Proposed MODIS-Atmosphere Collection 006 Changes
Version 26 (1/21/2011)

Status Keyword List: [Not Started], [Investigating], [Coding], [Testing], [Dropped] or [Implemented]. Note: If no status keyword appears after an item, the status was not communicated to the author of this document.

Aerosol (04_L2)

Dark Target Aerosol (04) (Updated 1/15/2010) Lorraine Remer, Shana Mattoo, Rob Levy, Allen Chu

- Over Land:

  A) Modify maps for assigning aerosol models over land:

  Due to a lack of sensitivity to aerosol absorption, the over-land retrieval must assume aerosol type. For C005, aerosol type was assigned, based on a global map of AERONET aerosol climatology. For C006, these map boundaries will be modified based on AERONET climatology collected since 2005.

  B) Modify surface reflectance parameterization:

  The aerosol retrieval must make assumptions as to surface reflectance boundary conditions. In C005, surface reflectance parameterization was based on small set of collocated MODIS and AERONET, and shown to have dependence on surface type, vegetation condition (NDVI), and scattering angle. For C006, the global parameterization will be modified to correct systematic biases in particular locations.

  C) Deleted SDSs:

  Based on validation studies of C005 products, the following derived aerosol size parameters have little or no quantitative scientific use, and will be deleted from L2 (and L3) processing:

  Angstrom_Exponent_Land
  Optical_Depth_Small_Land
  Mean_Reflectance_Land_All
  Standard_Deviation_Reflectance_Land_All
  Path_Radiance_Land
  Error_Path_Radiance_Land
  Critical_Reflectance_Land
  Error_Critical_Reflectance_Land
  QualityWeight_Path_Radiance_Land
  QualityWeight_Critical_Reflectance_Land

  D) Renamed SDSs:

  "Cloud_Fraction_Land" becomes "Aerosol_Cloud_Fraction_Land"

- Over Ocean:

  There are no significant changes to the basic aerosol retrieval algorithm, although QA "Confidence" flags may be modified

  A) Renamed SDSs:

"Cloud_Fraction_Ocean" becomes"Aerosol_Cloud_Fraction_Ocean"

- Applies to Both Land and Ocean:

  A) Expansion of retrieval over higher solar zenith angles.
  Based on sensitivity studies of radiative transfer, prior to MODIS launch on Terra (pre-1999), aerosol retrieval was limited to cases where solar zenith angle (solzen) was less than 72°. Relaxation of the threshold to solzen <84° greatly increases MODIS coverage in higher latitude/lower sun conditions. No large impact on data quality assurance (QA) is expected, but this is still being investigated.

  B) Examine aerosols in the proximity of clouds

  Cloud mask and distance to the nearest cloud is calculated and presented for every 500 m "cloud-free" pixel that allows better control of cloud contamination in the basic aerosol products. This information is also summarized statistically at the 10 km product resolution, and will be available for both land and ocean.

  C) Introduce an integer QA flag

  Users desire simple SDSs for QA that do not require bit decoding. We will introduce i) Flag determining whether a pixel is over land or ocean, and ii) Simple flag (0-3) that represents QA Confidence flags.

  D) New SDSs:

  These SDSs will be added to L2:
  Land_Sea_Flag (10 km resolution)
  Cloud_Distance_Land_Ocean (500 m resolution)
  Aerosol_Cldmsk_Land_Ocean (500 m resolution)
  Average_Cloud_Distance_Land_Ocean (10 km resolution)
  Land_Ocean_Quality_Flag (10 km resolution)

  E) Renamed SDSs:

  "Cloud_Mask_QA" becomes "Aerosol_Cloud_Mask_QA"

  F) Deleted SDSs:

  These SDSs will be taken out of Level 2 processing
  Optical_Depth_Ratio_Small_Land_And_Ocean

- Propagation to Level 3 (L3)

  A) Aggregation Logic:
  Remove pixel weighting in aggregating from daily to 8-day and to monthly, but retain minimum retrieval screen. Add information to attributes that gives threshold value of screen.

