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Realization of time sequential estimation of terrestrial reference frame using square-root information filter and smoother

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The JTRF2014 realization of terrestrial reference frame has adopted a weekly time series representation that can track dominant non-linear station motions including periodic and random variations. The realization is based on the Kalman filter and smoother algorithms whose time sequential nature would also be suitable for continuous updating of an existing frame as soon as new geodetic data become available.

As a part of preparation for the next reference frame realization, we have been examining alternative filter and smoother algorithms based on the square-root information filter (SRIF), known generally for improved numerical accuracy of the covariance matrix represented by a square-root matrix.

The new algorithms offer a number of other advantages over the conventional filter/smoother algorithms used in JTRF2014. Namely, the new approach allows us to (1) avoid using some fictitious covariance matrix to initialize the filter, (2) avoid the random-walk constraints for the Helmert parameter sequences, and (3) handle cross-temporal EOP data such as the week-long segments reported by the SLR and DORIS networks. We have also been enhancing the stochastic models of the station position motion to be used by the filter and smoother, including models for non-tidal deformation.