



CMS TECH TRANSFER – USER GUIDE

CMS WORK UNIT

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COASTAL INLETS RESEARCH PROGRAM

FY20 IN PROGRESS REVIEW

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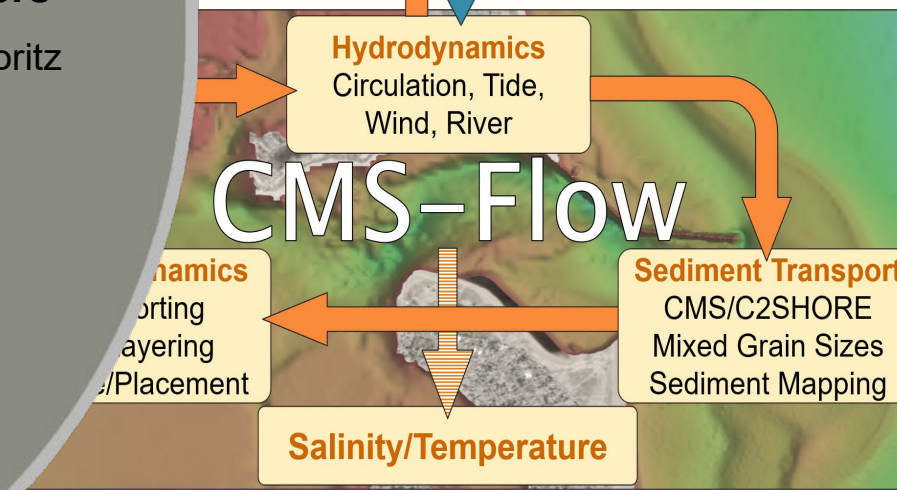
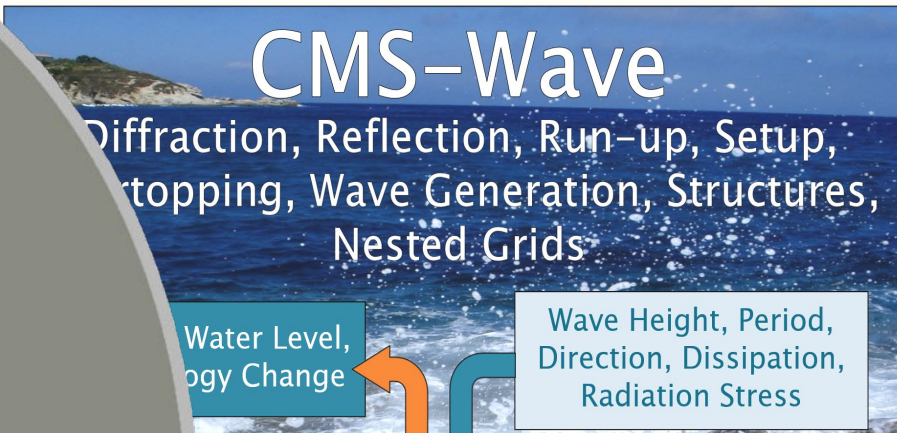
