

# Refinements in Continuous Galerkin Wetting and Drying Algorithms

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# Background

## Motivation:

- Storm surges
- Circulation in inlets

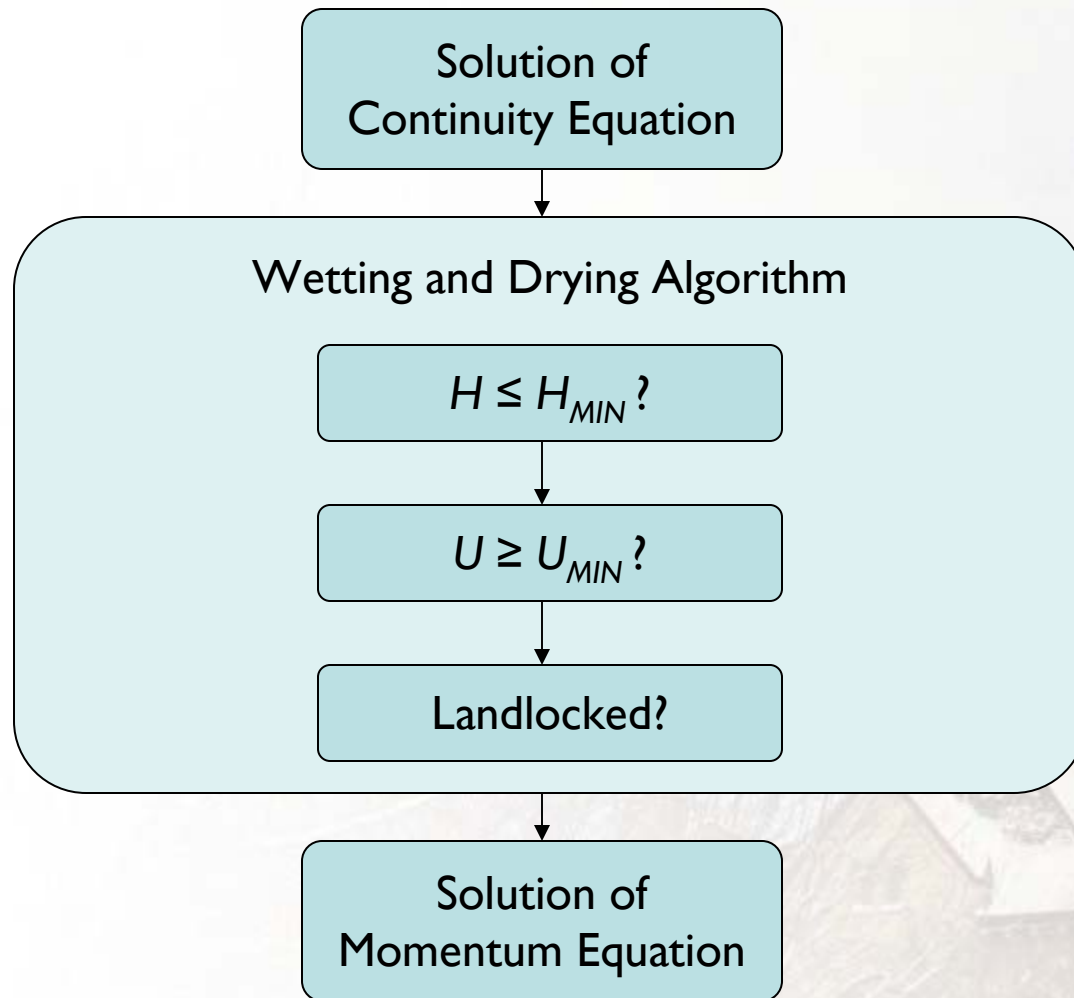
## Possible methods:

- Use spatially deforming grids
- Turn nodes/elements on and off – how?

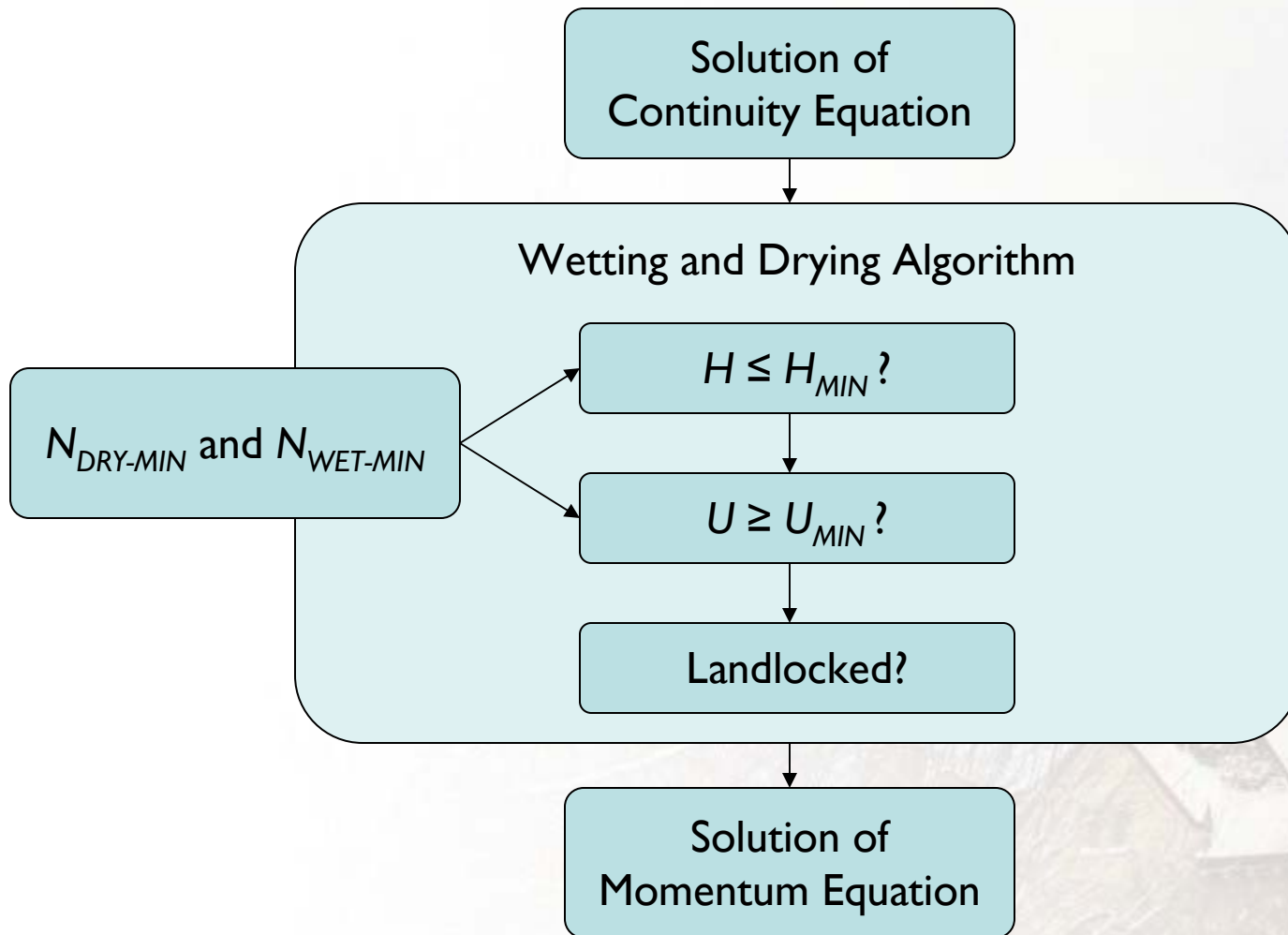
## ADCIRC:

- Algorithm implemented in 2D (X-Y) ADCIRC in early '90s
- Implement in 3D ADCIRC?

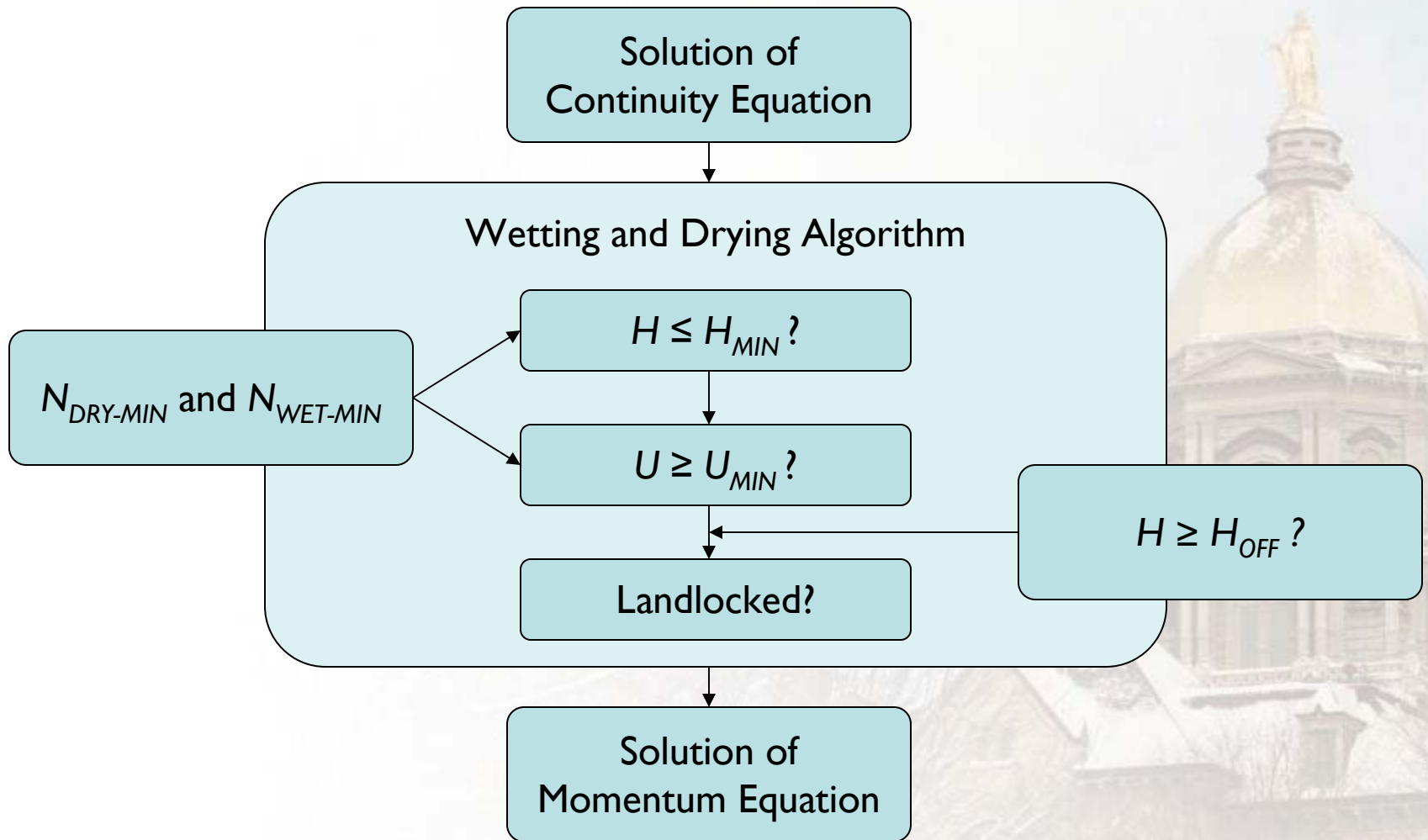
# Wet/Dry Algorithm



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# Wet/Dry Algorithm



# Objectives

## Primary Objective:

- Verify changes to algorithm are necessary and beneficial

## Secondary Objectives:

- Test algorithm in 2D (X-Z) and 3D
  - Does it work?
- Quantify behavior of algorithm
  - Heuristic stability
  - Parameter sensitivity
  - Horizontal resolution