  B) New SDSs
  Average_Cloud_Distance_Land_Ocean

  C) Deleted SDSs

Optical_Depth_Ratio_Small_Land_And_Ocean
Optical_Depth_Ratio_Small_Land
Optical_Depth_Small_Land
Angstrom_Exponent_Land
Mean_Reflectance_Land_All
Standard_Deviation_Reflectance_Land_All
Path_Radiance_Land
Error_Path_Radiance_Land
Critical_Reflectance_Land
Error_Critical_Reflectance_Land
QualityWeight_Path_Radiance_Land
QualityWeight_Critical_Reflectance_Land
Aerosol_Cloud_Mask_Cloud_Fraction_Land
Aerosol_Cloud_Mask_Cloud_Fraction_Ocean

Deep Blue Aerosol (04DB) (Updated 1/21/2010) Clare Salustro, Christina Hsu

- Expand coverage to vegetated regions
  - Whereas C005 and C051 Deep Blue retrievals were limited to bright surfaces, C006 will also include Deep Blue retrievals over vegetated regions.

- Introduce an integer QA flag
  - As with Dark Target above, we will introduce integer versions of the Deep Blue Usefulness Flag and Confidence Flag.

Water Vapor (05_L2) (Updated 1/11/2010) Bo-Cai Gao

- Improve QA for the near-IR water vapor products, and thoroughly screen out pixels saturated over bright clouds.

Cloud (06_L2)

Cloud Optical Properties (06OD) (Updated 1/21/2011) Steve Platnick, Gala Wind

- Integrate low-cloud temperature retrievals into the MOD06OD algorithm to include non-unity emissivity (from optical thickness, effective radius retrieval). Iterative approach requiring independent 11 μm cloud-top properties code from R. Frey et al. (retrieval logic and 11 μm radiative transfer code). Primary method: in conjunction w/3.7 μm retrieval (but could be done with other r_e retrievals as well). Status. Coding: Initial iterative algorithm coded in research version of CHIMAERA. Further integration awaiting UW code.

- Multilayer Flag. Update current MOD06OD multilayer flag to include other techniques and approaches (e.g., Pavolonis and Heidinger). Status. Coding: P&H integration completed. Initial Primary test (#2) completed. First iterative test (#2.1) completed; analysis ongoing.

- Separate 1.6 and 3.7 μm r_e retrievals

- Retrieve and store 1.6 and 3.7 μm retrievals as absolute values instead of differences from 2.1 μm. Allows for successful retrievals in absence of successful 2.1 μm retrieval, and separate aggregations in Level-3. [Status: Done]
- Add retrieval uncertainties to these separate size retrievals. [Status: Pending]

➢ Clear Sky Restoral algorithm

- Retrieved CSR-flagged pixels but assign a unique QA that allows them to be optionally included in Level-3 aggregations. [Status: Done]
- Add "color test" by adding 412 nm band. [Status: Incorporation of additional band in L1B read routines completed. CSR logic modification not started]
- Use new information incoming from collection 6 cloud mask (250m band 1 and 2 mean and standard deviation from L1B) for potentially better retrieval QA and/or clear sky restoral results. [Status: Not Started]
- CSR logic and QA assignment need to come last in the code structure. [Status: Done]
- 250m cloud mask handling

  * [from STM notes] CSR. According to Gala Wind, the default for 250 m tests is to set all of the 250 m pixels to clear, and then change to cloud upon reading such as result from cloud mask. But the logic should be reversed, i.e., all 250 m pixels are set to cloudy and then changed to clear upon reading such a result from the cloud mask. Either approach is irrelevant unless there are missing 250 m L1B pixels. This is the likely reason why CSR was showing thick ice cloud striping due to the faulty QA in the Jan. 2007 L1B LUT delivery. The old/original LUT was then used to reprocess data so isn't a cause of immediate widespread concern but this is an error in the logic. [Status: Done]

➢ Cloud-Top Properties. Use new C6 UW-Madison 1-km cloud top properties product for cloud top pressure and temperature instead of 5-km version. [Status: Integration. Use of 1km data set completed; awaiting final C6 version from UW]

➢ Retrieval QA.

