By Volume) | TBD | TBD | 60 m | Biweekly | Global (Land) | Way/Ulaby | Range: 0-90%. Critical. |
| Canopy Water Potential | SAR* | Bars | TBD | TBD | 60 m | Biwk/Diurnal | Global (Land) | Way/Ulaby | Range: 0- -40 bars. Critical. |
| Evapotranspiration | ITIR* | mm/day | ±1 mm/day | 0.5 mm/day | 90 m | | Local/Regional | Schmugge | Requires ancillary data. |
| Drainage Patterns | SAR* | Meter (Lin. Xtnt) | ±20 m | ±20 m | 30 m | Once | Regional | Engman | Range: 0-10 km. Required. MODIS needed. |

**LAND - Snow**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Snow Covered Area | HIRIS* | km^2 | ±5% | ±5% | 30 m | 2-16 Days | | Dozier | |
| Snow/Ice Cover | AIRS* | Dimensionless | | | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Snow Cover | MODIS* | km^2 | ±5% or less | ±5% or less | 1, 10 km | Daily/Weekly | Regionl/Global | Salomonson | Accuracy based on avr. Jan. snowcover N. Hemis. |
| Snow Area | ITIR* | km^2 | | | 15-30 m | 16 Days | 60 km Swath | | |
| Snow Extent (Wet or Dry) | SAR* | m^2 (Areal Xtnt) | 0.5km hi/2km | Less thn 5% | 30 m | TBD | Local | Ulaby/Elachi | Range: 0-X m. Required. HIRIS needed. |
| Snow Surface Spectral Reflectance | HIRIS* | Dimensionless | ±5% | ±5% | 30 m | 2-16 Days | | Dozier | |
| Snow Surface Grain Size | HIRIS* | µm | ±200% | ±200% | 30 m | 2-16 Days | | Dozier | Using shortwave IR bands. |
| Snow Particulate Content | HIRIS* | gm/m^3 | ±500% | ±500% | 30 m | 2-16 Days | | Dozier | Using visible bands. |
| Snow Water Equivalent | SAR* | cm (Height) | ±20% | ±20% | 30 m | TBD | Local | Ulaby/Elachi | Range: 0-3 km. Critical. |
| Snow Wetness | SAR | Fraction | | 20% | | | | | |
| Snow State (Wet or Dry) | SAR | Wet or dry | | 60mX60m | | | | | Areal extent in m^2. |

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Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod.