# Numerical Experiments

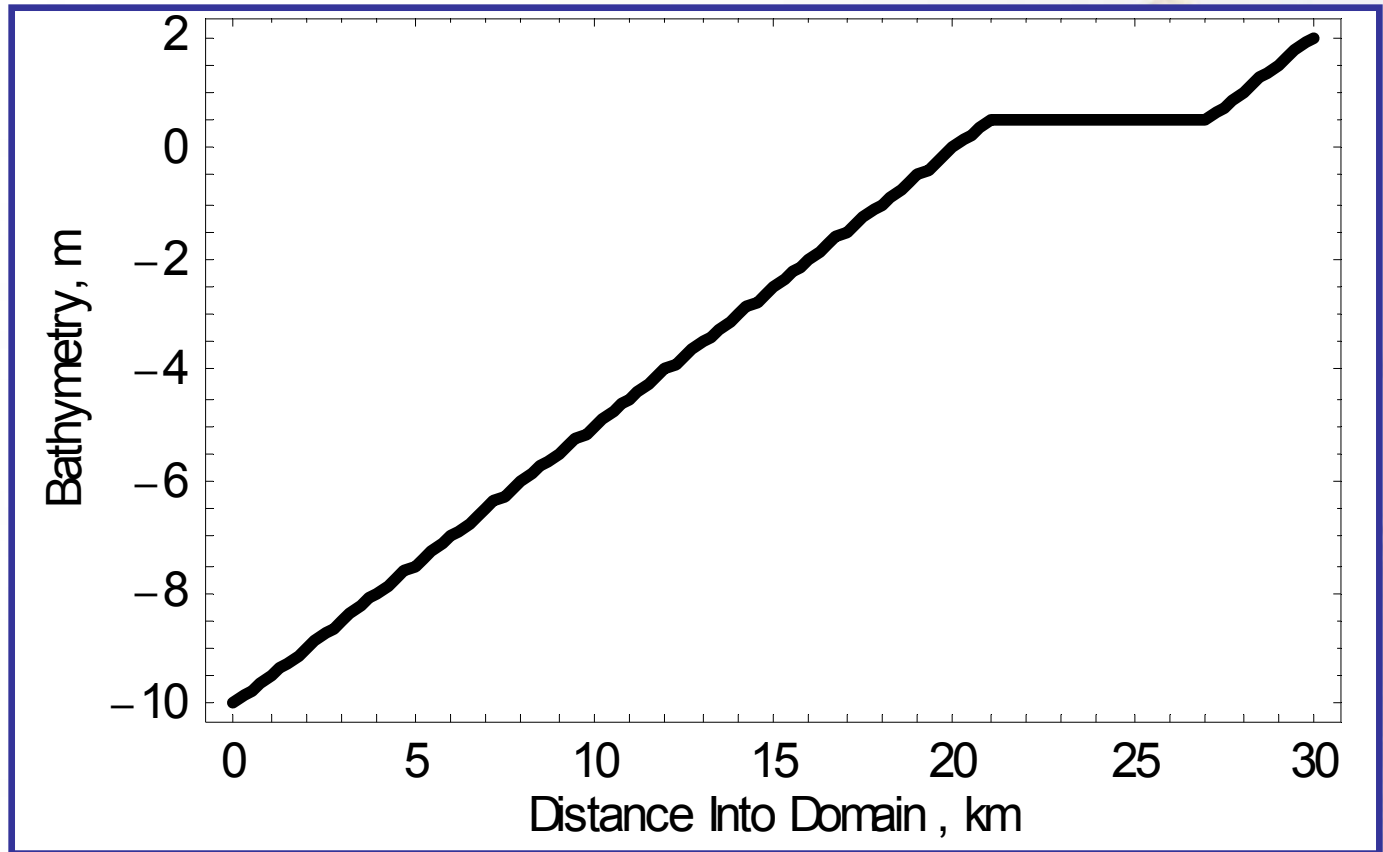
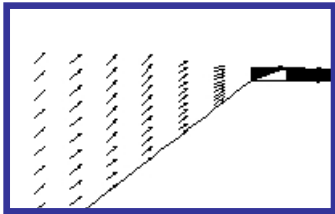
## Test Matrix

- “Original” versus “Improved” ...

	2D (X-Z)	3D
Heuristic Stability	<a href="#">Link</a>	<a href="#">Link</a>
$G$ and $K_{SLIP}$	<a href="#">Link</a>	<a href="#">Link</a>
$H_{MIN}$ and $U_{MIN}$	<a href="#">Link</a>	<a href="#">Link</a>
<i>Horizontal Resolution</i>	<a href="#">Link</a>	<a href="#">Link</a>