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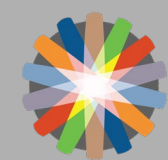
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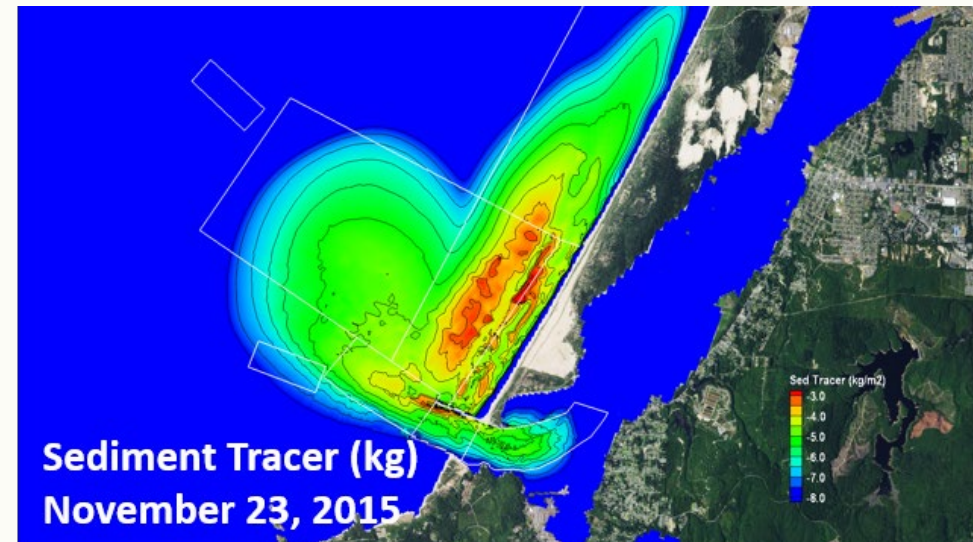
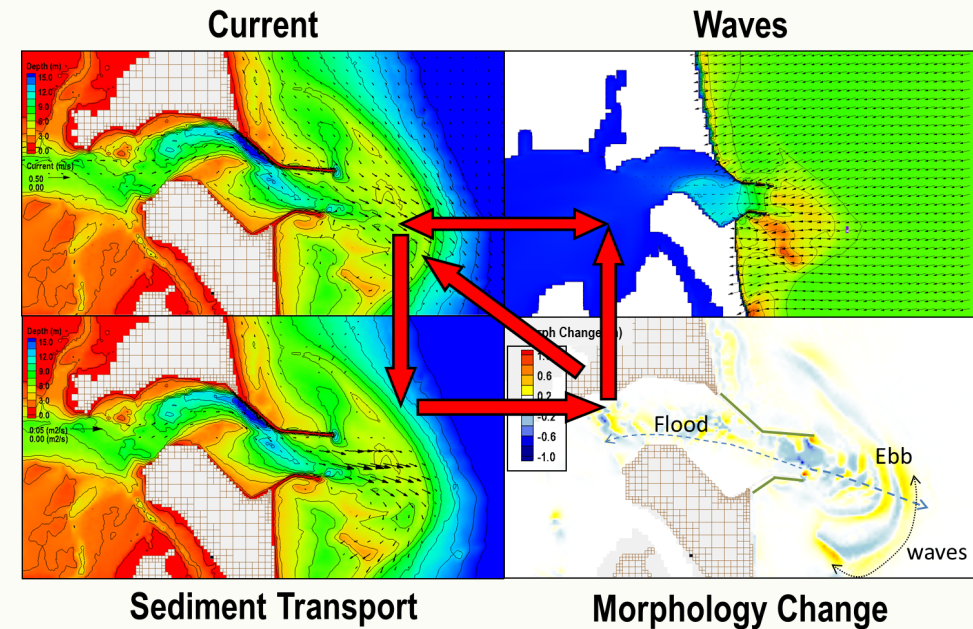
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Problem Statement