**LAND - Use/Maps/Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Land Use Pattern | ITIR* | None | | | 15-30 m | | Local/Regional | | |
| Land Use Change | HIRIS | | N/A | 30m | | | | | |
| Land Surface Albedo Maps | HIRIS | | 1% (I) | 0.5% (I) | | | | | |
| Surface Albedo | AIRS* | Dimensionless | TBD | TBD | 50 km | Daily | Global | Susskind | VIS. |
| Spectral Surface Albedo ? | MODIS | | ±0.01 | ±0.01 | | | | | |
| Spectral Reflectivity | ITIR* | Dimensionless | ±4% | ±0.5-1.3% | 15-30 m | | Local/Regional | GSJ/Slater | GSJ: Geological Survey of Japan. |
| Surface Bidirectional Reflectance Dist. Funct | HIRIS* | Dimensionless | ±5% | ±5% | 30 m | 16 Days | | Gerstl | Corrected for variable atmospheric path length. |
| Bidirectional Reflectance/Albedo | MODIS | Dimensionless | ±15% | ±5-8% | 1, 10 km | Daily/Weekly | Regionl/Global | Tanre/Muller-- | Strahlr/Huet.Hemis&nadir refl.Atmos&topo cor |
| Skin Surface Temperature | AIRS* | Degrees K | 1°K | 0.5°K | 50 km | Twice Daily | Global | Revercomb --- | Susskind/Smith/Fleming/Chedin also. IR/µwave |
| Surface Temperature | MODIS* | °C | ±1-3°C | ±1°C | 1, 10 km | Daily/Weekly | Regionl/Global | Wan/Susskind | Range -20 to 50°C. AMSU necessary. |
| Temperature and Extent of Volcanic Activity | HIRIS* | °C, m^2 | ±10°C | ±5°C | 30 m | 2-16 Days | | Rowan/Goetz | Day & night detectn of volcanc activity by MODIS |
| Thermal Anomalies (Volcanoes, Fires) | MODIS* | °C | ±10°C | ±5°C | 1, 10 km | Daily/Weekly | Regionl/Global | Kaufman | Day & night data required. |
| Thermal Anomalies (Volcanoes, Fires) | ITIR* | | | | 90 m | | Local/Regional | Tokyo University | |
| Spectral Brightness Temperature | ITIR* | °K | ±1-2°K | ±0.3°K | 90 m | | Local/Regional | GSJ/Kahle/Slatr | GSJ: Geological Survey of Japan. |
| Surface Kinetic Temperature | ITIR* | °K | ±1-6°K | ±0.3°K | 90 m | | Local/Regional | Tokyo Unv/Kahle | National Research Lab. of Metrology help. |
| Thermal History | HIRIS* | | | | 30 m | | | Rowan | crystallinity, therm. matur. of org. mattr |
| Day-Night Land Surface Temperature Diff. | AIRS* | Degrees K | 0.5°K | 0.25°K | 50 km | Twice Daily | Global | Revercomb --- | Susskind/Smith/Fleming/Chedin also. IR/µwave |
| Day-Night Surface Temperature Difference | ITIR* | Degrees K | ±1-2°K | ±0.3°K | 90 m | | Local/Regional | Tokyo Unv/Kahle | National Research Lab. of Metrology Assistance. |
| Thermal Inertia | MODIS | Degrees K ?? | 1°K ?? | 1°K ?? | 856 m | Daily | Regional | Barton | Units questionable. Under favorable conditions |
| Upward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Spectral Emissivity (3-17µm/microwave) | AIRS* | Dimensionless | 0.05 | 0.025 | 50 km | Twice Daily | Global | Revercomb---- | Fleming also. IR/microwave. |
| Surface Emissivity | MODIS | Dimensionless | ±0.01 | ±0.01 | 1, 50 km | Daily/Weekly | Regionl/Global | Barton | Accuracies optimistic? |
| Spectral Emissivity | ITIR* | Dimensionless | ±0.015-0.03 | ±0.005 | 90 m | | Local/Regional | JGI/Kahle | 8 to 12 µm. Rel. em. JAPEX Geoscience Inst |
| Relative Spectral Emissivity | ITIR* | None | ±0.005-0.01 | ±0.005 | 90 m | | Local/regional | GSJ/Kahle | GSJ: Geological Survey of Japan. |
| Emissivity Indices | ITIR* | Dimensionless | | | 90 m | | Local/Regional | Becker/Kahl/JGI | JGI: JAPEX Geoscience Institute, etc. |
| Incident Photosynthetically Active Radiation | MODIS | Mjoules/m^2 | ±200 | ±5-20% | 1 km | Daily/Weekly | Regionl/Global | Tanre | Photosynthetically Active Vegetation: PAR |
| Non-Vegetative Absorbed PAR | HIRIS* | W/m^2/sr | ±30% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | PAR absorbed by other than green vegetation. |
| Vegetative Absorbed PAR | HIRIS* | W/m^2/sr | ±30% | ±10% | 30 m | 2-16 Days | | Ustin/Wessman | PAR absorbed by green vegetation. |
| Upward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Level 2 Land Leaving Radiances | MODIS* | W/m^2/sr/µm | ±10% | ±5% | 0.5,1,10km | Daily | Regionl/Global | Tanre/Strahler | Kaufman too. |
| Multispectral Radiance | ITIR | | | | 15-90 m | | | | 0.4 TO 12.0µm. |
| Downward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Downward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Stereo Pairs | ITIR* | Dimensionless | | | 15-30 m | | Local/Regional | ERSDAC | Earth Res. Satellite Data Analysis Center. |





