Real-Time Operational Rain Gauge Quality Controlling

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Outline

1. Conceptual rain gauge QC model
2. Operational hydrologic data flow
3. QC model and operational data flow
4. Current field capabilities
5. Current status of QC in Hydromet Group
6. Implementation plan
7. Benefits
8. Customers
9. Future plans

Rain Gauge QC Model

Four level QC model:

1. Level I QC

   Checks performed on a single observation for a single location for a single observation time

   e.g. Transmission errors, format errors, gross errors etc.

QC Model (cntd.)

2. Level II QC

   Checks performed on a single observation for a single location for a single time

   Two types of checks

   1. Gross range checks

      e.g. Hourly rainfall of 10 inches

   2. Climatological range checks

      e.g. Hourly rainfall of 4 inches may be acceptable in Florida, but not in Idaho

QC Model (cntd.)

3. Level III QC

   Checks performed are based on multiple sensors, multiple locations and multiple observation times

   e.g. Spatial consistency check

   Multi sensor check

   Temporal consistency check

   Model consistency check

   Resolution check

QC Model (cntd.)

4. Level IV QC

All manual QC techniques

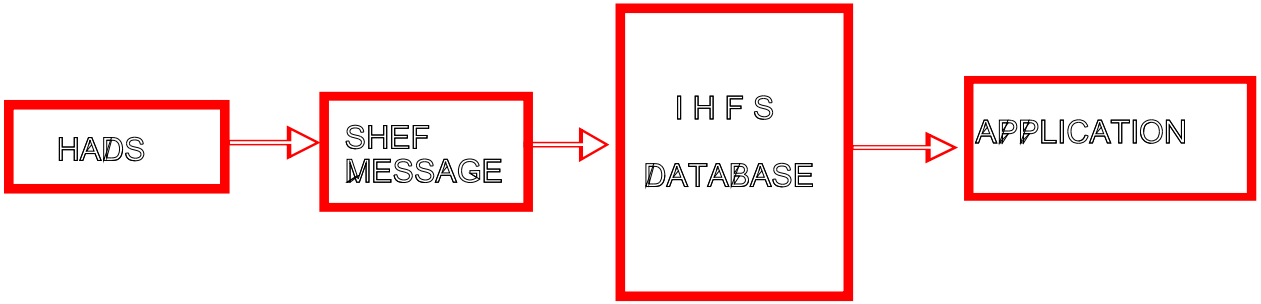
e.g. . Looking at time series' of data

. Looking at a table of various data

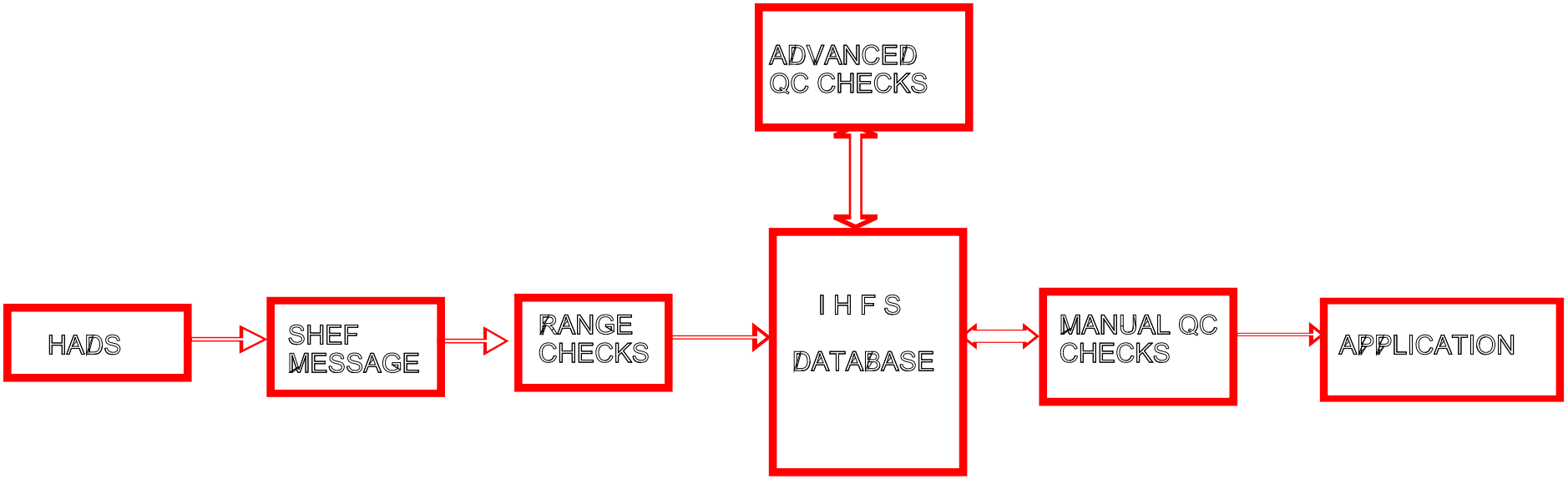
. Overlaying radar and satellite images on top of gauge data