- CMS and GUI SMS evolve continually, but only a draft out-of-date user guide is available.
- Publishing an updated user guide is necessary for USACE-wide tech transfer and user support.



Navigation Statements of Need

- 2019-N-1370: Testing and Evaluation of USACE Coastal Numerical Models.
- 2019-N-1509: Morphodynamic Modeling of Navigation Designs
- 2019-N-1355: Nearshore Processes Research and Development.

Capability and Strategic Impact Statement

An updated user guide will provide newly developed CMS features and GUI-SMS changes.

Assisting USACE users in field applications of the CMS is an important step of tech transfer and user support.

CMS User Guide – Formulation and User Interface

■ CMS-Flow

- Hydrodynamics (current, water level)
- Sediment transport/morphology changes
 - ▶ Non-equilibrium, multiple sized transport
 - ▶ LUND-CIRP
 - ▶ Van Rijn
 - ▶ C2SHORE
- Salinity/temperature

■ CMS-Wave

- Wave parameters
- Coastal processes (refraction, diffraction, reflection, run-up ...)

■ Features

- Coastal structures
- Sediment mapping
- Sea level change
- Dredge/placement module

■ SMS (V13)

| DRAFT CMS User Guide | | 3 |
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Summary

FY20 Major Advances in Capability

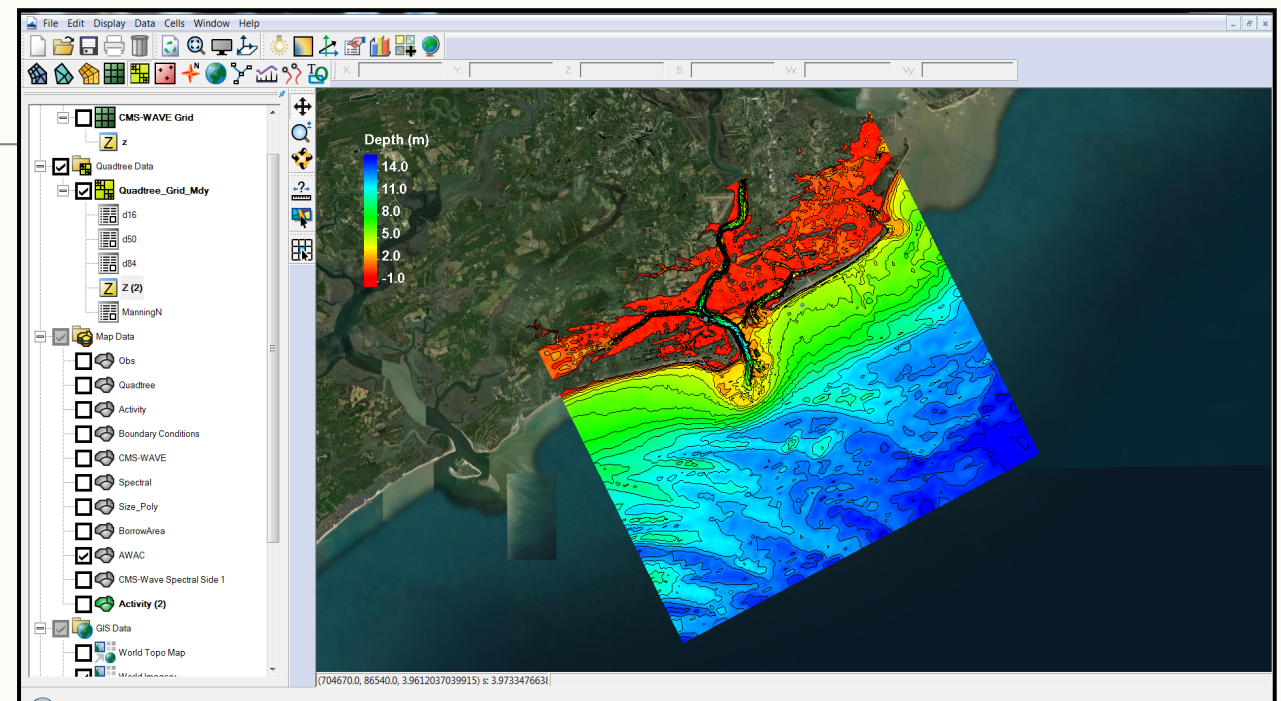
- Work with Aquaveo on SMS updates.
- Continue to incorporate new CMS features in SMS.
- Complete seven chapters out of eleven.

FY20 Major Products & Collaborations

- Draft TR

FY21 Products/Advances

- Test corresponding CMS/SMS features in the user guide.
- Complete the draft review.
- Publish the TR.