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**LAND - Surface & Subsurface State**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Level 1 Topographic Corrections | MODIS | Meters | ±100 m | N/A | Pixel Size | N/A | Regionl/Global | Muller?/Strahlr | Input for veg. indices. MODIS-T dig. terr. mod? |
| Vertical Site Positions | GLRS* | mm | 5 mm (vert.) | | | | | Cohen/Schutz,etc | Many other supporting scientists. |
| Digital Elevation Models | ITIR* | Meters | | ±50 m | 15-30 m | | Local/Regional | JGI | JGI: JAPEX Geoscience Institute, etc. |
| Topography | SAR* | Meters (Height) | ±60 m | ±10 m | 30 m | Once | Global (Land) | Zebker | Range: 0-7 km. Critical. |
| Lineament Pattern | ITIR* | None | | | 15-30 m | | Local/Regional | ERSDAC | ERSDAC: Earth Res. Satellite Data Analysis Centr |
| Geomorphic Features | GLRS* | mm | 100-500 mm | | .1-10 km s | Weeks/Years | | Cohen/Schutz,etc | 100-500 mm vertical resolution. |
| Surface Roughness | SAR* | cm (height rms) | ±2 cm | ±1 cm | 60 m | Semiannually | Regional | Evans/Zebker-- | Engman also. Range: 0-2 m. Critical. |
| Horizontal Site Positions | GLRS* | mm | 3 mm | | | | | Cohen/Schutz,etc | Many other supporting scientists. |
| Secular Three-Dimensional Site Velocities | GLRS* | mm/yr | 1mm/yr | | 1000s km s | Years | | Cohen/Schutz,etc | 1000s kms horizontal resolution. |
| Episodic Three-Dimensional Site Velocities | GLRS* | mm/month | 5 mm/month | | 100s km s | Months | | Cohen/Schutz,etc | 100s kms horizontal resolution. |
| Post Seismic 3-D Site Velocities | GLRS* | mm/week | 10 mm/week | | 100s km s | Weeks | | Cohen/Schutz,etc | 100s kms horizontal resolution. |
| Crustal Strain Rates | GLRS* | µstrain/year | 0.1 µstain/yr | | 1-100km s | Years | | Cohen/Schutz,etc | 1-100 km horizontal resolution. |
| Volcanic Inflation and Deflation Rates | GLRS* | mm/day-mm/yr | 100mm/dy# | | | Days to Years | | Cohen/Schutz,etc | #: to 5 mm/yr. |
| Intersite Distance Rates of Change | GLRS* | mm/wk-mm/yr | 10mm/wk# | | | | | Cohen/Schutz,etc | #: to 1mm/yr. |
| Height Rates | GLRS* | mm/day-mm/yr | 100 mm/day# | | 100s kms s | Years | | Cohen/Schutz,etc | #: to 5mm/yr. 100s kms horizontal resolution. |
| Subsurface Scattering | SAR* | m^2 (Area) | ±60 X 60 m | ±30X30 m | 50-75 m | Twice Yearly | Regional | Schaber | Range: 0-X m^2. Required. HIRIS needed. |

