Transitioning the NASA GPM Precipitation Processing System to NOAA Operations

Chandra Kondragunta¹, Ralph Ferraro², Yu Zhang³, and Robert Cefelli⁴

¹NOAA/NESDIS/OSD, Silver Spring, MD
²NOAA/NESDIS/STAR, College Park, MD
³NOAA/NWS/OHD, Silver Spring, MD
⁴NOAA/OAR/ESRL, Boulder, CO

Third Conference on Transition of Research to Operations
January 7, 2013, Austin, TX
Outline

- Background
- NOAA GPM-Related Requirements
- Current Activities
  - NOAA Steering Group
  - Precipitation Measurement Mission (PMM) Science Team
  - NOAA User Workshops, Recommendations, and Follow-up activities
  - Migration to Enterprise Processing System
- Summary and Future Plans
Background

National Research Council identified lessons learned from TRMM to enhance the use of GPM data in NOAA operations

NRC Report (2007)
NOAA’s Role in Space-Based Global Precipitation Estimation and Application

Committee on the Future of Rainfall Measuring Missions
Board on Atmospheric Sciences and Climate
Division on Earth and Life Studies

Eugene M. Rasmusson
University of Maryland (retired)

Nancy L. Baker
Naval Research Laboratory

V. Chandrasekar
Colorado State University

Carol Anne Clayson
Florida State University

Jeffrey D. Hawkins
Naval Research Laboratory

Kristina B. Katsaros
National Oceanic and Atmospheric Administration (retired)

M. Patrick McCormick
Hampton University

Matthias Steiner
Princeton University

Graeme L. Stephens
Colorado State University

Christopher S. Velden
University of Wisconsin

Ray A. Williamson
George Washington University

Staff
Paul Cutler
Program Officer
pcutler@nas.edu

Leah Probst
Research Associate
lprobst@nas.edu

Rob Greenway
Project Assistant
rgreenwa@nas.edu

Mailing Address
Board on Atmospheric Sciences and Climate
The National Academies
500 Fifth Street, NW
Washington, DC 20001

Phone: 202-334-3512
Fax: 202-334-3825

A Road Map
NOAA GPM Related Requirements
### NOAA GPM Related Requirements (1/2)

**Priority-1: Mission Critical – Observation is needed to meet operational mission objectives**

<table>
<thead>
<tr>
<th>Requirement Title</th>
<th>NOAA Program</th>
<th>Validation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imagery: Microwave</td>
<td>WW-Local Forecasts and Warning _NHC</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning _NHC_Storm Area</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning _WFO/SPC</td>
<td>Yes</td>
</tr>
<tr>
<td>Precipitable Water: Total</td>
<td>CT-Surface Weather</td>
<td>Yes</td>
</tr>
<tr>
<td>Precipitation Amount: Snow Water Equivalent</td>
<td>EM-Environmental Modeling Center_Global</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>EM-Environmental Modeling Center_Hemi US</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Integrated Water Forecasting (Hydrology)_Deep</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Integrated Water Forecasting (Hydrology)_Shallow</td>
<td>Yes</td>
</tr>
<tr>
<td>Precipitation Amount</td>
<td>CL-Climate Observations and Monitoring_Atlas</td>
<td>Not yet</td>
</tr>
<tr>
<td></td>
<td>CT-Surface Weather</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>EC-Environmental Modeling Center_Global</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>EC -Environmental Modeling Center_Hemi US</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Integrated Water Forecasting (Hydrology)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning _NHC</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning _WFO/SPC</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Source:** NOAA Consolidated Observation Requirements List (CORL)
# NOAA GPM Related Requirements (2/2)

Priority-1: Mission Critical – Observation is needed to meet operational mission objectives

<table>
<thead>
<tr>
<th>Requirement Title</th>
<th>NOAA Program</th>
<th>Validation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation Rate</td>
<td>CL-Climate Observations and Monitoring_Atmos</td>
<td>Not yet</td>
</tr>
<tr>
<td></td>
<td>CT-Aviation Weather_CONUS</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>CT-Aviation Weather_Global</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>CT-Surface Weather</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>EC-Environmental Modeling Center_Global</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>EC -Environmental Modeling Center_Hemi US</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Integrated Water Forecasting (Hydrology)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning_NHC</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning_WFO/SPC</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning_NHC_Storm Area</td>
<td>Yes</td>
</tr>
<tr>
<td>Precipitation Type</td>
<td>CT-Aviation Weather</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>CT-Surface Weather</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Integrated Water Forecasting (Hydrology)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning_WFO/SPC</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>WW-Local Forecasts and Warning_NHC_Storm Area</td>
<td>Yes</td>
</tr>
<tr>
<td>Radiance: Microwave</td>
<td>EC -Environmental Modeling Center</td>
<td>Yes</td>
</tr>
</tbody>
</table>