# Numerical Experiments – 2D (X-Z)

## Plateau (2D X-Z):





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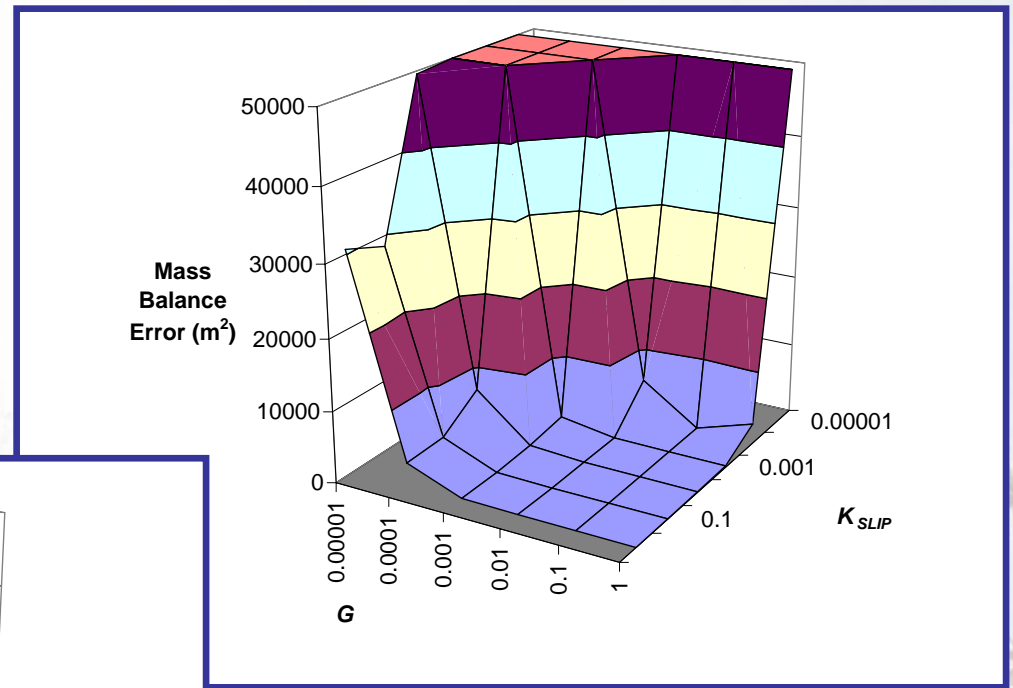
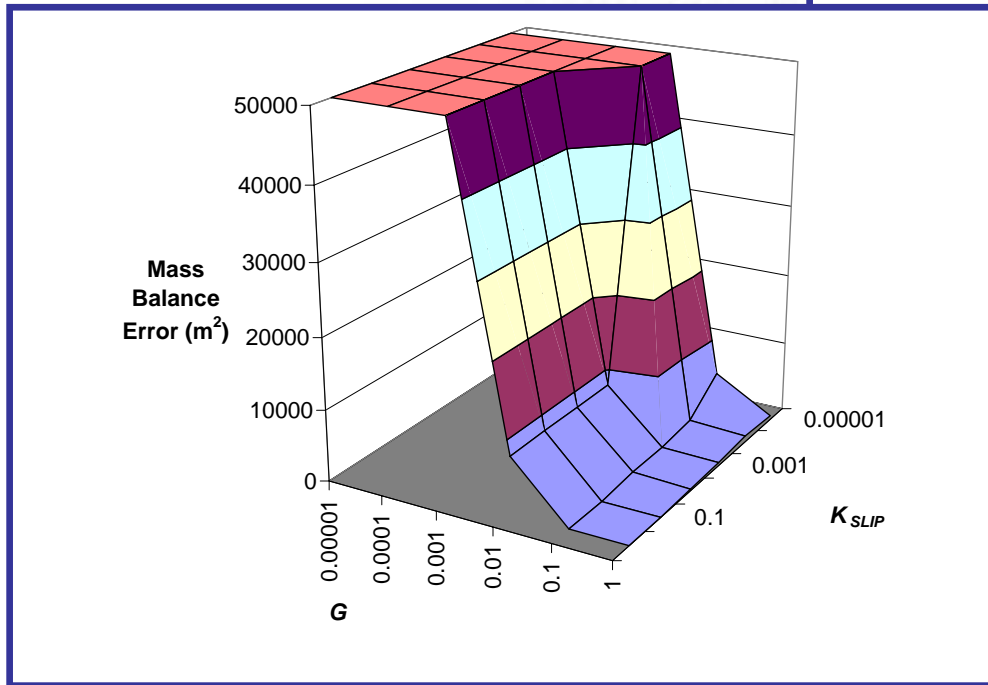
- Heuristic Stability

	Original Algorithm	Improved Algorithm
Maximum Stable Time Step	10 sec	20 sec
Mass Balance Error	15881 m <sup>2</sup>	20148 m <sup>2</sup>

