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Investigation of the noise properties at low frequencies in long GNSS time series

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The accuracy by which velocities can be estimated from GNSS time series is mainly determined by the low frequency noise, below 0.2-0.1 cpy, which are normally described by a power-law model. As GNSS observations have now been recorded for over two decades, new information about the noise at these low frequencies has become available and we investigate whether alternative noise models should be considered using the log-likelihood, Akaike and Bayesian information criteria. Using 110 globally distributed IGS stations with at least 12 years of observations, we find that for 80-90% of them the preferred noise models are still the Power-Law or Flicker noise with White noise. For around 6% of the stations, we found the presence of random-walk noise, which increases the linear trend uncertainty when taken into account in the stochastic noise model of the time series by about a factor of 1.5 to 8.4, in agreement with previous studies. Next, the General Gauss Markov with White noise model describes the stochastic properties better for 4% and 5% of the stations for the East and North component respectively, and 13% for the vertical component. For these stations, the uncertainty associated with the tectonic rate is about 2 times smaller compared to the case when the standard Power-law plus White noise model is used.