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Monte Carlo simulations for VLBI analysis

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In October 2003 the International VLBI Service for Geodesy and Astrometry (IVS) installed Working Group 3 (WG3) 'VLBI 2010' to examine current and future requirements for geodetic VLBI systems. The question how VLBI could exploit its present resources more efficiently and how future VLBI networks could look like should be investigated. At the IGG, Vienna different kind of simulations are carried out to evaluate new observing strategies and schedules, to improve modeling of the troposphere and the clocks, to find the best antenna configuration and to optimize the network geometry. To get reasonable geophysical conclusions out of the VLBI analysis, the designed networks contain two stations on each main tectonic plate. Networks with up to 40 stations are tested. Main part of the simulation studies is a so called Monte Carlo simulator that creates the artificial observations which are entered in the OCCAM VLBI software package. The most limiting factor of the VLBI system is the influence of the wet zenith delay. Therefore, turbulence models using wind speed and wind direction information from numerical weather models are used in the Monte Carlo Simulator to simulate realistic wet zenith delays. The criteria to evaluate the potential of the VLBI-system are: baseline length repeatabilities, formal errors of Earth orientation parameters and the agreement between the simulated stochastic processes (troposphere, clocks) and their estimates. The main goal of VLBI 2010 is to design a new VLBI system, i.e. the next generation of VLBI technology, that will provide baseline length repeatabilities of less than 1mm for the longest baselines in the network.