VLBI Network Simulations

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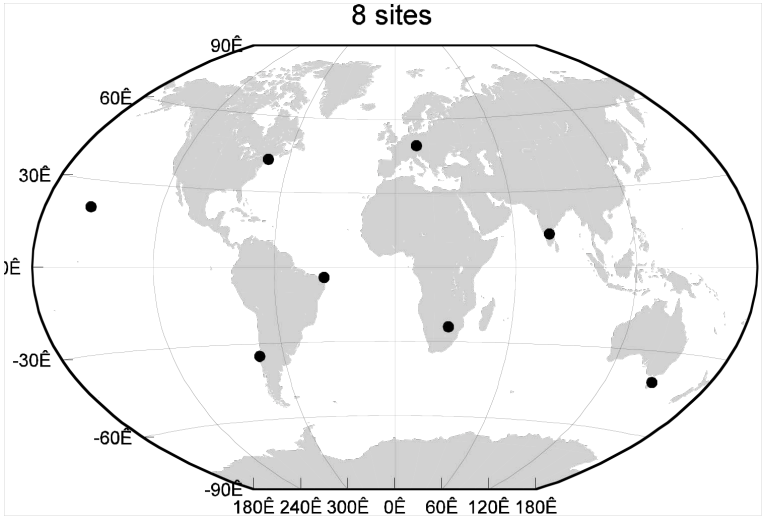
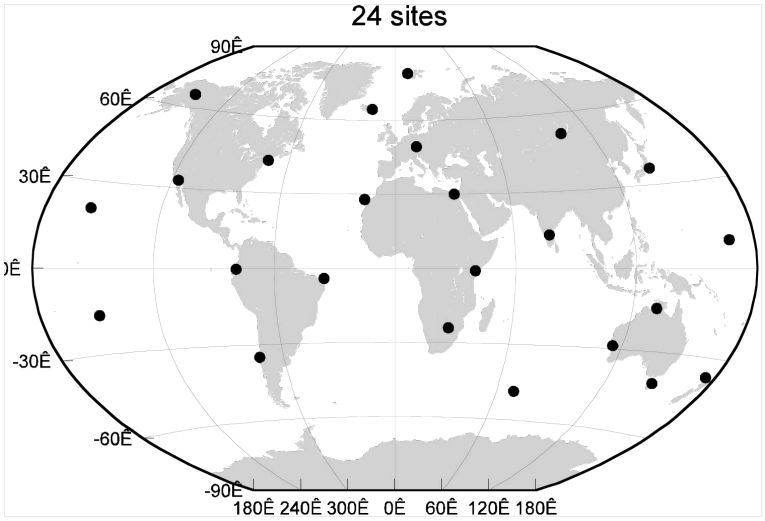
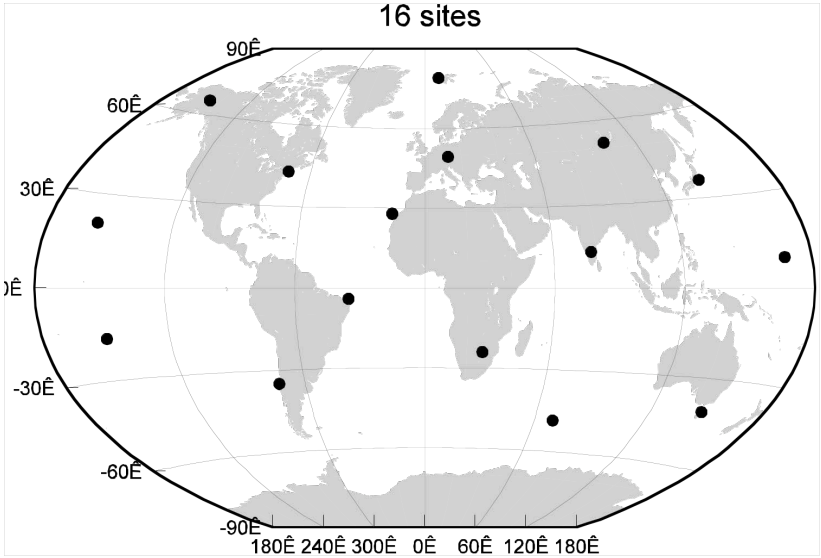
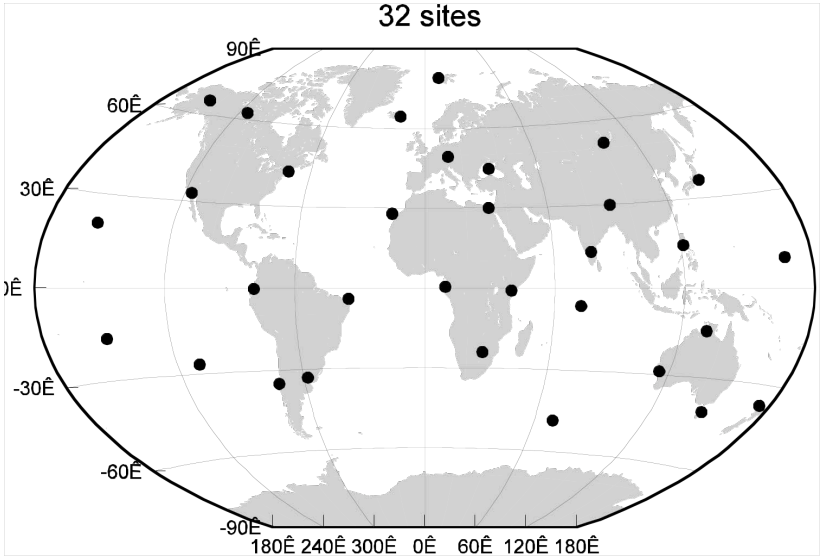
Network Simulations

