Forward Modeling

Presented at MT3DINV Workshop at DIAS

Yutaka Sasaki
Kyushu University

Maxwell's equations

$$\nabla \times \mathbf{E} = -i\omega\mu_0 \mathbf{H}$$

$$\nabla \times \mathbf{H} = \sigma\mathbf{E} + \mathbf{J}_0$$

Second-order equation in terms of the secondary electric field

$$\nabla \times \nabla \times \mathbf{E}_s + i\omega\mu_0\sigma\mathbf{E}_s = -i\omega\mu_0(\sigma - \sigma_p)\mathbf{E}_p$$

$\mathbf{E}_p$: field for 1D model

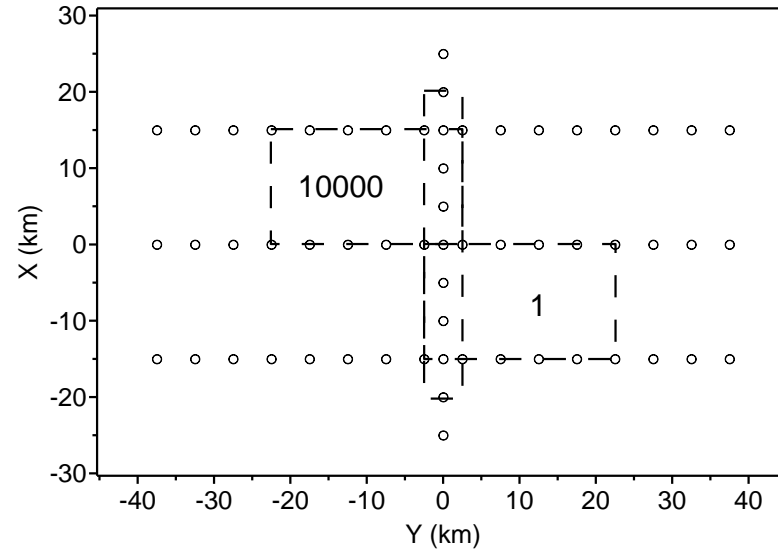# Staggered-grid finite difference method

Iterative solver: BCG

Preconditioner: Incomplete Cholesky
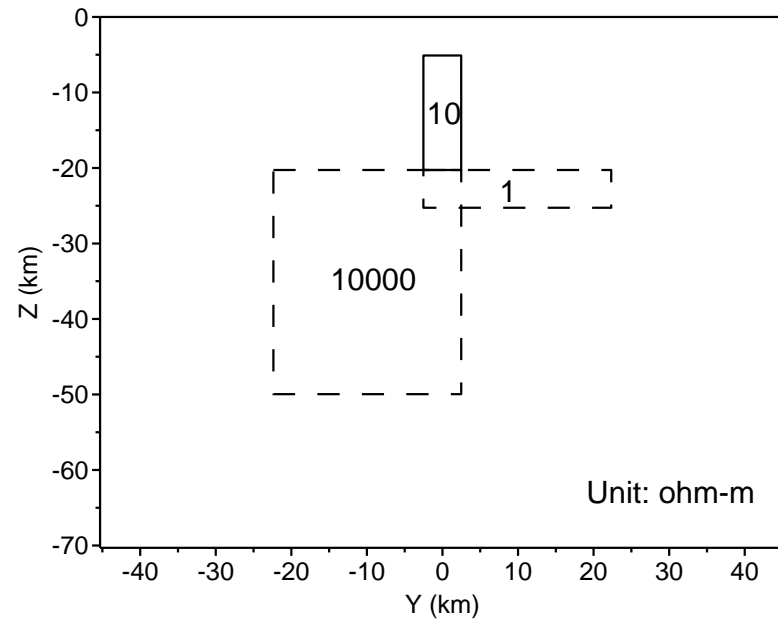decomposition

Static divergence correction (Smith, 1996)

The model

Periods:
0.1 – 10 000 s

Two grids used

1. 64 x 82 x 50 (= 262 400)
   Min. cell size: 1 x 1 x 1 km
   Max. cell size: 640 x 640 x 640 km