CMS DEVELOPMENT – VV/UQ, CODE TESTING

CMS WORK UNIT

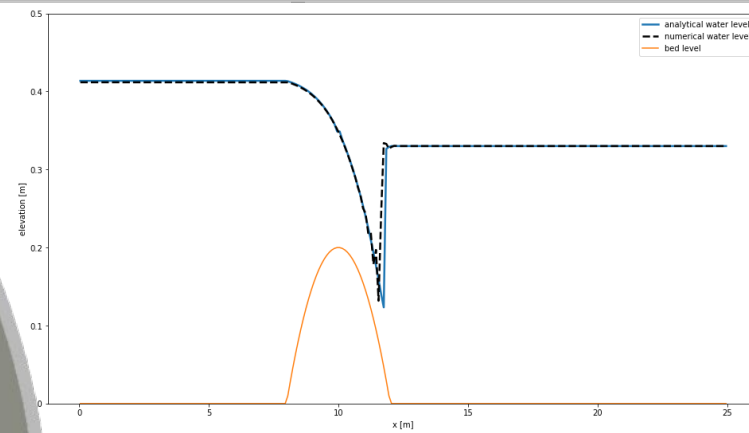
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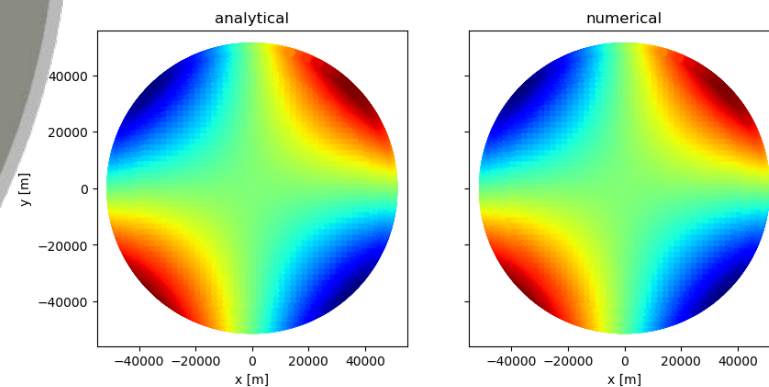
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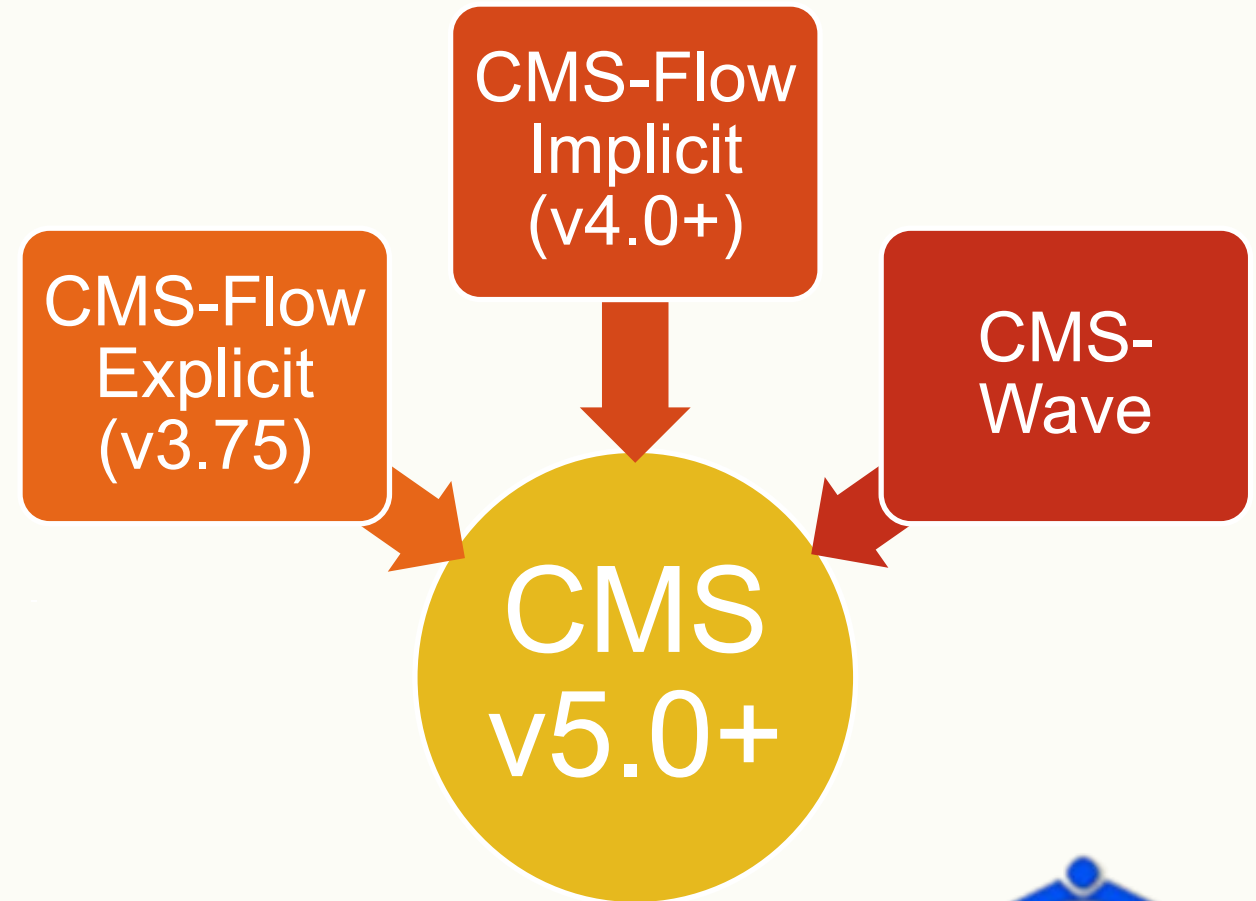


