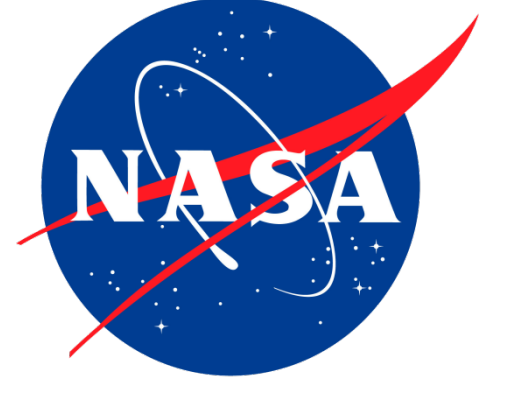# The Global Impact of 10+ Years of IMAPP Software in Support of Aqua and Terra

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International MODIS/AIRS Processing Package (IMAPP)

MODIS products (Terra and Aqua)

Atmosphere and Polar Products
- Cloud mask
- Cloud top pressure and temperature
- Cloud optical depth and effective radius
- Temperature and moisture profiles
- Total precipitable water
- Stability indices
- Aerosol optical depth
- Ice Surface Temperature
- Snow Mask
- Ice Cover and Ice Concentration
- Inversion Strength and Inversion Depth

Land Products
- Land surface reflectance
- Nadir BRDF-adjusted reflectance Image Products
- True color GeoTIFF and KML

AIRS and AMSU Products (Aqua)

Sensor Products
- Calibrated and geolocated radiances and reflectances (AIRS)
- Calibrated and geolocated antenna temperatures (AMSU)

Atmosphere Products
- Temperature, moisture profiles (JPL 3x3 AIRS FOV)
- Temperature, moisture profiles, clouds (single AIRS FOV)
- Collocated AIRS/MODIS temperature and moisture profiles (single AIRS FOV; clear and cloudy sky)

Utilities
- AIRS HDF to BUFR converter

AMSR-E Products (Aqua)

Sensor Products
- Calibrated and geolocated antenna temperatures

Atmosphere Products
- Rain rate

Surface Products
- Soil moisture and snow water equivalent

Aviation Products
- Software that identifies convective thunderstorm overshooting tops using MODIS Infrared Band 31 brightness temperatures

NWP Products
- The Direct Broadcast CIMSS Regional Assimilation System (DBCRAS) is a regional numerical weather prediction model that assimilates MODIS products in real time and creates forecasts up to 72 hours at 48 km and 16 km resolution.

Virtual Appliance
- The IMAPP Virtual Appliance is an automated processing system for MODIS, AIRS, and AMSR-E data acquired by direct broadcast. It is easy to install and run on platforms including:
  - Microsoft Windows (7, Vista, XP), Apple OS X and Intel Linux

Air Quality Forecasting Products
- Infusing Satellite Data into Environmental Applications – International (IDEA-I) is a globally configurable tool that uses IMAPP MODIS Aerosol Optical Depth (MOD04) retrievals to initiate trajectories that show the vertical and horizontal movement of the pollutants over the next 48 hours.

List of Countries With at Least 1 IMAPP Registered User

Italy	Pakistan	United Arab Emirates
Argentina	Nepal	Lithuania
Brazil	Portugal	United States
Kazakhstan	Poland	Thailand
Ukraine	Saudi Arabia	Romania
Indonesia	El Salvador	Malaysia
China	Colômbia	Algeria
Denmark	Serbia	Reunion
South Africa	Kenya	Austria
Taiwan	Oman	Finland
Japan	Sweden	Nigeria
Morocco	Uzbekistan	New Zealand
Iran	Mexico	Guatemala
Singapore	Hungary	Uruguay
India	Belgium	Israel
Germany	Norway	Azerbaijan
United Kingdom	Venezuela	Cuba
Australia	Sri Lanka	Kuwait
Czech Republic	France	Syria
Canada	Russia	Dominican Republic
Spain	Vietnam	Belarus
Chile	Mongolia	
Philippines	Switzerland	
	Iceland	

http://cimss.ssec.wisc.edu/imapp/

Keys to Success – Lessons Learned

Build Upon Experience

More than 25 years of Support for Direct Broadcast Users
- IAPP (International TOVS Processing Package) since 1985
- ITPP (International ATOVS Processing Package) since 1998
- IMAPP (International MODIS/AIRS Processing Package) since 2000
- CSPP (Community Satellite Processing Package) since 2011

The goal is to allow DB users the capability to create their own local products for local applications.

Needs of Users are *THE* Priority

Reach out to Find the Needs of the Community
- Meetings (like this one)
- IMAPP Forum:
  https://forums.ssec.wisc.edu/viewforum.php?f=3
- Workshops:
  http://cimss.ssec.wisc.edu/dbs/
  10 workshops taught on 5 continents
- Site Visits Including:
  US Weather Service Forecast Offices and Regional Headquarters
  US Forest Service
  Taiwan Central Weather Bureau

Software Standards
- Software must be robust, portable, efficient and reliable
- Software must have high scientific integrity – include peer reviewed references
- Software must be thoroughly tested prior to release
  IMAPP has Beta testers on 6 continents
- All Packages must be well documented

Collaborations

Work with Other Groups In their Areas of Expertise
- NASA Jet Propulsion Laboratory
- NASA Ocean Biology Group
- Boston University BRDF Group
- UK Met Office
- Australia Bureau of Meteorology
- Taiwan Central Weather Bureau
- South Africa CSIR
- NOAA Cryosphere Scientist Jeff Key

Cost and Good Quality of the Aqua and Terra Data

Free Distribution of Data, Software and Visualization Tools
- Result is explosion in the use of the data!

Future Enhancements

Current Funding Through 2013
- **Updated MODIS Level 2 Atmosphere Software**
  - Collection 6 Algorithms
- **AIR Quality Forecasting using AIRS retrievals**
  - Ozone location and 48 hour trajectory forecast
- **DBCRAS NWP Model Updates**
  - Improved Cloud and Precipitation Physics
  - Additional Projections Available
  - Additional Output Parameters **Update to IMAPP Virtual Appliance**
  - Add Multi-node processing capability
- **MODIS Physical Retrieval**
  - Supplementing the MOD07 statistical retrieval of vertical profiles of temperature and moisture with a product created using a physical retrieval technique

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- **IMAPP Applications Workshops**
  Hawaii, 2013
  Oman, 2013?