- Link QA to pixel-level uncertainty estimates. <u>Status</u>. Not started.
- Use new information incoming from collection 6 cloud mask (250m band 1 and 2 mean and standard deviation from L1B) for potentially better QA and/or clear sky restoral results. [Status. Not started]

➢ New Water and Ice Cloud Reflectance and Flux Reflectance/Transmittance Look-Up Tables (LUT).

- Replace discrete ordinate/asymptotic theory combination with DISORT to simplify code logic structure. [Status: Done]
- Determine needed LUT discretization and intervals (τ, r_e, μ, μ_0, $\Delta\phi$) to achieve linear interpolation error much less than other error sources. Status: completed; storing Fourier components for $\Delta\phi$ interpolation. <u>Status</u>: Done.
- Integrate Cox-Munk BRDF for water surfaces (vs. Lambertian in C5) for improved thin cloud (e.g., cirrus) retrievals. Determine number of wind speeds need achieve linear interpolation error much less than other error sources. [<u>Status</u>: Done]
- For ice clouds, include arrays of g and ϖ_0 so users can compare/scale the answers to their own radiative cloud models (i.e., scale τ from MOD06

retrievals to their user library of *g*'s for non-absorbing bands, and *g* & ϖ_0 for absorbing bands; scale MOD06 r_e to their user library of r_e by scaling ϖ_0). Also, done for water clouds for completeness. [Status: Done]

- Retrieval Algorithm
  - Solution logic that will allow retrievals just slightly outside the library space to proceed. [Status: Not Started]
  - Retrieval processing direction now in along-track direction to minimize LUT interpolation (using 99 along-track pixel positions at a time). [Status: Done]

- Cloud Phase Algorithm

  - Retrievals will be done for both liquid and ice phases simultaneously and effective radii differences between 2.1 and 1.6 μm will be used as a replacement to existing SWIR reflectance tests (requires update of retrieval code logic). Retrievals for only one phase will be kept and phase QA assignments need to precede CSR in code logic structure. [Status: Coding. Dual phase logic completed; still investigating phase logic changes]
  - Phase of thin cirrus. Cloud mask correctly detects the clouds with IR window difference and 3.9-11 μm tests, but we are getting a liquid water phase while IR is undetermined. Clearly, if the mask can detect the cirrus then we ought to use those mask tests to help in the phase logic. [Status: Not Started]

- Ancillary
  - Temporally and, where applicable, spatially interpolate GDAS fields to better capture diurnal heating rates and synoptic features that affect atmospheric and emission corrections. Will be using temporally and spatially interpolated surface temperature from UW-Madison's 1-km cloud top properties product in 3.7μm retrieval. Also read in the entire profile instead of roughly half of it, as done currently. [Status: science test completed, final requires UW-Madison official 1-km CT]
  - Examine possibility/effects of using next day's NISE in order to better capture freshly fallen snow. Currently incorrect non-absorbing band is used in those situations and abnormal cloud optical thicknesses result. [Status: Dropped. Changing production rules to use later NISE didn't help.]

- Aqua VIS focal plane adjustment for band 1 and 2.
  - Pursue study of Terra deregistration sensitivity.
  - Jan '10: Became aware of Ralf Bennartz Aqua re-registration algorithm and test in the Wisconsin PEATE.

    <u>Status</u>: Terra deregistration text completed in MODAPS. Need to compare Bennartz results with Terra deregistration test, and determine significance of misregistration sensitivity. Ongoing investigation, but unlikely to pursue.

- Improve cirrus cloud retrievals of τ_C, r_e
  - Improve thin cirrus detection using a combination of IR and 1.38 μm bands
  - Perform additional retrieval of τ_C using IR and/or 1.38 μm bands as an augmentation of the current solar reflectance approach Pavolonis/Heidinger beta 1DVAR.

[Status: Dropped. Investigation will continue via ROSES 2009 Aqua/Terra NRA proposals.]

- Partly cloudy pixels
  - Better use of 250 m cloud mask (at least over ocean) for QA of MOD06OD and CT retrievals.
  - Coakley-type spatial variance vs. temperature approach (Note: Rich Frey doesn't think the Coakley algorithm should be included in this list. However, he could see calculating a variance statistic of some kind using band 2 and including a flag in the L2 output that indicates a non-uniform scene. I think the cloud team should discuss this more before we commit to anything.)