| Coriolis | Rmse [m] | Bias [m] | r ² |
|----------|----------|----------|----------------|
| Yes | 1.2e-4 | 1.2-4 | 0.9809 |
| No | 2.5e-5 | 2.5e-5 | 0.9991 |



Problem Statement

- Over the past 15+ years, the Coastal Modeling System has evolved from three separate models into one merged code.
- Initial Validation/Verification effort was done in 2011 using the three individual models
- Additional VV/UQ and code testing is being performed on merged CMS v5.1.



Navigation Statements of Need

- 2019-N-1370: Testing and Evaluation of USACE Coastal Numerical Models.



Validation & Verification & Uncertainty Quantification

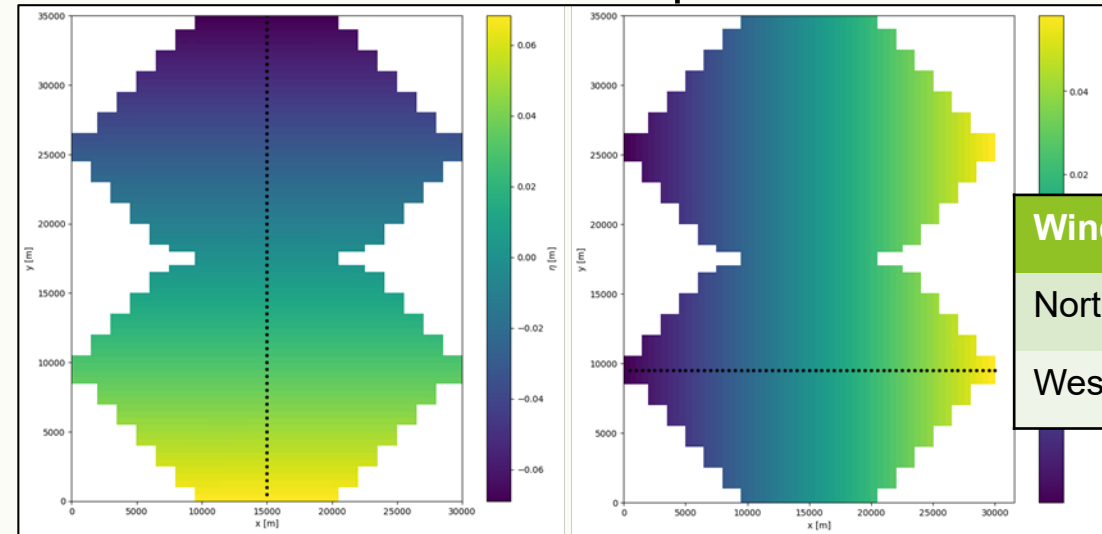
Analytical

- Wind setup
- Wind driven flow
- Tidal propagation
- Flow over a bump
- Long-wave runoff over slope
- Scalar transport
- Wave generation and growth
- Non-linear wave-wave interaction
- Wave diffraction

Laboratory

- Steady flow in rect. flume w/spur dike
- Steady flow in rect. flume w/sudden expansion
- Planar sloping beach w/incident waves
- Channel infilling: steady flow
- Channel infilling: wave parallel to flow
- Channel infilling: wave perpendicular to flow
- LSTF Cases
- Clear water jet erosion
- Bed aggradation and sediment sorting
- Wave breaking
- Wave runup
- Cleveland Harbor experiments