# Numerical Experiments – 2D (X-Z)

## Plateau (2D X-Z):

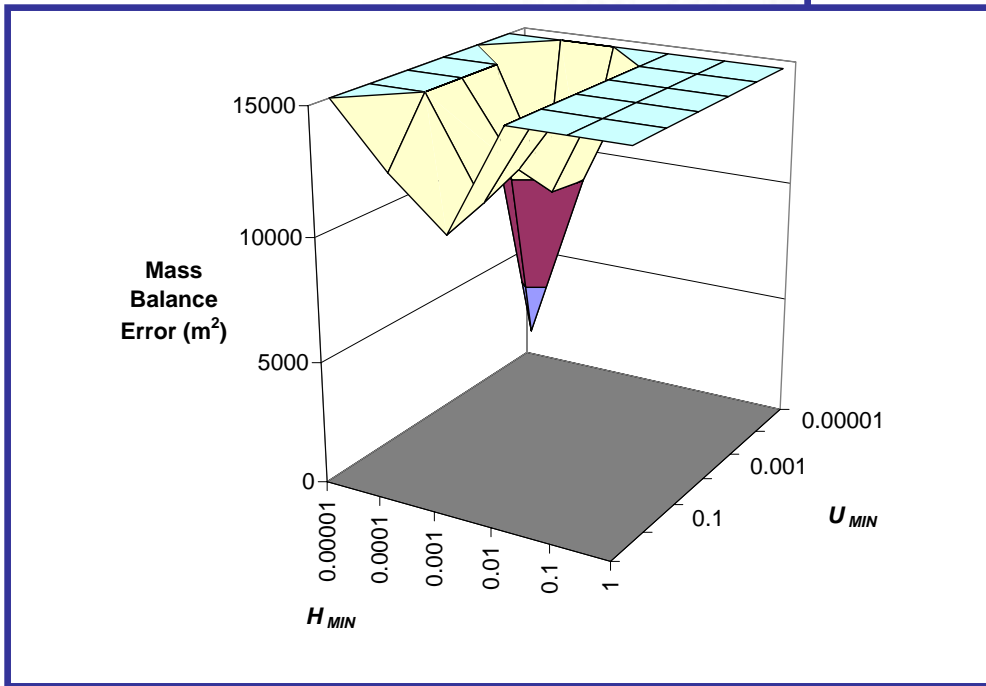
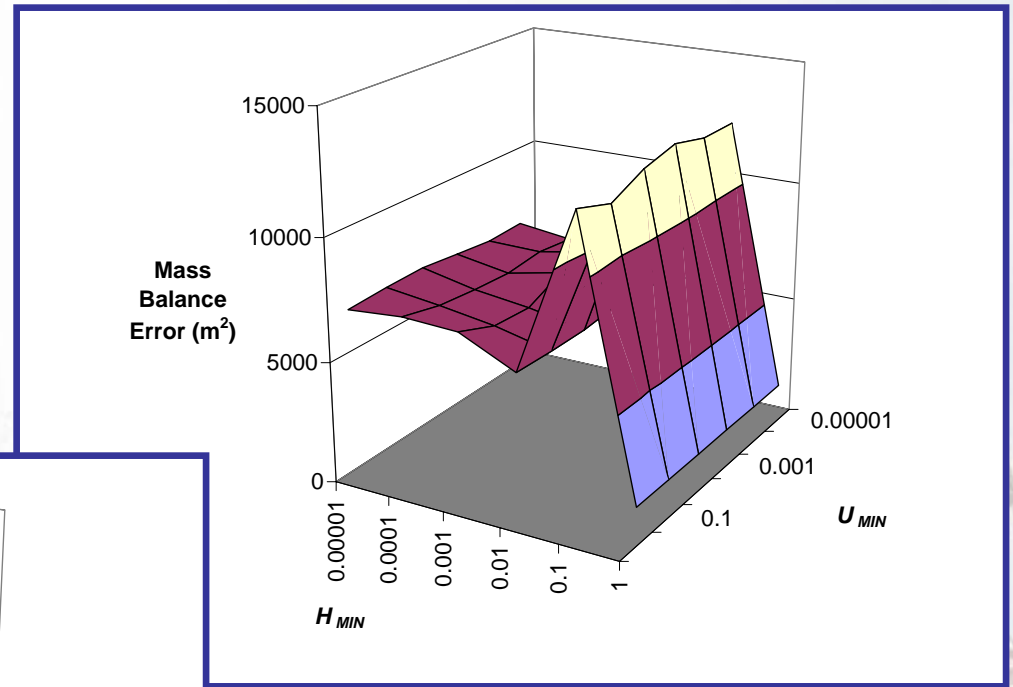
- $G$  and  $K_{SLIP}$