    [Status: Dropped]

Other items from previous change document …

- Change the multilayer cloud code so that above-cloud precipitable water is interpolated instead of being estimated by the nearest table index. [Done. However the impact wasn't as significant as thought it would be]
- Examine correcting the 0.86 μm ozone in the multilayer cloud detection algorithm. [Dropped. The extinction cross-section is too small to bother]
- Use ecosystem-dependent vegetation and snow/ice thresholds in the multilayer cloud detection algorithm. [Dropped]
- Reduce the size of multilayer and cloud phase SDSs from 16 bit to 8 bit to save space. [Done]
- Examine the effect of interpolated (advected where needed) ancillary data on the retrievals. [Science test completed. We will not use advection, but interpolate instead.]
- Document the meaning of the settings (0 to 4) in the CDL file spec and HDF file for the "Cloud_Phase_Optical_Properties" SDS. Add a new local attributed called "description". [Done]
- Change the SDS size for Cloud_Multi_Layer_Flag and Cloud_Phase_Optical_Properties from 16 bits to 8. This will save 5.5 Mb/granule uncompressed. [Done]
- Examine the possibility of augmenting the Surface Albedo dataset to include colored water albedo: sedimented / blooming / shallow. [Dropped]

Cloud Optical Properties (06OD) (Updated 1/16/2010) Steve Platnick, Michael King, Gala Wind

- Integrate low-cloud temperature retrievals into the MOD06OD algorithm to include non-unity emissivity (from optical thickness, effective radius retrieval). Iterative approach requiring independent 11 μm cloud-top properties code from R. Frey et al. (retrieval logic and 11 μm radiative transfer code). Primary method: in conjunction w/3.7 μm retrieval (but could be done with other r_e retrievals as well). [Status: Initial iterative algorithm coded in research version of CHIMAERA. Further integration awaiting UW code.]

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completed. Initial Primary test (#2) completed. First iterative test (#2.1) completed; analysis ongoing.]

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Lambertian surfaces, being run for Cox-Munk. Integration: completed for Lambertian surfaces (Primary Test #3); Integration for Cox-Munk not started (Primary Test #4).]

- For ice clouds, include arrays of g and ϖ_0 so users can compare/scale the answers to their own radiative cloud models (i.e., scale τ from MOD06 retrievals to their user library of g's for non-absorbing bands, and g & ϖ_0 for absorbing bands; scale MOD06 r_e to their user library of r_e by scaling ϖ_0). Also, done for water clouds for completeness. [Status: Done]

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  - Solution logic that will allow retrievals just slightly outside the library space to proceed. [Status: Not Started]
  - Retrieval processing direction now in along-track direction to minimize LUT interpolation (using 99 along-track pixel positions at a time). [Status: Completed]
  - Set the value of 3.7 μm solar spectral irradiance according to the Terra and Aqua average in Platnick and Fontenla (1998), Table 2, i.e., 10.93 W/m^2-μm. [Status: Not yet implemented]

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- Examine correcting the 0.86 μm ozone in the multilayer cloud detection algorithm. [Dropped. The extinction cross-section is too small to bother.]
- Use ecosystem-dependent vegetation and snow/ice thresholds in the multilayer cloud detection algorithm. [Dropped]
- Reduce the size of multilayer and cloud phase SDSs from 16 bit to 8 bit to save space. [Done]
- Examine the effect of interpolated (advected where needed) ancillary data on the retrievals. [Initial testing completed. We will not use advection, but interpolate instead.]

  From Gala Wind: "Drop the item about GDAS advection. It turned out to be too much of an overkill and also created some computational 'waves' in the profile fields that I really didn't like. They (and we) are temporally interpolating profiles instead. Seems to work just fine."

