Breakout Group 1
In-Situ and Remotely Sensed Data

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State of Observations

• State of practice:
  • Observations
    • Currently OWP/NWC uses USGS level and Streamflow observations (operational flows) – operational defined as stable with Service Level Agreements (SLAs) – use for Operations (O) and Validation (V)
    • Aerially sensed snow pack and soil moisture (human in loop process to correct snow states, tbd on soil moisture flights) delivered on a spot and irregular basis – primarily snow season – not used in NWM (O)
  • Assimilation:
    • Based off nudging – not state of science
    • Only assimilate USGS streamflow observations (O)
Gaps in Observations, Potential to address gaps (1 of 3)

- **In Situ**
  - 20% of discharge stations covered - gap in coverage, 8100 USGS gauges / 120,000 miles gaged out of 5M total miles, addresses stream and level, moderately biased to populated areas
  - Potential Operationally available and suitable existing in-situ data sources (O), (V).
    - Hydropower and energy companies (snow data, temperature, flow, discharge, precipitation)
    - Water systems (levels, real time water quality)
    - River authorities, flood management districts (level, precip)
    - Engineered systems and diversions (level, flow, quality – some cases)
    - Irrigation districts (soil moisture and precip, evapotranspiration)
    - State and local networks (ground water, water level, precip)
    - CoCoRHaS
  - Gaps in particular in rural areas. Most instrumentation focused on where people live.
Gaps in Observations, Potential to address gaps (2 of 3)

- Remote Sensed – available now (O), (V)
  - Moderate resolution (350M – 2KM) imagery (blended polar / Geo)
  - High resolution imagery
  - Radar Altimetry, gravimetric
  - Wide swath SAR
  - Microwave, hyperspectral
  - Quantitative Precipitation, Vegetation, Soil moisture, evapotranspiration, snow cover, ice monitoring,

- Remote Sensed – advances
  - New sensors and missions planned out for next 7-8 years, many having applicability
  - New science – limited investments focused on water needs, but include cryosphere, altimetry (fully focused SAR), water quality,
Gaps in Observations, Potential to address gaps (2 of 3)

• Airborne and Episodic (O) / Campaign based (V) in-situ and remote sensing used today
  • FEMA mission assignments
    • Temporary gauges
    • High water mark diagnostics
  • NOAA airborne snow and moisture measurements for snow water equivalent
  • Airborne incident and post incident vis, IR and Radar observations for floods and inundation, damage assessment

• Episodic / Campaign based in-situ and remote sensed available with potential for use primarily in model validation (V)
  • Satellite field validation campaigns (NOAA and NASA), example Snow X
  • Private versions of field campaigns
Methods to acquire data and make useable

• In-Situ observation owners / data suppliers
  • General needs
    • Published criteria / processes to become a data source (quality, service level) and an ambassador program to communicate the value proposition and onboard the contributions
    • Data ingest infrastructure (NOAA secure ingest)
    • Intellectual Property (IP) policies
    • Data Management Policy / mechanism (archive, curation, stewardship)
  • Specific categories which may need some unique approaches
    • Private Entities
      • Purchase of aggregated / Quality Controlled data
      • Cooperative agreements for data sharing
    • Public authorities, States and Local Governments
      • Partnerships under MOAs / IAAs
      • Cooperatives to aggregate
    • Other Federal Agencies beyond NOAA and USGS
      • MOAs, Joint Centers

• Remote Sensed
  • Identify types and forms of data required for assimilation, and co-develop assimilation capabilities in a priority order, and set up operational delivery agreements according to R2O schedules
  • Identify types and forms of data required for validation, jointly specify required products and service level agreements
Gaps in Science to use observations

• Model Operations
  • NWM needs an assimilation system

• Validation
  • Diagnostic infrastructure and evaluation system