**OCEAN - Surface & Subsurface State**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Surface Wave Height | SAR* | Meters (Height) | ±20% | ±20% | 5 km | Daily (regionl | Global (Oceans) | Plant | Range: 0-20 m. Required. ALTIMETER needed. |
| Along-Track Wave Height | ALTIMETER* | meters | ±0.5m or 10% | | 7 km | 1 second | | L.-L. Fu | Abs. accuracy (rms) the greater of the two. |
| Surface Waves | SAR* | m(length),°(dir | ±10%, 10° | ±10%, 10° | 5 km | Daily (Regnl) | Global (oceans) | Plant | Range: 100-500 m; 0-360°. Critical. |
| Along-Track Sea Surface Height | ALTIMETER* | cm | ±10 cm(rms) | | 7 km | 1 second | | L.-L. Fu | Requiring GGI & AMSR (or HIMS) |
| Sea Surface Topography Maps | ALTIMETER* | cm(h), km(dist) | ±5cm (rms)# | | 25 km | 16 days | | L.-L. Fu | #Grnd trk to 25% of std. dev. of var. in void regs |
| Skin Surface Temperature | AIRS* | Degrees K | 0.5°K | 0.4°K | 50 km | Twice Daily | Global | Revercomb---- | Susskind/Smith/Fleming/Chedin also. IR/µwave |
| Sea Surface Temperatures | MODIS* | °K | ±0.3-0.4°K | ±0.1-0.3°K | 1, 20 km | Daily/Wk/Mo. | Regionl/Global | Brown/Barton | Also Season/yr. ±4 km positioning on Earth grid |
| Sea Surface Temperature | ITIR* | Degrees K | ±1-2°K | ±0.3°K | 90 m | | | | |
| Spectral Brightness Temperature | ITIR* | Degrees K | ±1-2°K | ±0.3°K | 90 m | | | | National Research Lab. of Metrology help. |
| Water Temperature Pattern | ITIR* | Degrees K | ±0.5°K | ±0.3°K | 90 m | | | | National Research Lab. of Metrology Assistance |
| Ocean Tide Model | ALTIMETER* | Cm | ±2 cm (rms) | | 100 km | 15 mins | | Sanchez | |
| Crustal Def. Contr. to Appar. Sea Level Chnge | GLRS* | mm/year | 1 mm/year | | 100s kms s | Years | | Bevis/Cohen--- | Schutz also. 100s kms horizontal resolution. |
| Currents, Fronts, Eddies | SAR* | Latitude/Long. | ±120 m | ±120 m | 60 m | Biweekly | Global (Oceans) | Johannessen | Useful. MODIS needed. |
| Currents, Fronts, Eddies | MODIS | Meters | 214-856 m ? | | 214-856m | | Regional | | May be deleted. Seasonally dependent. |
| Currents, Fronts, Eddies | SAR* | m/s (bndry vel.) | ±20% | ±20% | 60 m | Biweekly | Global (Oceans) | Johannessen | Range: 0-3 m/sec. Required. |
| Internal Waves | SAR* | Latitude/Long. | ±60 m | ±60 m | 60 m | Biweekly | Global (Oceans) | Johannessen | Required. |
| Bathymetric Features | SAR | | | 60m | | | | | |



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Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod.

**OCEAN - Ice**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Ice Type | HIRIS | | | | | | | | |
| Sea Ice Type | SAR* | Frct.(5-10types | 5%hi;10%Glob | 5hi;10%Glo | 5 km | 5 Days | Global | Carsey | Range: 0-100% each. Required. AMSR needed. |
| Floe Ice Fractional Area | HIRIS | | | 10% | | | | | |
| Sea Ice Concentration | SAR* | Fraction | 5 hi;10%Glob | 5%hi;10Glo | 5 km | 5 Days | Global | Carsey | Range: 0-100%. Required. AMSR needed. |
| Floe Ice Area and Perimeter | HIRIS | | | 10% | | | | | |
| Sea Ice Cover (Open Water) | AIRS* | Dimensionless | 0.1 | 0.05 | 50 km | Twice Daily | Global | Staelin/Rosencrn | Microwave. |
| Sea Ice (Maximum Total Extent) | MODIS* | km^2 | ±5% or less | ±5% or less | 1, 10 km | Daily/Weekly | Regionl/Global | Salomonson | Accuracy based on March Ice N. Hemisphere |
| Ocean Ice Area | ITIR* | km^2 | | | 15-30 m | | | | |
| Sea Ice Extent | SAR* | Latitude/Long. | ±1 km | ±1 km | 5 km | 5 Days | Global | Carsey | Range: 50-80°N/S. Required. AMSR needed. |
| Floe Ice Size Distributions | HIRIS | | | 10% | | | | | |
| Broken Ice Fractional Area | HIRIS | | | 10% | | | | | |
| New Ice/Open Water/Lead Fractional Area | HIRIS | | | 10% | | | | | |
| Open Water Area | ITIR* | km^2 | | | 15-30 m | | | | |
| Sea Ice Crack Density | HIRIS | | | N/A | | | | | |
| Ice Sheet Mass Balance | GLRS* | TBD | TBD | | | | | | |
| Ice Sheet Volume Change | GLRS | | | 10 cm | | | | | |
| Ice Sheet Height Profiles | GLRS* | mm | 100 mm | | | | | | |
| Ice Sheet Height | GLRS | | | 10 cm | | | | | |
| Sea Ice Height Profiles | GLRS* | mm | 100 mm | | | | | Bentley | |
| Ice Sheet Topography Maps | ALTIMETER* | cm(h), km(dist) | ±50 cm; 5 m# | | 15 km | 1 year | | Zwally | #50 cm (flat regions); 5 m (steep regions) |
| Ice Sheet Surface Roughness Profiles | GLRS* | mm | 100 mm | | | 3 months | | Bufton | |
| Sea Ice Surface Roughness Profiles | GLRS* | mm | 100 mm | | | | | Thomas | |
| Ice Sheet Displacement and Velocity | GLRS* | mm/day | 100 mm/day | | | months | | Zwally | |
| Sea Ice Motion | SAR* | km/day (velocity | ±0.5 km/day | ±0.5km/day | 5 km | 5 Days | Global | Carsey | Range: 0-40 km/day. Critical. |
| Ice Sheets and Shelf Dynamics | SAR* | m/year (velocity | ±0.2 km/year | ±0.2 km/yr | 30 m | 2 maps/Wintr | Regional | Carsey | Range: 60-90° N/S. Required. |
| Ice Sheet Strain Rates | GLRS* | µstrain/year | 1 µstrain/yr | | | | | | |
| Sea Ice Bidirectional Reflectance Dist. Funct. | HIRIS | | | 10% | | | | | |