- Document the meaning of the settings (0 to 4) in the CDL file spec and HDF file for the "Cloud_Phase_Optical_Properties" SDS. Add a new local attributed called "description". [Done]
- Change the SDS size for Cloud_Multi_Layer_Flag and Cloud_Phase_Optical_Properties from 16 bits to 8. This will save 5.5 Mb/granule uncompressed. [Done]
- Examine the possibility of augmenting the Surface Albedo dataset to include colored water albedo: sedimented / blooming / shallow. [Dropped]

Cloud Top Properties (06CT) (Updated 1/8/2010) Paul Menzel, Rich Frey

- Implement "top-down" method of final cloud top pressure choice for Aqua. [Status: Implemented]
- Restrict range of CTP retrievals appropriate to channel pair (36/35 < 450 hPa, 35/34 < 550 hPa, 34/33 < 650 hPa, 35/33 < 650 hPa). [Status: Implemented]
- Avoid CO_2 slicing solutions in water clouds and IRW solutions in ice or mixed phase clouds. [Status: Implemented for water surfaces only, no plans for land]

- Output cloud (geopotential) heights along with cloud top pressures. [Status: Implemented]
- Use GDAS ozone profile data in stratosphere; merge with climatological profiles currently in use. [Status: Implemented]
- Reduce NEDR thresholds for band selection in CO_2-slicing algorithm. [Status: Implemented]
- Implement "spectral shift" (Tobin et al.) in forward model calculations involving bands 34-36 (Aqua only). [Status: Implemented]
- Investigate use of "gamma-adjusted" transmittance profiles to replace current clear sky radiance bias correction. [Status: Dropped]
- Investigate identification of stratospheric clouds ("overshooting tops") by use of positive 6.7-11 μm and 13.6-11 μm BTDs; use stratospheric temperature profiles and IRW BTs in these cases to locate clouds. [Status: Implemented detection only]
- Use LEOCAT software to produce 1-km resolution products (in addition to current 5-km products); CTP, CTH, CTT, ECE. [Status: Implemented]
- Include cloud overlap / phase at 1 km. [Status: Dropped]
- Include multiple cloud top pressure solution flag for window channel retrievals. [Status: Dropped]
- Investigate inversion detection for low level water cloud to be located below inversion. [Status: Dropped]
- GDAS temperature profile data will be used to identify regions where temperature inversions exist and an alternative IRW method will be implemented. [Status: Dropped]
- Investigating use of latitude-dependent lapse rates for calculation of cloud heights in inversion situations. [Status: Implemented for water surfaces only, no plans for land]
- UW is considering the possibility of using G. Wind's advection code in their C6 CT. (Wind & Frey, 02/09). [Status: Dropped]
- Hubanks to check with Frey if a new flag category should be added to the Cirrus Flag and High Cloud Flag. The category would be 3 = clear sky. Currently the category 0 = "missing" includes both missing satellite data and clear sky. This change would allow a true fraction to be implemented in L3. [Status: Coding]

Cirrus Detection (06CD) (Updated 1/11/2010) Bo-Cai Gao

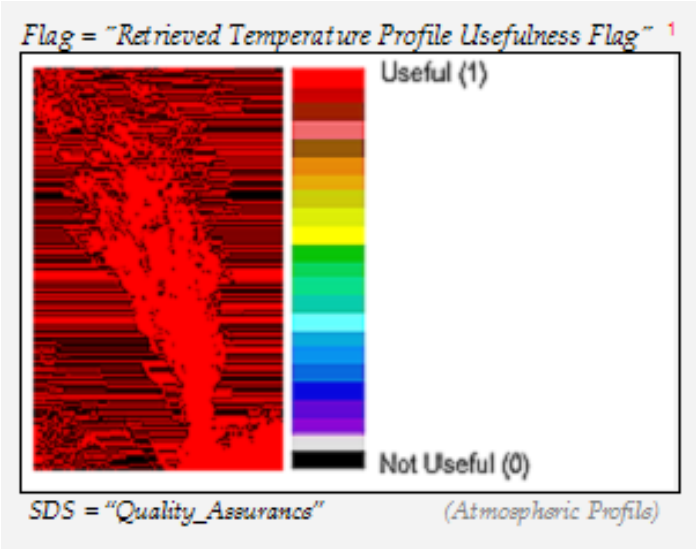
- Improve cirrus reflectance retrievals over dry high elevation areas, such as the Tibetan Plateau, Andes Mountains, Antarctica, and Greenland. The collection 05 cirrus reflectance products over these areas are slightly contaminated by surface reflection effects. Region-specific thin cirrus test techniques will be implemented.