. Making phone calls

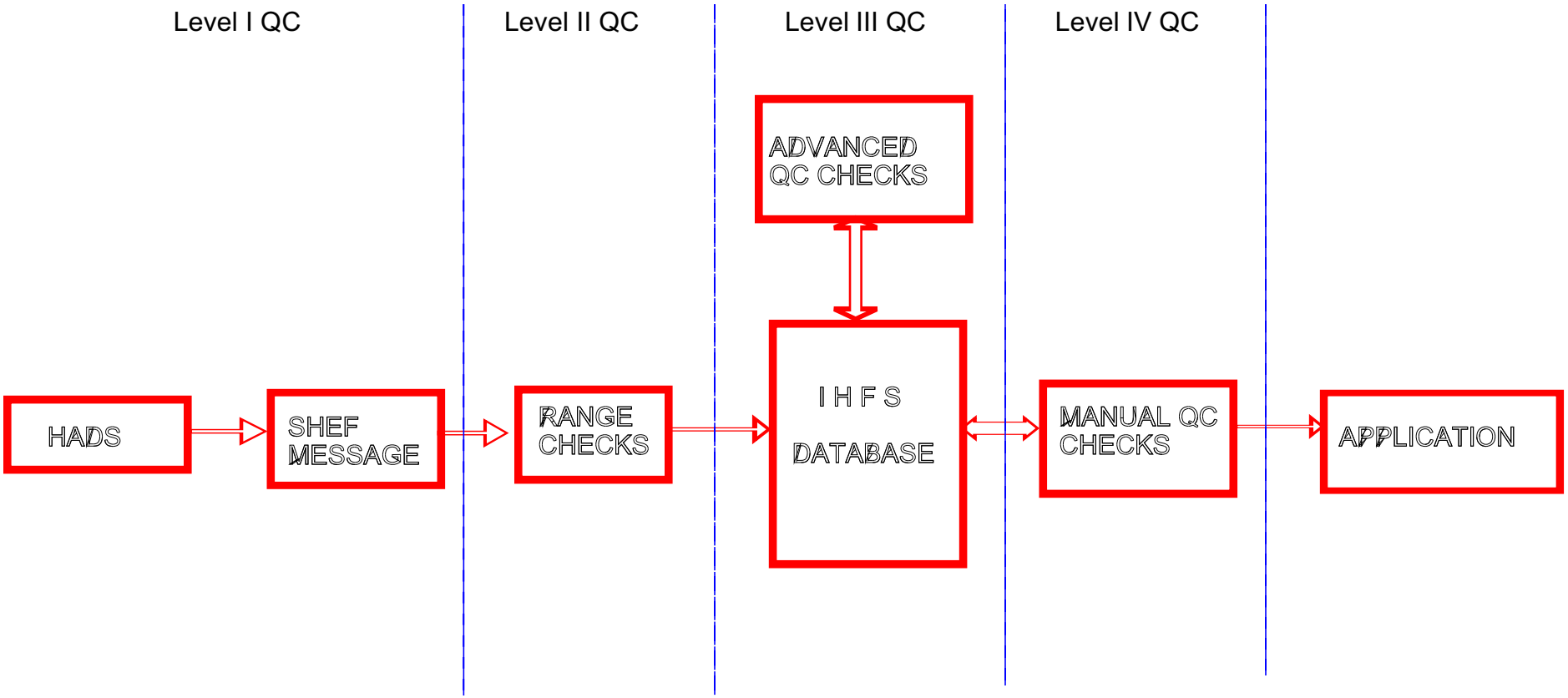
Operational Hydrologic Data Flow



Rain Gauge QC Operations in Hydrologic Data Flow



Rain Gauge QC Operations in Hydrologic Data Flow



Current Field Capabilities

Current QC tools that are in use at field:

1. ABRFC - XNAV
2. CBRFC - Mountain Mapper
3. MBRFC - Shef_check
4. LMRFC - Precip_QC
5. HSEB - Hydroview

Current status of QC in Hydromet

. Hydromet Group focuses on level III QC

. Three types of quality problems identified

1. Outliers

   Spatial consistency checking

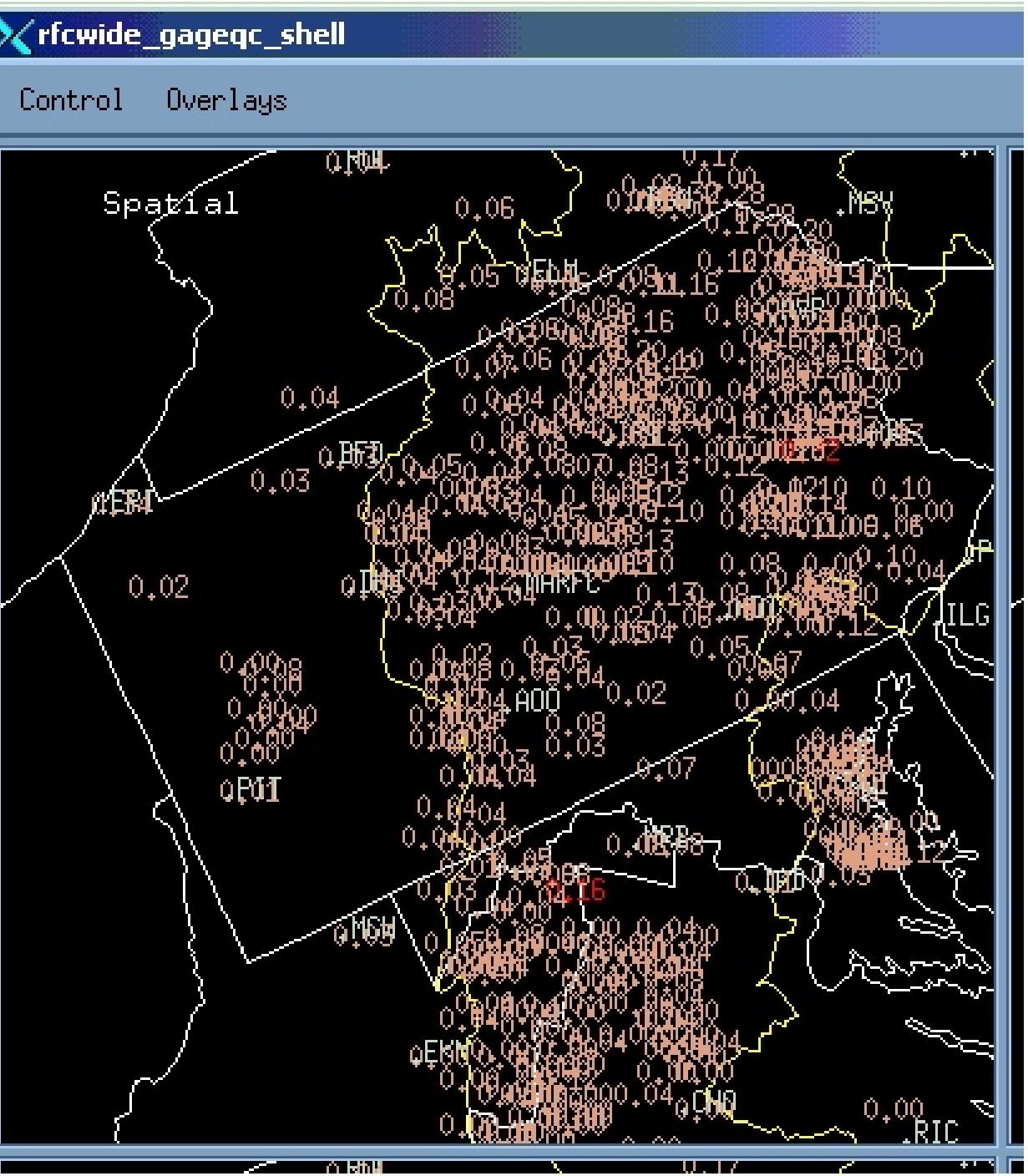
2. Stuck gauges (Zero values)

   Temporal consistency checking

   Multi sensor checking

3. Middle values

   Model consistency checking



Spatial Consistency Check

Purpose:

To identify outliers

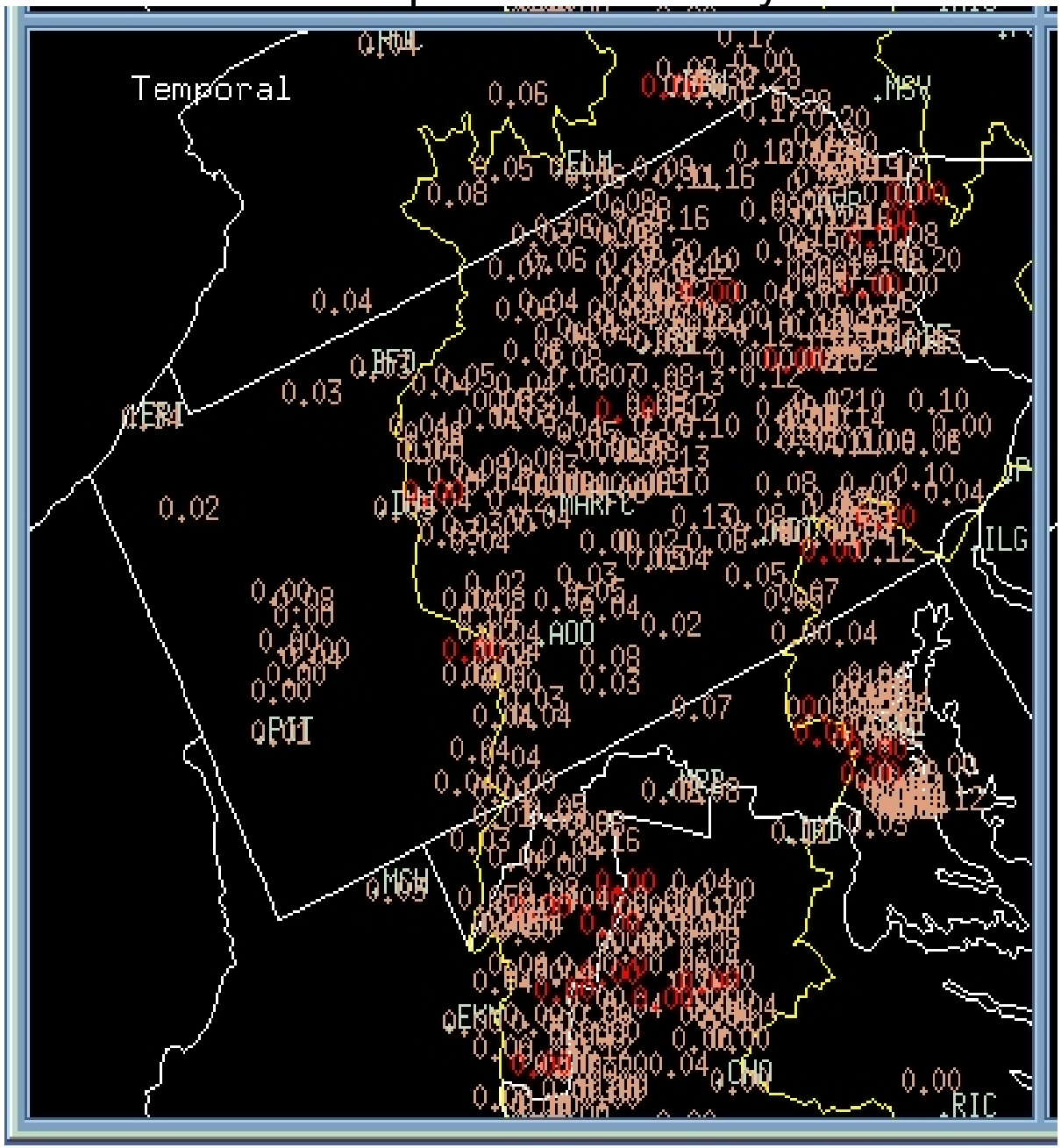
Test:

Looks for consistency of a gauge with neighboring gauges

Result:

Gauges highlighted in red are suspect gauges as pointed out by Spatial Consistent Check

Temporal Consistency Check



Purpose:

To point out stuck rain gauges

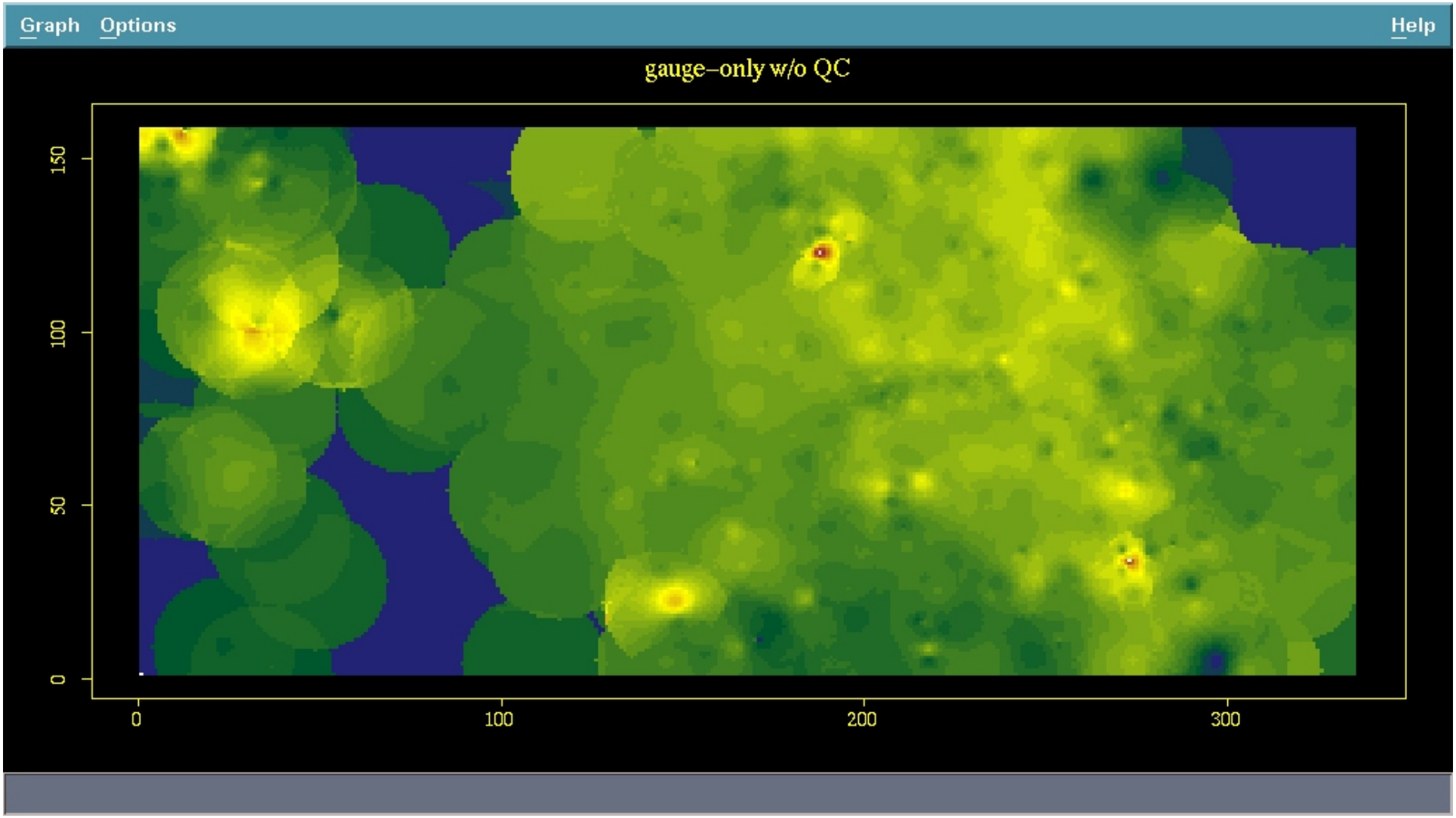
Test:

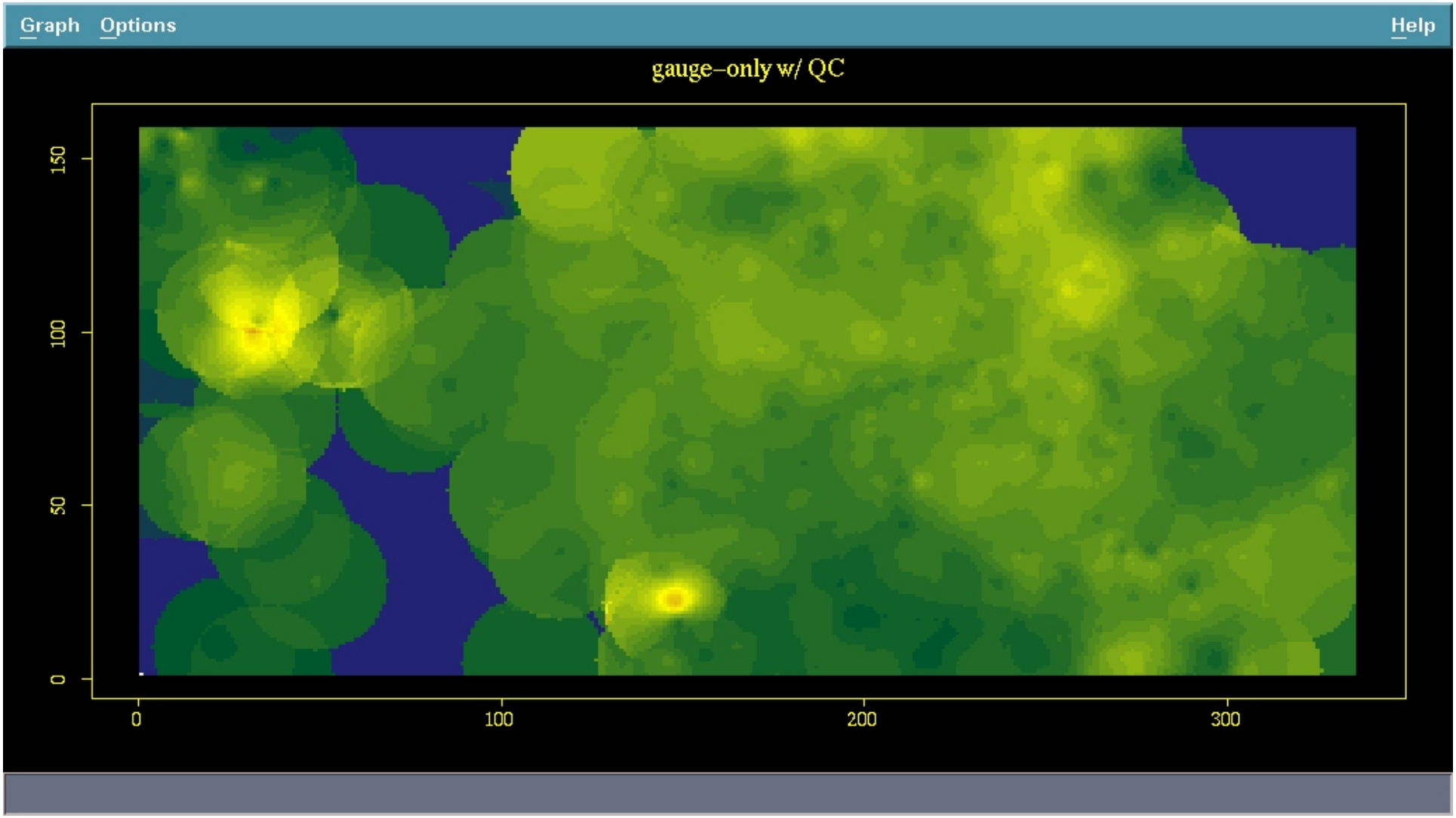
Compares time series of rain gauge summations with radar summations