# Numerical Experiments – 2D (X-Z)

## Plateau (2D X-Z):

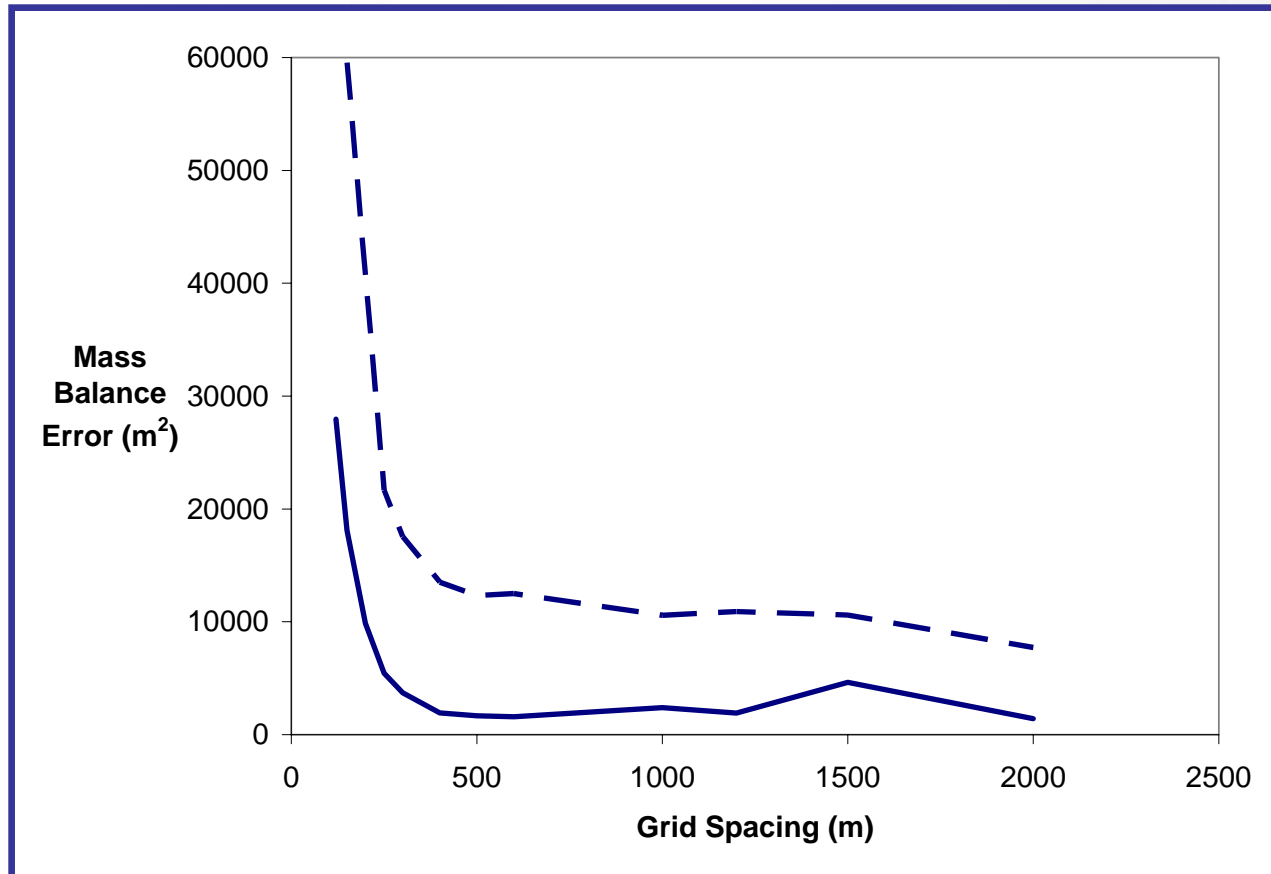
- $H_{MIN}$  and  $U_{MIN}$



# Numerical Experiments – 2D (X-Z)

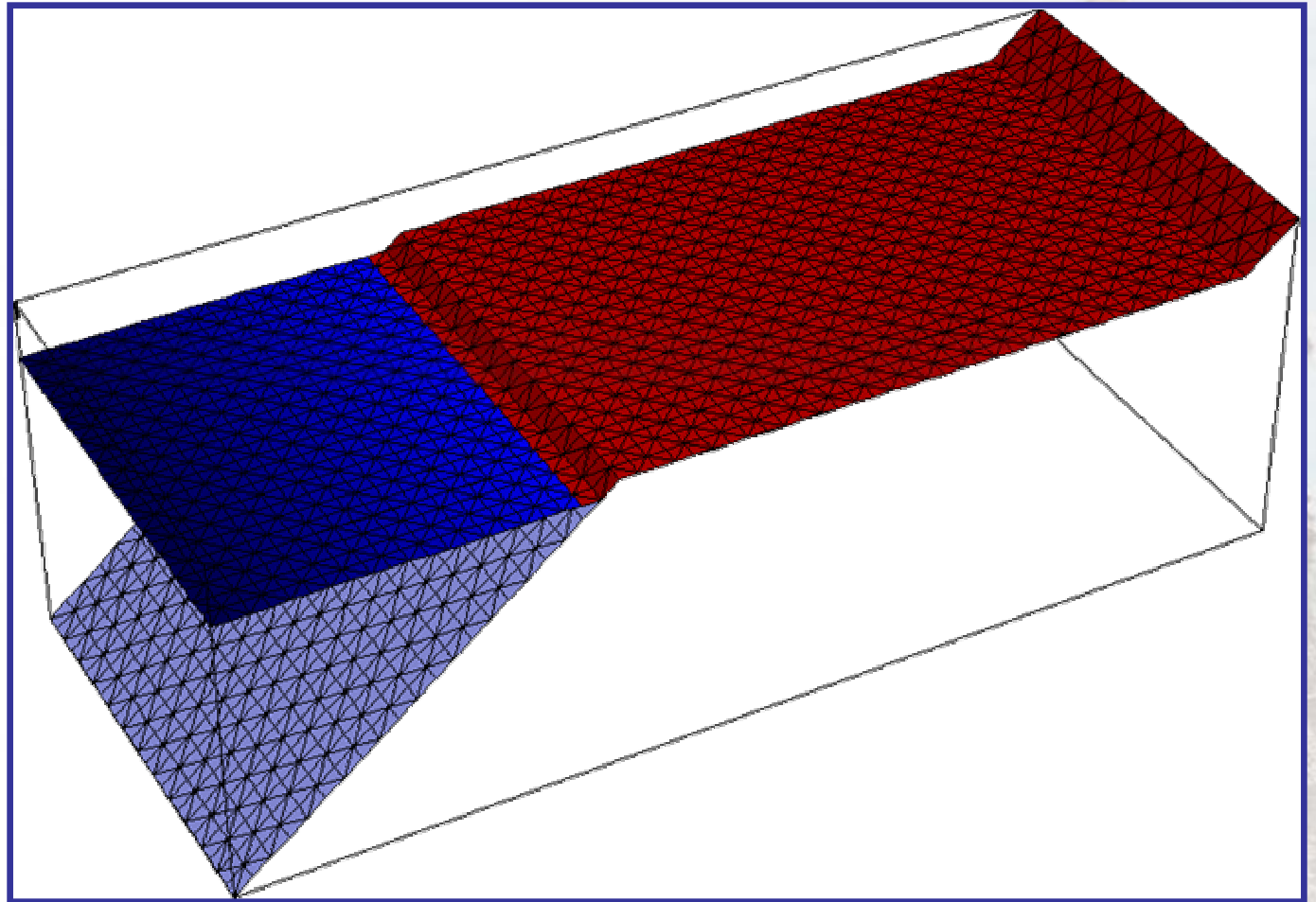
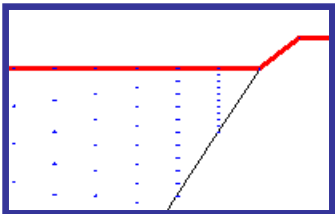
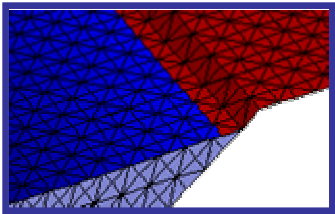
## Plateau (2D X-Z):