**OCEAN - Physics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Downward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Downward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Upward Shortwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Daily | Global | Gautier | VIS. |
| Upward Longwave Flux | AIRS* | W/m^2 | TBD | TBD | 50 km | Twice Daily | Global | Gautier | IR. |
| Water-Leaving Radiance, Visible Channels | MODIS* | mW/cm2/sr/µm | ±10% | ±5% | 1 km | Daily | Local/Reg/Glob | Gordn/Evns/Tan | Typical conditions. |
| Aerosol Angstrom Exp., Optical Depth <0.6 | MODIS* | Dimensionless | ±15% | ±5% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Gordon/Tanre | Accuracy depends upon SNR, pixel averaging. |
| Single Scattering Aerosol Radiance, ta < 0.6 | MODIS* | mW/cm2/sr/µm | ±10% | ±5% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Gordon/Tanre | Case I waters w/moderate concentrations. |
| Spectral Reflectivity | ITIR* | Dimensionless | ±4% | ±0.5-1.3% | 15-30 m | | | | |

17-Jan-90



Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod.

**OCEAN - Organics and Inorganics**

| PRODUCT | INSTRUMENT | MEASUREMENT UNIT | ABSOLUTE ACCURACY (std. error) | PRECISION (Relative accuracy) | RESOLUTION (Spatial or vertical) | TEMPORAL RESOLUTION | SPACE SCALE | RESPONSIBLE SCIENTIST | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| Total Suspended Solids | MODIS* | g/m^3 | ±50% | ±35% | 1, 20 km | Daily/Weekly | Global | Clark | Anc: OWP |
| Gelbstoff Absorption Coefficient (410nm) | HIRIS* | Per meter^2 | ±50% | ±25% | 90 m | 2-16 Days | | Carder | Used to infer humic and fulvic acid conc.(±75%) |
| Chlorophyll-a, Case I Waters | HIRIS* | mg/m^3 | ±50% | ±25% | 90 m | 2-16 Days | | Carder/Davis | Melack too. Acc. impvd by using larger res. elem. |
| Chlorophyll-A Concentration (Case I) | MODIS* | mg/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Evns/Clrk/Gordn | Typical conditions. |
| Chlorophyll-A Conc. from Fluorescence | MODIS | mg/m^3 | 0.5 mg/m^3 | ±35% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Abbott/Gordon | Only >0.5 mg/m^3. Anc: OWP. >acc by spatial avr |
| Chlorophyll-a, Case II Waters | HIRIS* | mg/m^3 | ±70% | ±35% | 90 m | 2-16 Days | | Carder | Non-turbid environments. |
| Chlorophyll-a, Turbid Case II Waters | HIRIS* | mg/m^3 | ±100% | ±50% | 90 m | 2-16 Days | | Carder | Somewhat site specific. |
| Chlorophyll-A Concentration (Case II) | MODIS* | mg/m^3 | ±50% | ±10% | 1, 20 km | Daily/Weekly | Regionl/Global | Cardr/Clrk/Hoge | Parslow also. Based on simulated lab data. |
| Chlorophyll Fluorescence (Line Height) | MODIS* | mW/cm2/sr/µm | ±30% | ±10% | 1, 20 km | Day/Week/Mo | Regionl/Global | Gordn/Abot/Evan | Hoge also. Probably >>error at low concent. |