Result:

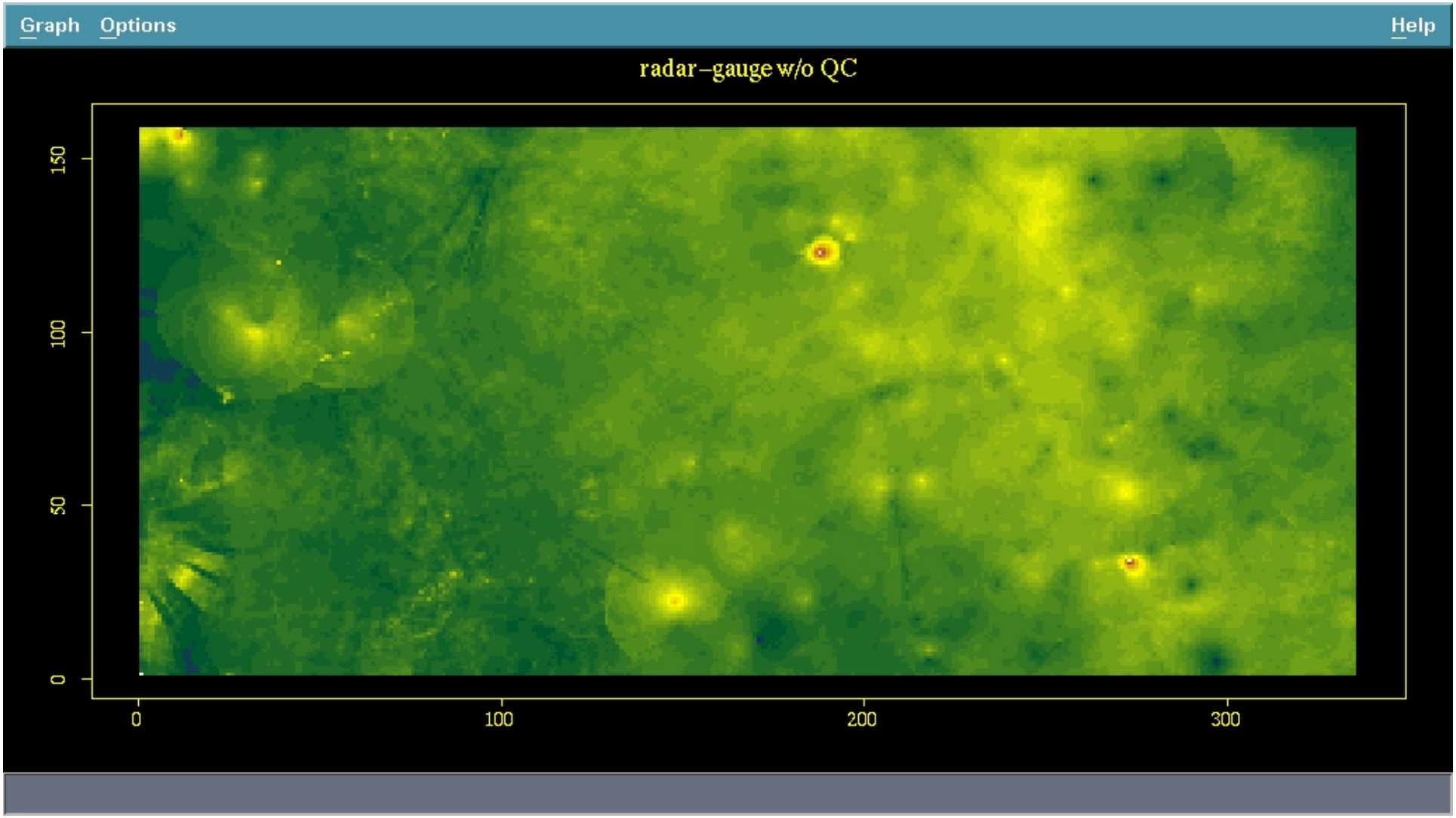
Gauges highlighted in red are stuck gauges as pointed out by this test

Reanalysis (D.J. Seo)




Graph
Options
Help
gauge–only w/ QC
150
100
50
0
0
100
200
300

Reanalysis (D.J.Seo)



