GPM in the NOAA Integrated Water Forecasting Program

CAPT Barry Choy
Acting Director
NWS Office of Hydrologic Development
Overview

- NOAA Integrated Water Forecasting Program
- Precipitation needs for operational water predictions
- Needs and opportunities for use of GPM-era satellite precipitation estimates
- Recommendations and challenges
NOAA Integrated Water Forecasting Program

• Providing critical water-related forecasts and decision support services for the nation:
  o River stages
  o River and flash flooding
  o Water resources outlooks
  o Climatic extreme precipitation frequencies

• Evolving capabilities (summit to the sea):
  o Probabilistic streamflow prediction (longer range)
  o Soil moisture prediction
Service Delivery Programs

Advanced Hydrologic Prediction Service (AHPS)
Expanded forecast and water resources services

Integrated Water Resources Science and Services (IWRSS)
A framework to align multiple agencies with complementary water-related missions to accomplish operational goals; NOAA, USACE, USGS
Share technology, information, models, best practices
Precipitation Needs for Water Forecast Program

- Precipitation info (estimates and forecasts) is one of the most critical input forcings for a variety of water prediction needs.

- Requirements for precipitation estimates:
  - Real-time: Accurate, high-resolution, low latency and seamless
  - Calibration: similar to real-time but without latency requirement and needs to be climatologically-consistent
Current State of Operations

Field offices create multisensor precipitation estimates from:
- Rain gauges
- Ground radars (WSR-88Ds)
- Airborne
- GOES Infrared-based estimates (Hydro-estimator)

Precipitation is input to:
- Prediction models (Rainfall-runoff, Snowpack, ...)

Weather Forecast Offices:
- Flash flood monitoring by radar and rain gauges
- Issue watches and warnings to the public
Limitations of Existing Precipitation Products

• Radar:
  o Beam blockage/overshooting
  o Radar-to-radar calibration differences
  o Dual-pol algorithms are evolving

• Gauges
  o Spatial coverage and
  o Quality control and maintenance issues

• GOES IR-based estimates
  o Low latency but often inaccurate
  o Parallax location errors at higher latitudes

• NWP models
  o Poor absolute accuracy
Radar Coverage Gaps:

RADAR
Total rainfall 27-31 Aug 2008
Southwestern US
No coverage (white) or compromised coverage over many areas.
Oval shows area contributing to the Rio Grande.
Precipitation values from WSR-88D network

SATELLITE
Total rainfall 27-31 Aug 2008
Southwestern US and Mexico
Spatially complete coverage over all areas contributing runoff to United States rivers.
Precipitation values from NWS CMORPH products
What does GPM offer?

• Direct
  o Fills in the gaps in radar/gauge coverage
  o Identify/mitigate conspicuous radar/gauge/IR quality issues
  o Snow detection in cold regions

• Indirect
  o Better forecasts from numeric weather/climate prediction models
Status of Current Work

• OHD and NESDIS have conducted studies to identify the effects of TRMM (proxy of GPM) on:
  o Hydrologic forecast accuracy

• OHD has worked with RFCs to come up with algorithm enhancements to better meet their requirements for satellite precipitation

• OHD has participated in developing the Level 1 Requirements Document and CONOPS document for NOAA Enterprise Precipitation System
The impacts of TRMM Ingest

Control experiments using Self-calibrating multivariate precipitation retrieval (SCaMPR) products w/ and w/o TRMM

TRMM ingest yields broadly lowered errors in streamflow simulation
Challenges and Next Steps

• Better O2R paradigm
  o Does GPM algorithm development address forecast needs?
  o How does GPM complement the strength of our existing sensor platforms?

• Recommendations
  o Use a test bed environment
    ▪ Demonstrate/identify the utility of GPM-era QPE for a variety of water resources prediction needs
    ▪ Increased synergy between NOAA and NASA in developing fusion products that meet the operational requirements
Opportunities

- Development of NOAA Enterprise Precipitation Processing System for multi-sensor data integration
- Development of NCEP Rapid Updating Analysis system
- Operations at River Forecast Centers and National Water Center to add value to precipitation products