   CPU time = 74 min. on PC (Pentium-4)
   (for 21 periods)
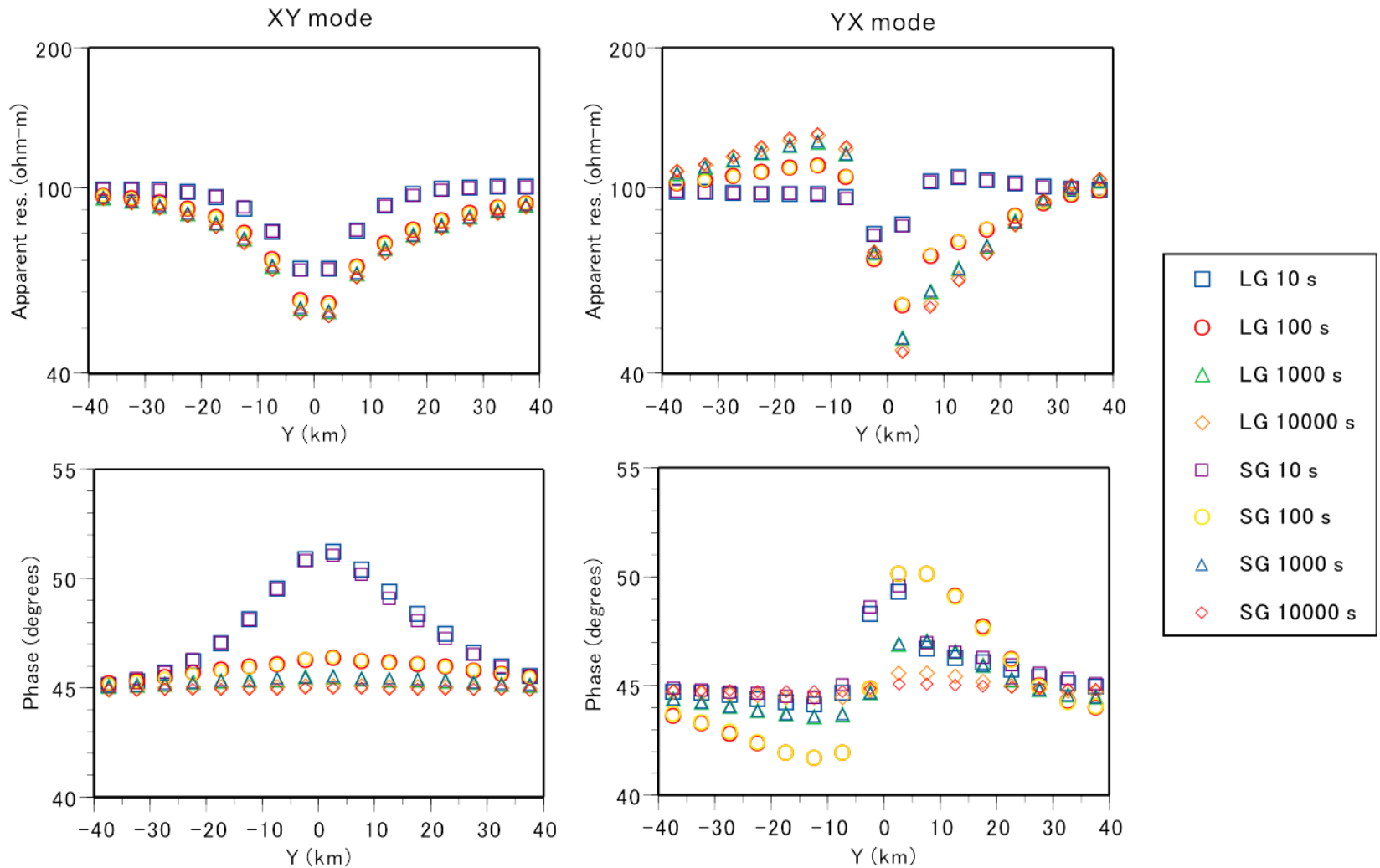
2. 40 x 50 x 32 (= 64 000)