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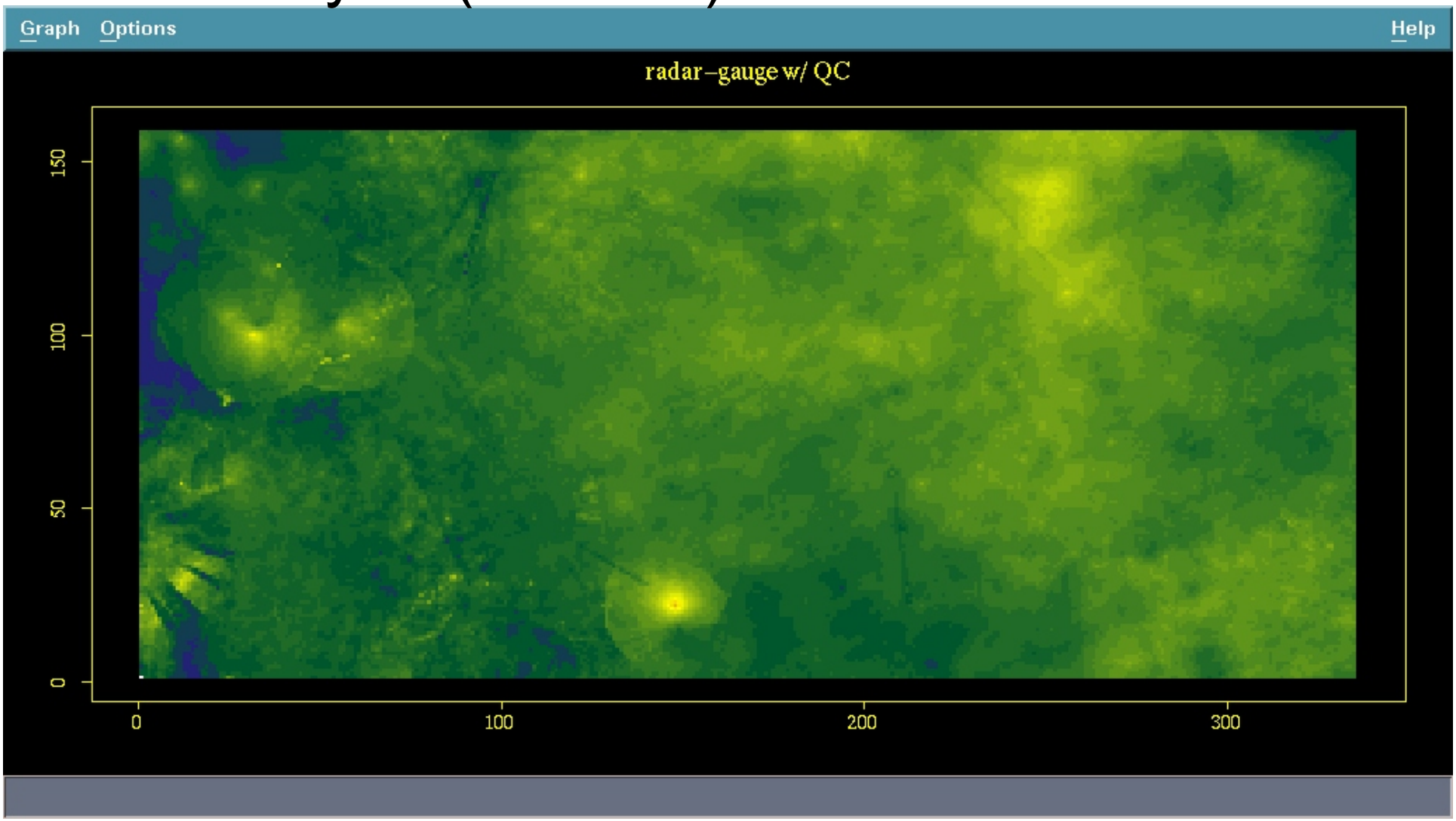


Implementation Plan

Implemented in two phases

Phase I

- An MBA proposal was prepared
- Implement Spatial consistency check and multi sensor check in HMAP/MPE
- Test and implement in operations

Approximate Timeline: Phase I

Obtain copy of Fieldgen and add spatial consistency and point check
1 MONTH

Develop lightning table in Informix database
1 MONTH

Enhance operational MPE GUI to display suspect gauge values in different colors
1.5 MONTHS

Real-time testing and HSEB evaluation *
1.5 MONTHS

Operational implementation and delivery *
1 MONTH

MARCH **APRIL** **MAY** **JUNE**

* Subject to HSEB evaluation

Resources

HSMB

1. Chandra Kondragunta
2. Feng Ding (contractor)
3. Kiran Shrestha (student)

HSEB (Contingent upon MBA approval)