- Chose a 32-site network of globally distributed sites from our simulation list of 69 candidate colocated SLR and VLBI sites
- Generated 24-hour observing schedules for the 32-site network and for 24-site, 16-site, and 8-site subsets of this network.


8 sites
90Ê
60Ê
30Ê
-30Ê
-60Ê
-90Ê
180Ê 240Ê 300Ê 0Ê 60Ê 120Ê 180Ê


24 sites
90Ê
60Ê
30Ê
-30Ê
-60Ê
-90Ê
180Ê 240Ê 300Ê 0Ê 60Ê 120Ê 180Ê


16 sites
90Ê
60Ê
30Ê
-30Ê
-60Ê
-90Ê
180Ê 240Ê 300Ê 0Ê 60Ê 120Ê 180Ê

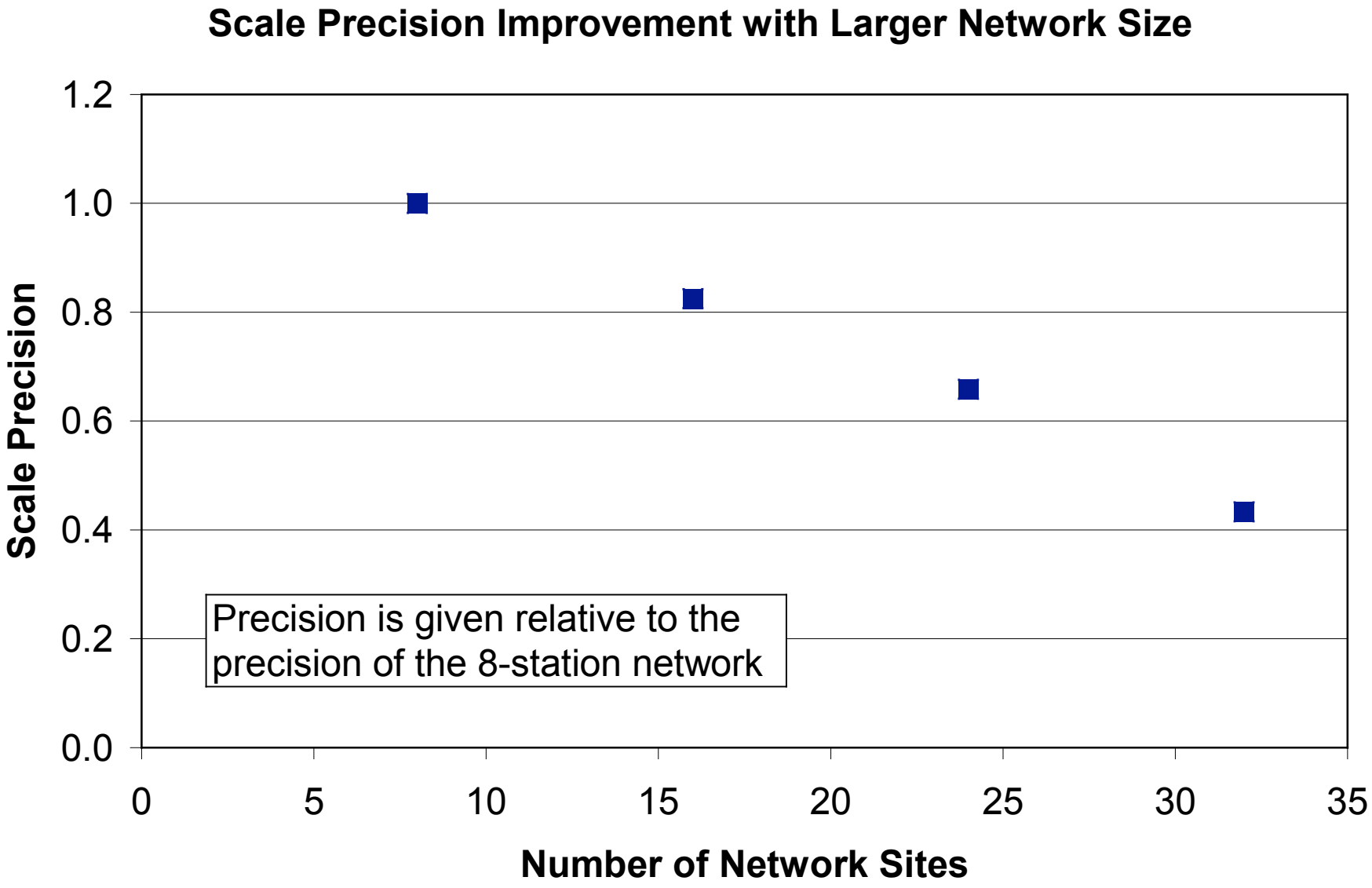

32 sites
90Ê
60Ê
30Ê
-30Ê
-60Ê
-90Ê
180Ê 240Ê 300Ê 0Ê 60Ê 120Ê 180Ê

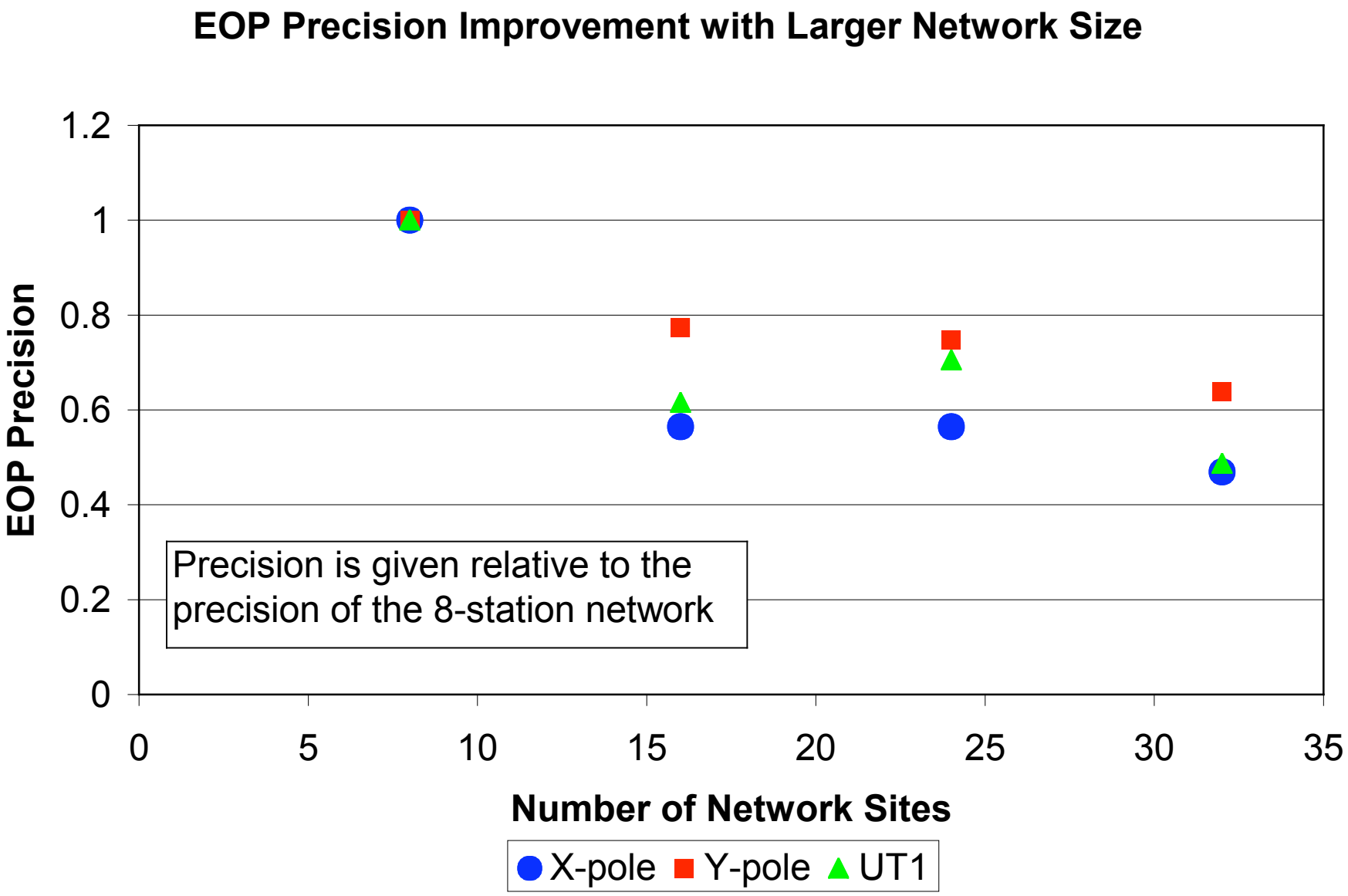
Network Simulations

• Ran simulation observation files from observing schedules for each network with the VLBI SOLVE analysis program

• Performed Monte Carlo simulations using simulated observations generated from atmosphere/clock/noise models by running SOLVE with different input simulation delays.

• Computed RMS precision (repeatability) of estimated parameters (Earth orientation and scale) from the series of Monte Carlo runs


Scale Precision Improvement with Larger Network Size
Scale Precision
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30
35
Number of Network Sites
Precision is given relative to the precision of the 8-station network


EOP Precision Improvement with Larger Network Size
EOP Precision
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
35
Number of Network Sites
Precision is given relative to the precision of the 8-station network
X-pole
Y-pole
UT1

SLR + VLBI Combined Solution

- Verified procedure to generate Geodyn normal equations for a single VLBI daily solution
  1) Run VLBI solution to generate Geodyn input files
  2) Generate simulation delay data file
  3) Run Geodyn to make the VLBI normal equations

- Next steps
  1) Generate time series of observing schedules for each network size
  2) Run VLBI solutions to generate Geodyn input
  3) Make time series of VLBI normal equations with Geodyn
  4) Combine SLR and VLBI normal equations and compute TRF positions/velocities and EOPs
  5) Analyze precision of VLBI-only TRF solutions using time series daily observing sessions