Terra SYN/AVG Products

Combined effort of TISA & SARB

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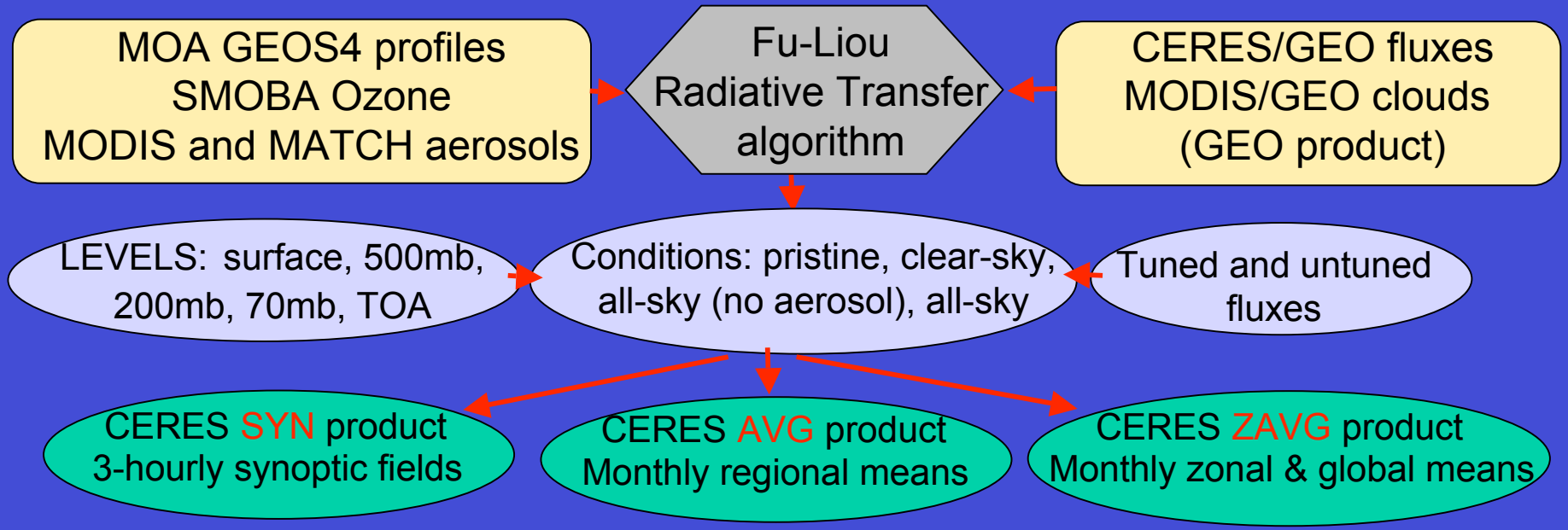
SYN/AVG/ZAVG Product

- Product Features:
  - –Surface, TOA, and atmosphere Fu-Liou radiative transfer modeled fluxes consistent with CERES observed TOA fluxes and cloud properties
  - – Computed hourly, all inputs must be temporally interpolated
  - – Computed at the CERES 1° grid resolution



Product Sequence

- **SSF**
  - CERES footprint flux and clouds
- **CRS**
  - SARB (Fu-Liou radiative transfer) footprint profile fluxes
- SSF + CRS -> **FSW**
  - 1° gridded flux, clouds and SARB profile fluxes at instantaneous Terra overpass times
- FSW + GGEO -> **TSI**
  - Add GEO clouds and fluxes and temporally interpolate all parameters at hourly GMT increments completely
- TSI->**SYNI**
  - Compute SARB fluxes hourly

* Not publicly released

Product Sequence

- SYNI->**SYN** (9 GB/month)
  - create 3-hourly synoptic SARB product
- SYN->**AVG** (0.6 GB/month)
  - Sum all 3-hourly fluxes to compute monthly mean and monthly hourly GMT based product
- AVG->**ZAVG** (4 MB/month)
  - Compute zonal and global monthly means

- This sequence is only processed for the instrument in cross-track

* Not publicly released

MODIS and GEO cloud properties

Cloud Parameter	MODIS retrieval (5 channel)	GEO-daytime* (VIS & IR retrieval)	GEO-night time† (IR-only retrieval)
Cloud Fraction	X	X	X
Cloud Effective Pressure	X	X	X
Cloud Effective Temperature	X	X	X
Cloud Effective Height	X		
Cloud Top Pressure	X	X	
Cloud Base Pressure	X	X	
Cloud Phase	X	X	X
Liquid Water Path	X		
Ice Water Path	X		
Liquid Particle Radius	X		
Ice Particle Diameter	X		
Infrared Emissivity	X	X	
Cloud Optical Depth – Linear	X	X	
Cloud Optical Depth – Log	X	X	

* The GEO 2-channel routine assumes a 10μm particle radii and 60μm particle diameter.