7 Requirements from 6 Programs
Current Activities
NOAA’s Steering Group on Precipitation Measurement from Space

- Interacts with NASA
- Engages in budgeting and planning activities
- Educates users and gains stakeholder support
- Provides oversight within NOAA on GPM related activities and prepares required documentation
  - Transition Plan, L1RD, NASA/NOAA MOU, User Workshops, NOAA Science Team project reviews etc.
NOAA’s Contributions to NASA’s PMM Science Team and GPM Program

- Six NOAA PIs on NASA’s PMM science team, jointly funded by NASA and NOAA (FY 2010-12)
  - Shows expansion of interest in GPM at NOAA (Four PIs in FY 2007-09)
  - Funds provided by NESDIS and OAR

- Continued coordination on Ground Validation (GV) Programs
  - Hydrometeorology Testbed (HMT-SE)
  - MRMS
2nd NOAA User Workshop on the GPM
(November 29 - December 1, 2011)

- Over 60 participants from NOAA, NASA, DoD, Academia and Private Sector
- Meeting format - Plenary sessions, Panelists /Working Groups focused on four main themes
  
  **WG1 : Enhancing R&D and Innovation of GPM-era data at NOAA**
  - NOAA Unique Products
  
  **WG2 : Accelerating GPM Data use at NOAA**
  - Existing testbeds? Or new infrastructure (e.g. proving ground)
  
  **WG3 : Data Fusion**
  - How to integrate GPM data into merged products (e.g Q2, MPE, CMORPH etc.)
  
  **WG4 : Data Delivery and Formats**
  - How to improve product processing and delivery to users at minimal data latency
Recommendations from 2nd Workshop (1/2)

- NOAA needs to prepare immediately to exploit GPM-era data and products:
  - Data delivery and distribution
  - Research and Development
    - Continuity of operations from current sensors into GPM-era sensors
    - Climate applications and model verification
    - NWP assimilation and model verification
    - Data fusion and uncertainty estimation
    - NOAA unique products from GPM sensors
  - Accelerating the use of GPM data at NOAA through emerging Proving grounds and existing test-beds
    - Look to exploit activities under both GOES-R and JPSS Programs
    - Climate, Hydrometeorology, Hurricane, etc. test-beds
Obtain specific NOAA requirements for GPM-era data:
- Level 1 Requirements Document
- Transition Plan for a NOAA-specific, operational version of NASA’s GPM Precipitation Processing System (PPS)
Follow-up to 2nd Workshop

• A tiger team was formed to develop a GPM Level-1 Requirements Document (L1RD) and a Concept of Operations
  - Captures specific NOAA needs for GPM-era data
  - Supports advanced planning and budgeting activities

• **Tiger Team Members:**
  - Bob Kuligowski
  - Brian Nelson
  - Chandra Kondragunta
  - Dan Mundell
  - David Hermreck
  - David Kitzmiller
  - James Yoe
  - James Heil
  - John Beven
  - Kevin Schrab
  - Limin Zhao
  - Michael Brennan
  - Miek Bodner
  - Mike Johnson
  - Pingping Xie
  - Ralph Ferraro
  - Richard Fulton
  - Rob Cefelli
  - Sheldon Kusselson
  - Sid Boukabara
  - Tom Schott
  - Yu Zhang
Current Precipitation Processing in NOAA

NOAA POES (AMSU & MHS)
EUMETSAT Metop-A (AMSU & MHS)
DMSP (SSMIS)
NPP (ATMS)
DMSP (SSMIS)
GOES
GPS
TMI (TRMM) & SSMIS
GEO (GOES, MTSAT, METEOSAT, etc) (IR)
RAIN GAUGE
WSR-88D

MSPPS
MIRS
bTPW/RR
HydroEstimator
MPE/Q2 (GAUGE+WSR-88D + GOES)

TPW, CLW, snow cover, RR, SFR & IWP
T & q Prof, TPW, CLW, Snow cover, RR, IWP & RWP
TPW & RR from MSPPS and MIRS
Blended TPW % of TPW Normal
RR -> Blended RR
Inst, 1hr, 3hr & 6hr RR

NWS/WFO/RFC
NWS/Centers
FNMOC
NESDIS
NASA
JCSDA
CLASS

CLASS Researchers

Legend
Sensor or satellite
Processor
End User
Proposed Enterprise Precipitation Processing in NOAA

Legend
- Sensor or satellite
- Processor
- End User
Summary and Future Plans

• GPM data address NOAA observation requirements
  - Provide data continuity beyond current passive microwave sensors (AMSU, SSMIS, etc.)
  - Will help improve and build the foundation for merged precipitation products for weather, climate and aviation

• Goals for upcoming year:
  - Continue working with NASA on PMM Science Team and GPM Ground Validation programs
  - Organize 3rd NOAA User Workshop on the Global Precipitation Measurement (GPM) Mission: Focus on Proving Ground
  - Complete L1RD and Transition Plan for PPS