- Horizontal Resolution



# Numerical Experiments – 3D

## Plateau (3D):



# Numerical Experiments – 3D

## Plateau (3D):

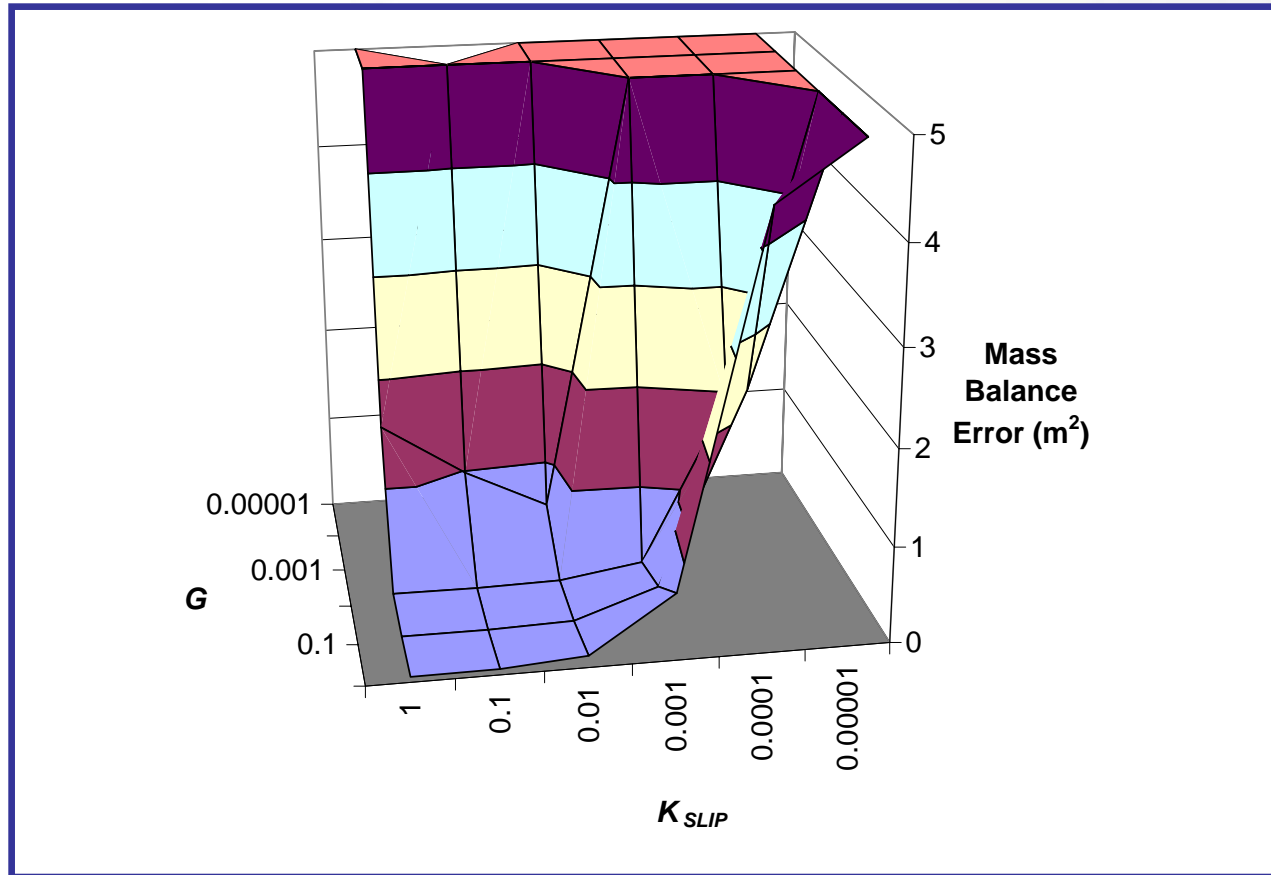
- Heuristic Stability

	Original Algorithm	Improved Algorithm
Maximum Stable Time Step	35 sec	45 sec
Mass Balance Error	103 m <sup>2</sup>	109 m <sup>2</sup>