| Accessory Pigments, Case I Waters | HIRIS* | mg/m^3 | ±70% | ±35% | 90 m | 2-16 Days | | Davis (marine) | Melack (fresh) also. Somewhat site specific. |
| Pigment Concentration (CZCS) | MODIS* | mg/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Clark/Gordon | Anc: OWP |
| Pigment Concentration (Curvature) | MODIS | mg/m^3 | | ±35% | 1, 20 km | Daily/Weekly | Regional | Hoge/Esaias | Coastal & estuarine. Anc: OWP. |
| Phycoerythrin Pigment Concentration | MODIS* | mg/m^3 | ±200% | ±50% | 1, 20 km | Daily/Weekly | Regionl/Global | Hoge | |
| Suspended Inorganic Matter (Concentration) | HIRIS | | 50 - 200% | 20 - 50% | | | | | |
| Suspended Organic Matter (Concentration) | HIRIS | | 100 - 200% | 20 - 50% | | | | | |
| Dissolved Organic Matter Concentration | MODIS* | mg/m^3 | ±150% | ±30% | 1, 20 km | Daily/Weekly | Regionl/Global | Carder/Parslow | Hoge also.Anc:OWP.30% error simu.data(Parsl) |
| Dissolved Organic Matter (Concentration) | HIRIS | | 100 - 300% | 20 - 50% | | | | | |
| Detached Coccolith Concentratn (E. huxleyi) | MODIS* | mg CaCO3/m^3 | ±30% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Gordon | Anc: OWP. |
| Organic Fraction | MODIS | Dimensionless | | ±10% | 1, 20 km | Daily/Weekly | Global | Clark | Anc: OWP. |
| Productivity of Phytoplankton | HIRIS | | 300% | 50% | | | | | Accuracy based on model result |
| Primary Productivity, Case I Waters | MODIS | mg C/m^2/day | | ±50-100% | 1, 50 km | Daily/Wk/Yr | Regionl/Global | Abbott/Esaias | Anc: OWP, MLD, CS |
| Primary Productivity (Annual Product) | MODIS | GT C/year | | ±20% | 20 km | Annual | Global | Esaias | Anc: OWP. |
| Surface Photosynthetically Active Radiation | HIRIS | | 40% | 25% | | | | | |
| Surface Incident PAR (h nu) | MODIS | Quanta/m^2/sec | ±10% | ±5% | 1, 100km | Daily | Global | Esaias/Tanre | Daily avr. TBD; Anc: OWP, AVHRR, GOES |
| Attenuation of PAR | HIRIS | | N/A | 30% | | | | | |
| Attenuation of PAR (K) | MODIS | Per meter | ±35% | ±10% | 1, 20 km | Daily/Weekly | Global | Clark | Anc: OWP. |
| Beam Attenuation Coefficient, c, 520 nm | MODIS | Per meter | | ±35% | 1, 20 km | Daily/Weekly | Global | Clark | Anc: OWP. |
| Backscattering Coefficient (560 nm) | HIRIS* | Per meter^2 | ±50% | ±25% | 90 m | 2-16 Days | | Carder | Used to infer suspnded particulats (org.&inorg.) |
| Particulate Scattering | MODIS | Per meter | | ±30% | 1 km | Daily | Global | Parslow | Based on simulated lab data. |
| Attenuation K at 490 nm (Case I Waters) | MODIS* | Per meter | ±25% | ±10% | 1, 20 km | Daily/Weekly | Local/Reg/Glob | Clark/Gordon | Accuracy based on typical conditions. |





Comparsns based on nearest relations among prods. Similar prods are grouped. OWP = Anc. data: ozone, winds, s/s press. MLD: Mixed Layer Depth modl. CS: Coupled Sim. modl. s: Horiz. res. *: At launch prod