- Refine the "slope" derivation procedure from the scatter plot of 1.38 μm apparent reflectance vs 0.66 μm apparent reflectance.

Atmospheric Profile (07_L2) (Updated 1/26/2010) Eva Borbas

- Update surface emissivity data base to current version. [Implemented]
- Training data improvements regarding skin temperature assignment. [Study completed, no change will be made]
- Update NedT for both Terra and Aqua. [Implemented]

- Investigate the dry bias in Aqua TPW for moist cases and make adjustments to improve. [Implemented by SRF shifts]
- Apply zero bias in the radiative transfer calculation. [Implemented]
- Introduce H2O/CO2 channel spectral shifts for Aqua. [Implemented]
- Update the radiative transfer model from prototypeCRTM to CRTM. [Implemented]
- Perform a more thorough evaluation of the ozone product through intercomparisons with TOMS and AIRS and make adjustments to algorithm. [Implemented]
- Assess the TPW Low and TPW High products and possibly change the levels of integration to make them more useful. [Implemented]
- Improve QA/QC flags and screening for bad input MOD02L1B data. [Working on]
- Examine the MOD07 Level 3 products for consistency with other long term datasets. [Partly done/dropped]
- Making Aqua and Terra DAAC code uniform. [Implemented]
- Look into whether we can include all profiles at 101 levels in direct broadcast or at the DAAC, and adding water vapor mixing ratio profiles. [Done/Implemented]
- Output file label updates: [All Implemented]
    - Change "Surface Temperature" to "Skin Temperature" in the output file
    - Adding pressure levels, offset/scale factor usage to the output file
    - Fix K-index valid range in the output file
- Have the Atmosphere Profile development team fix (remove the noise in fill regions) all 07_L2 Atmosphere Profile Usefulness and Confidence QA Flags. This problem might stem from the QA flags not being initialized as 0's; but this is unclear. [Fixed, Implemented]



<u>Cloud Mask</u> (35_L2) (Updated 1/8/2010) Steven Ackerman, Rick Frey

- Use LEOCAT software (C, C++); replaces current FORTRAN code. [Status: Implemented]
- Implement day/night, land/water dust detection algorithm. [Status: Implemented]
- Implement cloud adjacency flag (Frey, 01/09). [Status: Implemented]
- Implement lower 1.38 μm thresholds to "thin cirrus" values, but keep thin cirrus flag for users (all scene types except snow/ice). [Status: Implemented]
- Investigate cloud test using variability of 0.86 μm reflectances in a 3x3 region for day ocean. [Status: Dropped]
- Implement scattering angle and background NDVI-dependent 0.66 μm thresholds for day land. [Status: Implemented]

- Investigate cloud test using variability of 3.75 μm BTs for night ocean. [Status: Dropped]
- Implement 7.2-11 μm BTDs in polar ice-cap (Greenland, Antarctica) day scenes. [Status: Implemented]
- Investigate use of 11 μm BTs and surface data to help screen out false snow from both maps (night) and NDSI (day). [Status: Dropped]
- Implement Pinty et al. version of GEMI as a cloud test for day land; use on all surface types including desert. [Status: Implemented for arid regions only (NDVI < 0.3)]
- Implement use of background NDVI map to define desert (arid and semi-arid) processing path. [Status: Implemented]
- Eliminate tri-spectral test for oceans; replace with simple 8.6-11 μm BTD threshold test. [Status: Implemented]
- Implement additional 3.9-11 μm BTD test for low clouds over night ocean using TPW-dependent thresholds; keep original 3.9-11 μm BTD test for low-emissivity stratus clouds. [Status: Implemented]
- Change night land 3.9-11 μm BTD test thresholds to be function of TPW. [Status: Implemented]
- Implement new SST test for day and night ocean. [Status: Implemented]
- Use collocated CALIOP/MODIS data to verify or adjust cloud test thresholds. [Status: Implemented]

Joint Atmosphere (ATML2) (Updated 4/22/2010) Steve Platnick, Paul Hubanks, Lorraine Remer, Clare Salustro