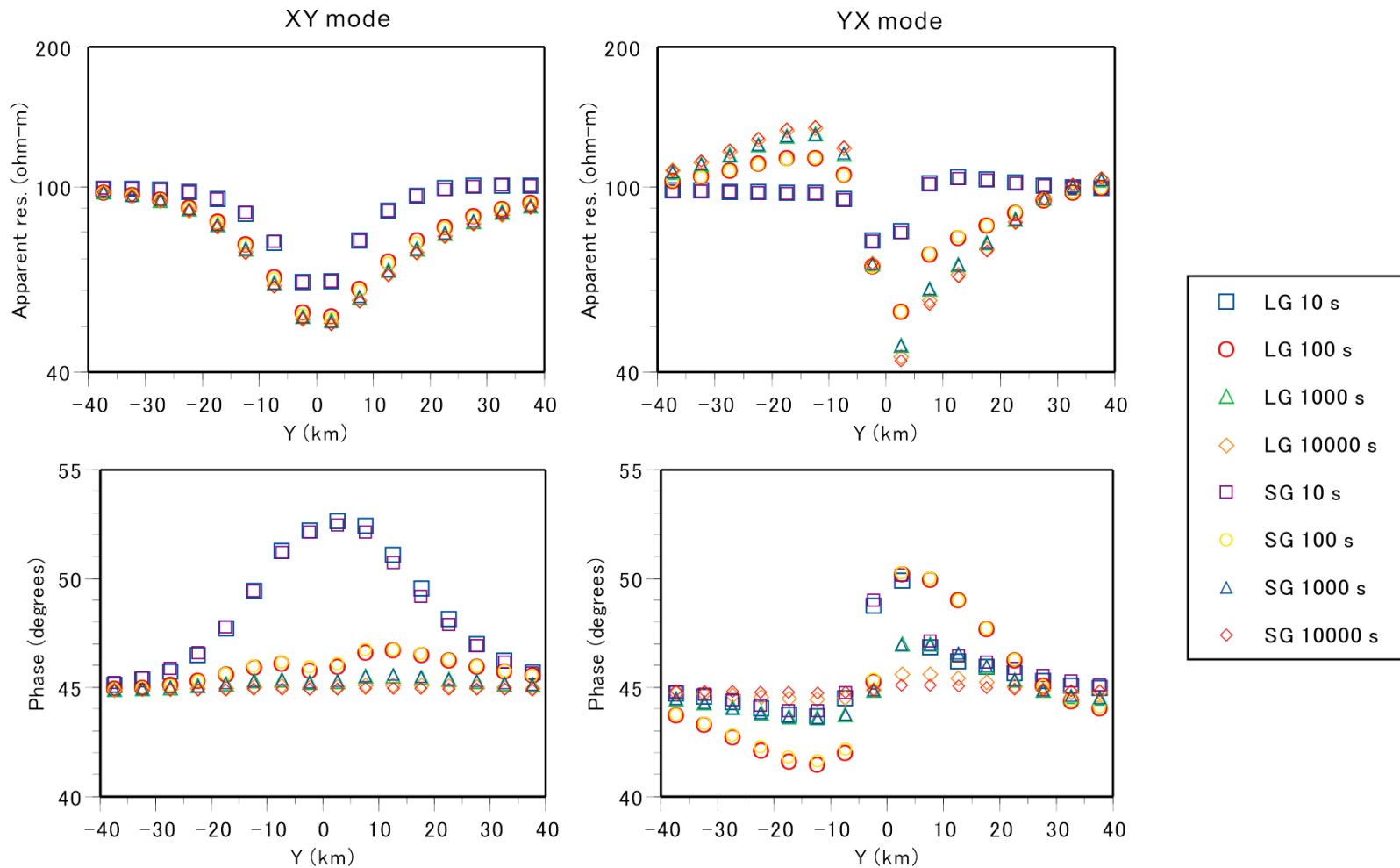   Min. cell size: 2.5 x 2.5 x 2.5 km
   Max. cell size: 160 x 160 x 160 km