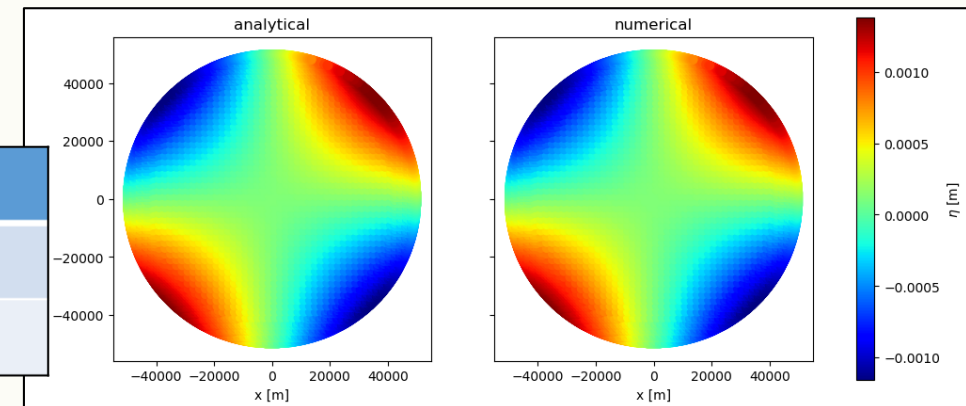
Wind setup



| Wind dir. | Rmse [m] | r^2 |
|-----------|----------|---------|
| North | 1.5e-4 | 0.99999 |
| West | 7.2e-5 | 0.99999 |

| Coriolis | Rmse [m] | Bias [m] | r^2 |
|----------|----------|----------|--------|
| Yes | 1.2e-4 | 1.2e-4 | 0.9809 |
| No | 2.5e-5 | 2.5e-5 | 0.9991 |

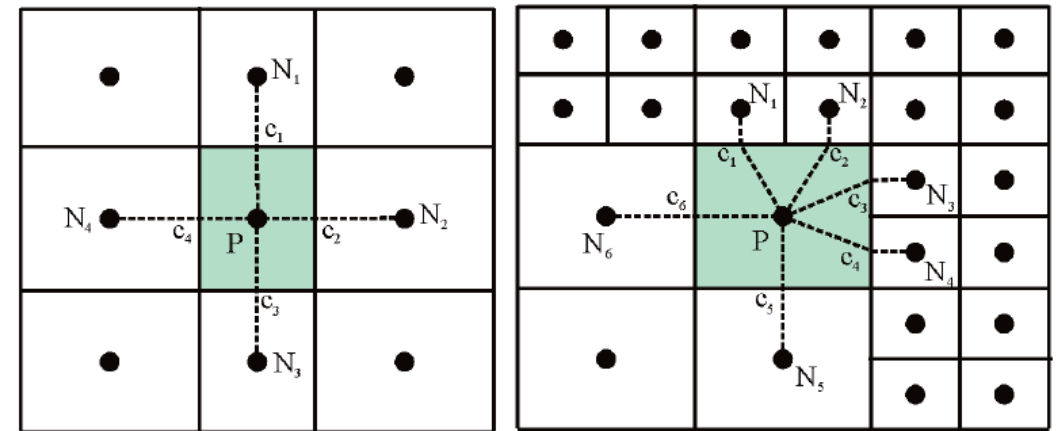
Wind-driven Flow



CMS Code testing

- CMS-Wave integration in CMS merged code was thoroughly evaluated
 - A few issues were identified and updated code has been tested and will be integrated into next “release” version of CMS (v5.2)
 - Additional testing is continuing

- Explicit solution scheme of the CMS merged code was evaluated
 - A few issues have been identified and are under investigation.
 - Additional discussion with developers and consultants is needed.
 - No code changes have been submitted for resolution of the issues at present.



Summary

FY20 Major Advances in Capability

- Updated VV/UQ comparisons and statistics for analytical and laboratory tests have been ~75% completed.
- Changes for CMS-Wave integration into combined CMS code has been completed.
- Complete seven chapters out of eleven.

FY21 Products/Advances

- Remaining Analytical/Lab VV/UQ cases to be completed.
- 6 VV/UQ field cases to be completed.
- Publish VV/UQ Tech Report.
- Determine future of Explicit code in CMS