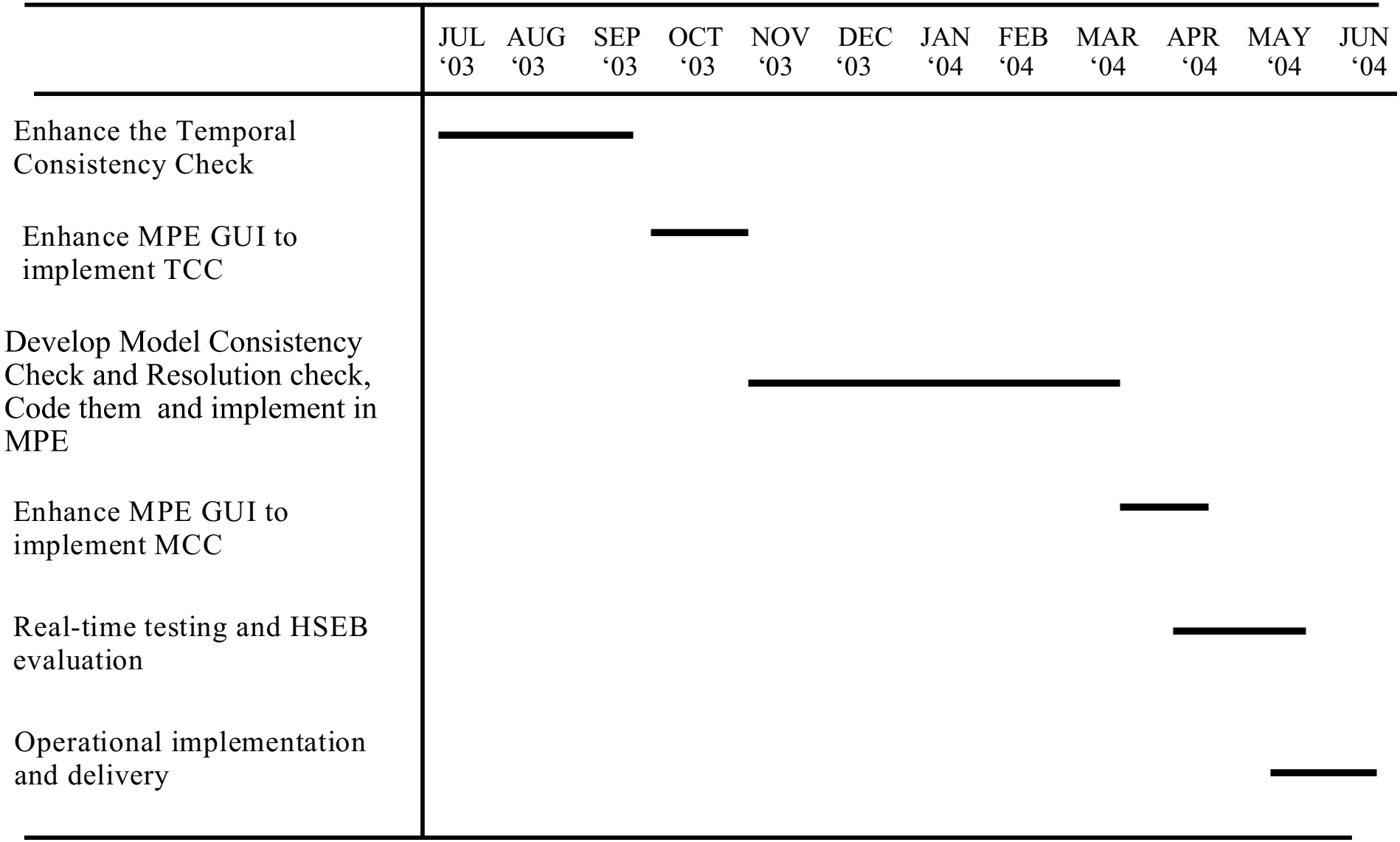
1. Mark Glaudemans (Focal point)
2. XXXXXXXXXX (contractor)

Implementation Plan (cntd.)

Phase II

- Prepare an MBA proposal for phase II
- Improve efficiency of the temporal consistency check
- Develop model consistency check and resolution check
- Develop GUI in HMAP/MPE
- Test and Implement in the operations

Approximate Timeline: Phase II



Benefits

- Enable timely forecasting by reducing manual hours spent in QC process
- Bring objectivity to the QC process
- Improve efficiency of MPE because MPE needs quality controlled gauge data for every hour
- QC checks developed are used in the reanalysis project to generate retrospective data (needed to calibrate hydrologic models)

Customers

Primary customers:

- River Forecast Centers
- Weather Forecast Offices
- National Center For Environmental Prediction

Secondary customers:

- National Climatic Data Center
- U.S. Geological Survey
- Academia
- Any private entity who uses gauge data

Future Plan

Future plan is to develop an automated decision making model

- Develop more QC checks and implement
- Gather decision making information from the field
- Collect lot of data to develop decision making model
- Develop decision making model (Neural Networks or Expert System)
- Test and deliver to field for feedback
- Implement in the operations