† The GEO 1-channel routine assumes a emissivity of unity.

Interpolation of Cloud Properties

- Cloud properties are interpolated separately for 4 layers
  - 4) surface-700, 3) 700-500, 2) 500-300, and 1) 300-50mb
- Fill hourboxes with GEO then with MODIS measurements
  - MODIS overwrites GEO
- Interpolate cloud amount
- Interpolate all other cloud properties between cloudy measurements and extrapolate to clear-sky
  - Interpolate MODIS-only properties across GEO observations
  - Interpolate MODIS and GEO daytime properties across GEO night observations
  - P_{eff} is first interpolated, then P_{top}-P_{eff} and P_{bot}-P_{eff}
  - Assume particle size to be 10μm radii and 60μm diameter for liquid and ice, if GEO observation is surrounded bv clear-sky
  - LWP/IWP computed from optical depth, phase and particle size for consistency

Interpolation of Fluxes

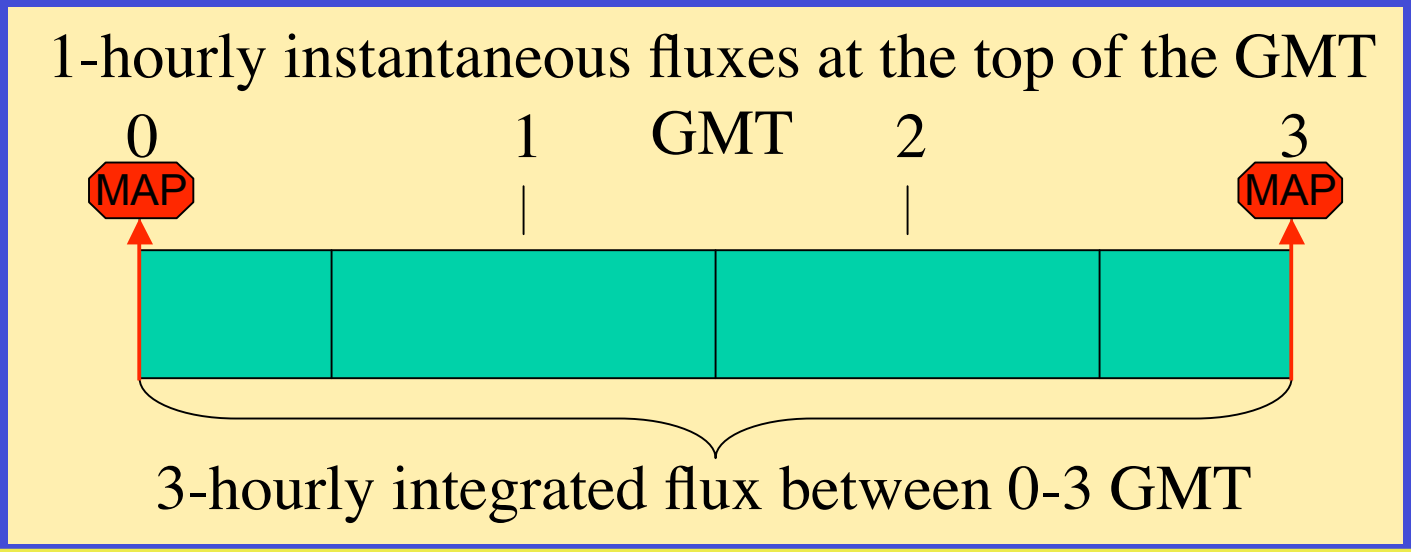
- Fill hourboxes with GEO then with CERES measurements
  - CERES overwrites GEO
- Temporally interpolate SW and LW for both clear-sky and all-sky conditions
- Linearly interpolate all-sky and clear-sky LW fluxes
- Clear-sky GEO SW flux is from monthly hourly nonGEO
  - GEO clear-sky SW fluxes are unable to resolve land spectral differences
  - GEO fluxes designed to take into account diurnal variation
- Apply CERES directional models between SW fluxes
  - GEO SW fluxes are normalized on a monthly basis and are not limited to days with CERES measurements
  - Fill in missing day using previous and following day (rare)