# Numerical Experiments – 3D

## Plateau (3D):

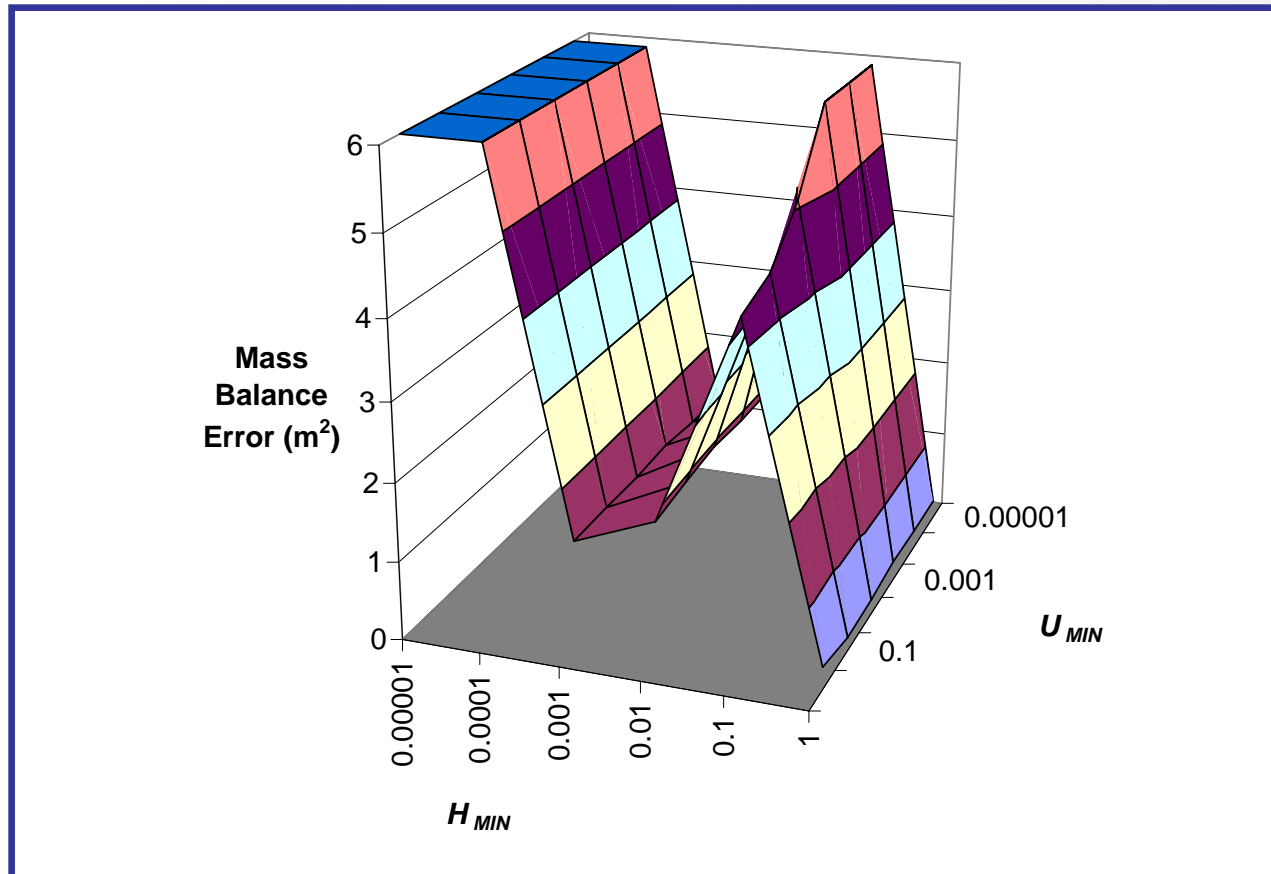
- $G$  and  $K_{SLIP}$



# Numerical Experiments – 3D

## Plateau (3D):

- $H_{MIN}$  and  $U_{MIN}$

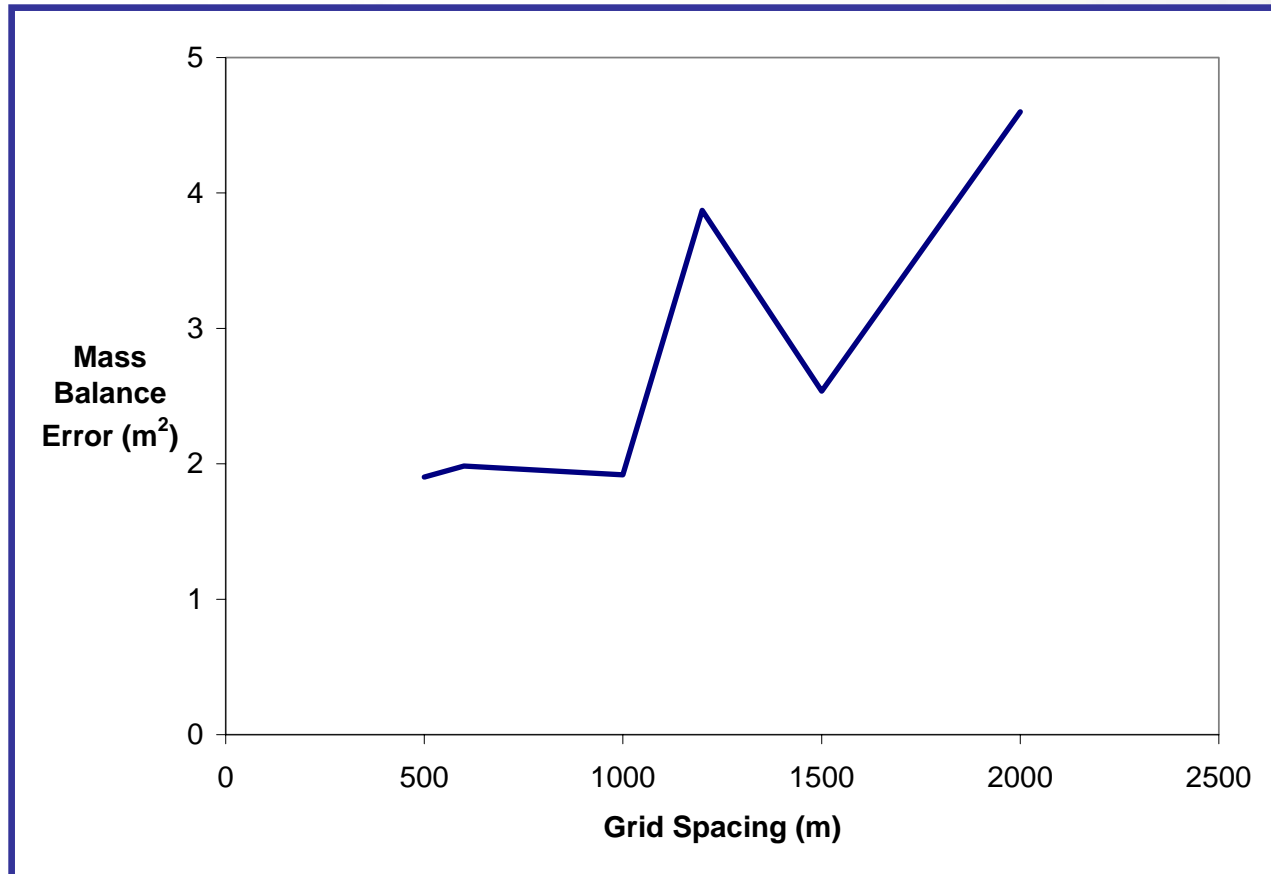




# Numerical Experiments – 3D

## Plateau (3D):

- Horizontal Resolution



# Conclusions

## Were changes beneficial?

- Increases maximum stable time step
- Increases range of stable parameters
- Decreases mass balance errors

## Does algorithm work in 3D?

## Can we quantify behavior?

- Heuristic stability
- $G$  and  $K_{SLIP}$
- $H_{MIN}$  and  $U_{MIN}$
- Horizontal resolution

# Questions?