- New: Incorporate 5 km L1B samples from MYD02SSH per request from A. Heidinger. Will have to modify MYD02SSH sampling (currently pixel 3, 3) to be consistent with ATML2. [Status: Not Started]
- Add all needed cloud top and cloud optical parameters and QA flags to the ATML2 product so files can be used to create user-tuned L3-like products on the fly (post operational processing). This endeavor was started upon request by UW. [Status: Some investigation and meetings have taken place.]
- Check with all L2 development teams to ensure any C006 changes to L2 HDF files (new parameters, new or changed QA, etc.) are accounted for in the Joint L2. [Status: Not Started]
- Revisit complete Joint Product SDS list with all Atmosphere teams for additions or deletions. [Status: Not Started]
- The Deep Blue Aerosol group has no changes regarding the Deep Blue SDS's for C006. Both Terra and Aqua should contain the same Deep Blue SDSs.
- Regarding Deep Blue Aerosol Quality Assurance, we'd like this to represent only the Deep Blue Confidence Flag from 04_L2 "Quality_Assurance_Land" (Byte #4, bits 1-2). We would like this same integer SDS to be present in the C006 04_L2 files, so this can be a direct copy.
- The dark target Aerosol group required the following change. Change the **source** SDS for the ATML2 SDS Aerosol_Optical_Depth_Ratio_Small from the 04_L2 SDS Optical_Depth_Ratio_Small_Land_And_Ocean to the 04_L2 SDS Optical_Depth_Ratio_Small_ Ocean (the former SDS will be dropped from 04_L2 in C6). Change the description (long name) from "over land and ocean" to "over ocean only".
- Hubanks needs clarification from the Aerosol group if the new QA usefulness and confidence flags for "Aerosol Size" for Ocean Aerosol added by Rob Levy in C6 need

to be copied over to ATML2. These new flags are in Quality_Assurance_Ocean, byte 4, bits 1-4. Hubanks believes it might be better to copy both Aerosol QA arrays Quality_Assurance_Land and Quality_Assurance_Ocean in their entirety into ATML2 for future flexibility.

- Hubanks notes that it's unclear if the "Deep_Blue_Aerosol_Quality_Assurance" SDS in the C51 ATML2 file is being populated or not. I wonder if this might have been a place holder array to be populated for C006. I think Brad Wind worked on this before he left. Note that the file spec doesn't show the dimension of this Deep Blue QA SDS as being defined. It's possible that for the Joint product, the file spec is written after the fact and is not critical (i.e. the guts are in the software not the file spec). At minimum for C006 the following needs to be done: a.) fix the file spec so the dimension variable of the above SDS is defined – and b.) check the ATML2 software to see if the dimension of this SDS is defined and if any bits are being copied to it.

Level-3 Gridded Product (D3, E3, M3) (Updated 1/14/2010) Steve Platnick, Paul Hubanks

- Add joint histogram of cloud optical thickness and cloud top pressure for combined phase to more easily compare with ISCCP joint histogram. [Status: Not Started]
- Check with Aerosol to see if they are interested in smoke only, dust only, and/or sulfate only aggregations of Deep Blue aerosol. Aggregate aerosol single scattering albedo for dust from Deep Blue algorithm. Make sure to sync any L2 Deep Blue Aerosol Type flag change to L3. [Status: Not Started]
- Modify Cloud Effective Radius (r_e) liquid water cloud histograms and joint histograms to start at 4.0. In addition, use the newly defined Research L3 boundaries for Cloud Effective Radius (r_e) joint histograms. [Status: Coding]

  New Bin Bounds for C006 = 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30