The Goal of SARB products

- Two competing goals, which is more important?
- Derive synoptic maps at specific GMT times
  - Compare to instantaneous model results
- Maintain accurate 3-hourly and monthly flux products
  - Climate quality product of consistent flux, clouds and atmosphere

Syntopic Maps

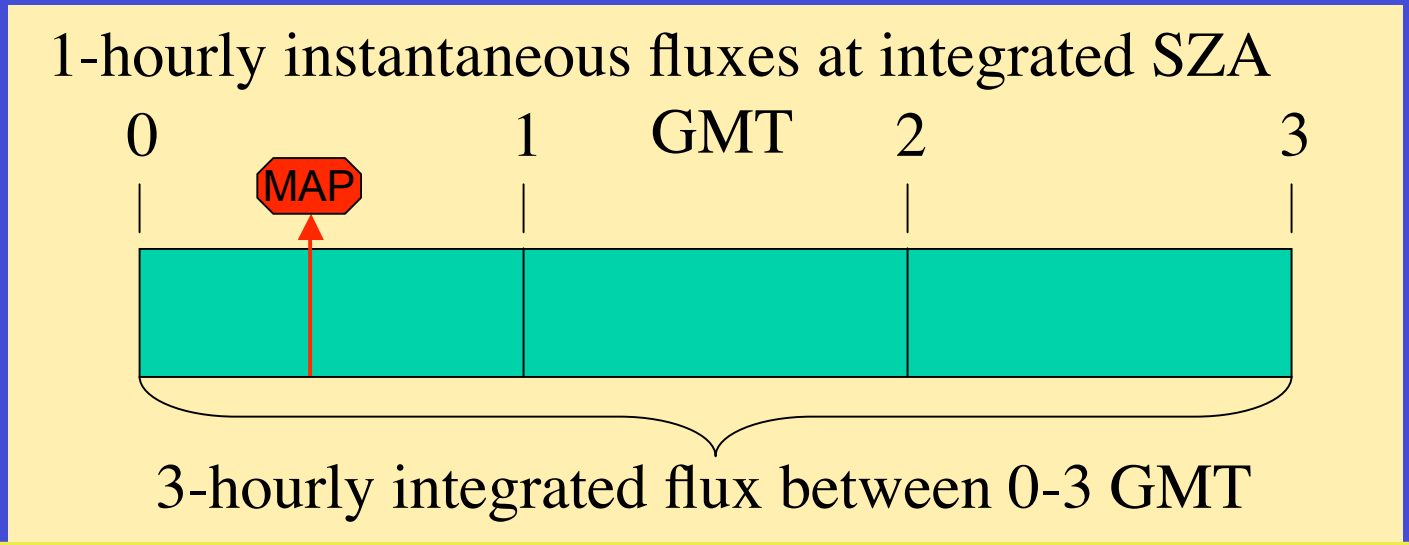
- SARB products computed at a specific GMT time
  - Can easily be compared with other datasets
- SW fluxes need to be properly weighted to derive 3-hourly, daily and monthly accurately fluxes
  - Uncertain how to do that for atmospheric and surface fluxes



$$F^{mean}_{3-hour} = \frac{0.5F_0 + 1.0F_1 + 1.0F_2 + 0.5F_3}{3.0}$$

Accurate 3-hourly and monthly flux products

- SARB products computed with hourly integrated solar zenith angles to allow for easy summation of monthly flux
  - Adjustments needed to compare with other synoptic datasets
  - Twilight corrections, insolation improvements can easily be implemented in the integrated solar zenith angle
  - No further weighting needed for surface and atmospheric SW fluxes



$$F^{mean}_{3-hour} = \frac{1.0F_1 + 1.0F_2 + 1.0F_3}{3.0}$$

FSW/TSI/SYN/AVG/ZAVG Status

- SYN/AVG/ZAVG Beta1 (Jan02-Dec02 by Jan07)
  - >99.5% successful SARB computations - consistent input
  - SZAs computed at top of GMT hour
    - Might not match exactly with SRBAVG products, no SW integration
  - SARB variables were reordered and renamed in HDF structure to avoid ambiguity
    - No more difference fluxes or adjusted input parameters
    - Tuned, Untuned, pristine, clear-sky, … fluxes consistently labeled
  - # of measurements parameter added
    - (Tuned,Untuned,Observed)x(SW,LW)
    - # parameter removed from all variables to conserve file size
- SYN/AVG/ZAVG Beta2 (3-years by Oct07)
  - Compute proper integrated SZA for accurate monthly fluxes
  - Improve input SARB cloud and flux temporal interpolation