   CPU time = 7 min. on PC(Pentium-4)
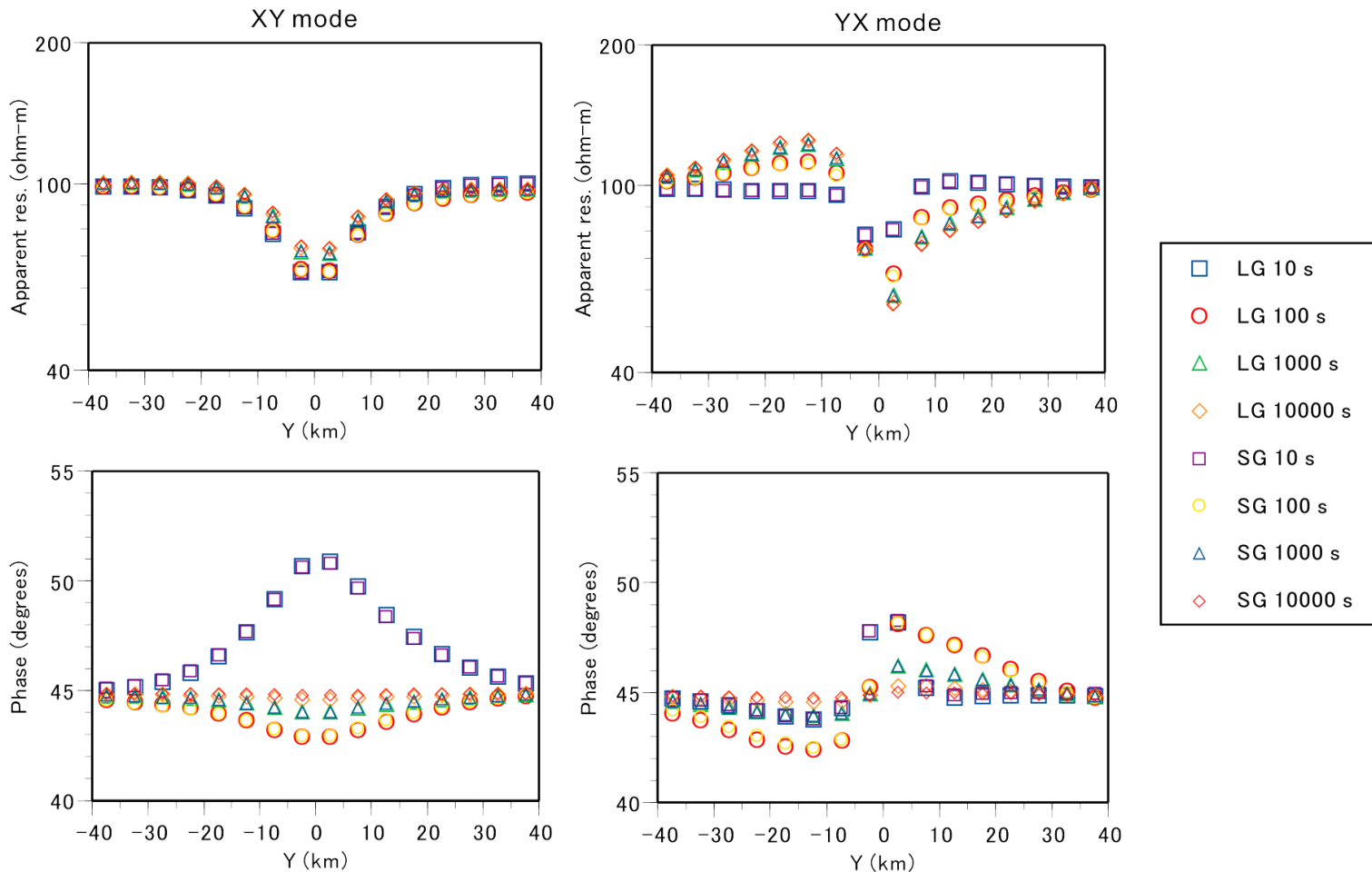   (for 21 periods)

Comparison of the responses
at X = -15 km between two grids

Comparison of the responses at X = 0 km between two grids

Comparison of the responses
at X = 15 km between two grids

Comparison of the responses at Y = 0 km between two grids