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The Combination of Kalman Filter and Least-Squares Solutions of Different VLBI Analysis Centers

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The IVS (International VLBI Service for Geodesy and Astrometry) Analysis Centers (BKG (Federal Agency for Cartography and Geodesy), NASA GSFC (Goddard Space Flight Center), DGFI (Deutsches Geodaetisches Forschungsinstitut), SHA (Shanghai Astronomical Observatory), USNO (U.S. Naval Observatory), MAO (Main Astronomical Observatory), AUS (Geoscience Australia)) use various analysis softwares to analyze geodetic VLBI observables. The software packages apply different statistical methods and a priori information to derive the parameters of interest. These statistical methods are the Least-Squares (LSQ) method, the Kalman filter (KF) method, the Square-Root Information Filter (SRIF) and the Least-Squares Collocation (LSQC) method. These statistical approaches differ in the propagation of variance-covariance information and the behaviour of the stochastic parameters. However, it is difficult to state that one solution is better than the other. The quality of products of geodetic Very Long Baseline Interferometry (VLBI) observations are improved in terms of reliability, robustness and accuracy if the results of different analysis software packages are combined using a suitable combination process (intra-technique combination). In our previous combination algorithm, the normal equations in SINEX format were taken on a session-by-session basis from five different IVS Analysis Centers (BKG, GSFC, DGFI, SHA, USNO) which apply only LSQ solutions. With this study, we start to consider Kalman filter and LSQ in our combination, too. It is aimed to present ideas and to discuss problems about such a possible combination. The Kalman filter with stochastic models is an alternative approach to the use of polynomials to model the effects of the clocks and atmospheric delays. The effect of the stochastic models on the

estimates of geodetic parameters and the quality of these estimates will be compared to the conventional LSQ method.