  Old Bin Bounds for C005 = 2, 4, 6, 8, 10, 12.5, 15, 17.5, 20, 25, 30
- Increase number of bins in the marginal histograms (especially for ice cloud effective radius). Check all the Research L3 histogram bin bounds against the Operational L3 (change the Operational L3 where appropriate). Increase # of bins and reduce histogram bin sizes for r_e Ice especially in the 20 to 32 μm range but perhaps along entire range. [Status: Investigating. Looking at all histograms and joint histograms in L3 and tuning the bin boundaries to balance bin detail with file size]
- Add Cloud Top Height parameter to L3. Add new marginal histograms for this SDS (develop a most useful definition of histogram bin boundaries). Q: Are new joint histograms based on this parameter envisioned? [Status: Investigating]
- Modify L3 code to compute median. Add median statistics to some parameters of L3. (esp. Cloud Optical Property parameters). [Status: Not Started]
- Fix File Spec "long name" for Cloud Fraction Histogram Counts (delete at 10 intervals). [Status: Implemented]
- Use uncertainty to develop new QA-weighted means of Cloud Optical Property parameters (check with S.Platnick). [Status: Not Started]
- Check with all L2 development teams to ensure any changes to L2 HDF files (new parameters, new or changed QA, etc.) are accounted for in the L3 (sync the L3 to L2). [Status: Collecting Information from L2 Teams]
- Investigate a clean up of the Mean_Reflectance_Land_All parameter (using QA for 47 and QA for 66). [Status: Not Started]
- Investigate if the Standard Deviation of the Daily Means should be weighted in the multiday product (and if so, how should this be done and what does this mean). This statistic is currently weighted by D3 pixel counts. [Status: Closed. The weighting by D3 pixel counts is correct.]

- Determine if the Aerosol group wants to add any of their new SDSs into L3. [Status: Not Started]
- Add numerous SDSs derived from L2 Cloud Top Properties. Add joint histograms to allow determination of mean statistics of several CT parameters for Low, Middle, and High Clouds. Also aggregate some parameters for near-nadir view only. [Status: Investigating]
- Add Cloud_Phase_Infrared_Cloud_Fraction_Liquid, Ice, Mixed, Undetermined and Combined. Previously only Histogram Counts were computed in L3. [Status: Not Started]
- To allay user confusion, rename the L3 SDS "Aerosol_Cloud_Mask_Cloud_Fraction" SDSs. Some suggested names are "Fraction_Unsuitable_For_Aerosol_Retrieval" or "Aerosol_Retrieval_Mask". It should be noted that these SDSs are not a cloud fraction but instead show the fraction of all the pixels that do not make it into the retrieval. These pixels (scenes) where an aerosol retrieval cannot be performed include all clouds, lakes/rivers/oceans with sediments, swamps over land, snow and ice (both over land and ocean), bright surfaces, and ocean sun glint. A final decision on the SDS name is pending. The 04_L2 SDS, which is used to derive the L3 SDS, is called "Cloud_Fraction_Ocean" and "Cloud_Fraction_Land". SDS name changes need to be coordinated between L2 and L3. [Status: Dropped—Aerosol decided to drop these SDSs from L3]
- Revisit the Cloud_Fraction_Combined, _Liquid, _Ice, _Undetermined SDS names. Steve Platnick suggested adding the word Retrieval (Cloud_Retrieval_Fraction_Combined, _Liquid, _Ice, _Undetermined), since this SDS really shows the fraction of successful retrievals in each cloud phase category. An alternative could be to simply modify the "long_name" local attribute making this clearer. [Status: It was decided to add the word "Retrieval" to the SDS name. Change of file spec and HDF structure files not started.]
- Check with Rich Frey if a new flag category should be added to the Cirrus Flag and High Cloud Flag. The category would be 3 = clear sky. This would allow a true fraction to be implemented in L3. This could be approximated with the current structure (format) by putting category (0) = missing in the denominator. It appears this category included both clear sky and missing satellite data. [Status: Investigating. Need to coordinate with Rich Frey.]

Other PGE's (Updated 2/1/2009)

MOD021KM – radiances (Chris Moeller)

For Collect 6, missing data in L1B files will no longer be interpolated. Missing data values will be used instead. This should be transparent to the UW Atmosphere algorithms because the destriping algorithm replaces missing data.

MOD_PRDS – destriping (Liam Gumley)

Replace granule based destriping with global LUT from day 1 of each month (will require code changes).

MODCSRG – clear sky radiances (observed and calculated) (Kathy Strabala)

Will use new forward model if MOD_PR06CT uses a new forward model
Adjust CO_2 amount daily (1.5 ppm per year using 367 for Jan 2000)