Validation of CryoSat-2 based lake levels

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Introduction

The presented work investigates the performance of CryoSat-2 in SAR mode for lake level estimation compared to conventional satellite altimetry from e.g. Envisat. A novel methodology is used in the construction of the time series, where temporal correlation and erroneous observations are accounted for. The water levels are evaluated in terms of along-track precision and agreement with in-situ data. The study area includes lakes from Denmark and Sweden with a surface area of just 9 km^2 to 5655 km^2. We find an along-track precision of a few cm, even for the small lakes and an RMS value of 5 cm when comparing with in-situ data
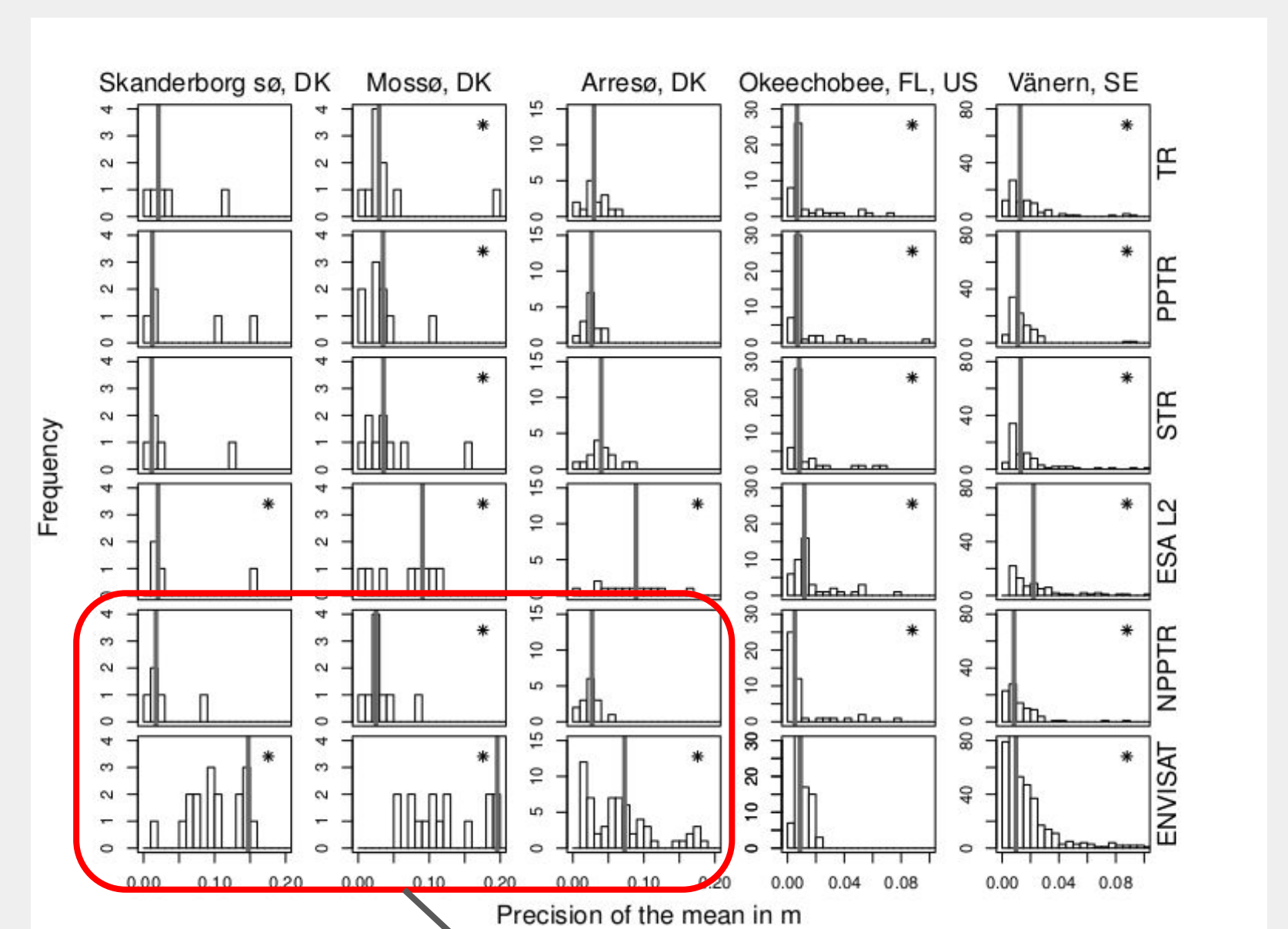
Study area

The figure on the left displays the study area with CryoSat-2 (blue) and Envisat (red) tracks [1].
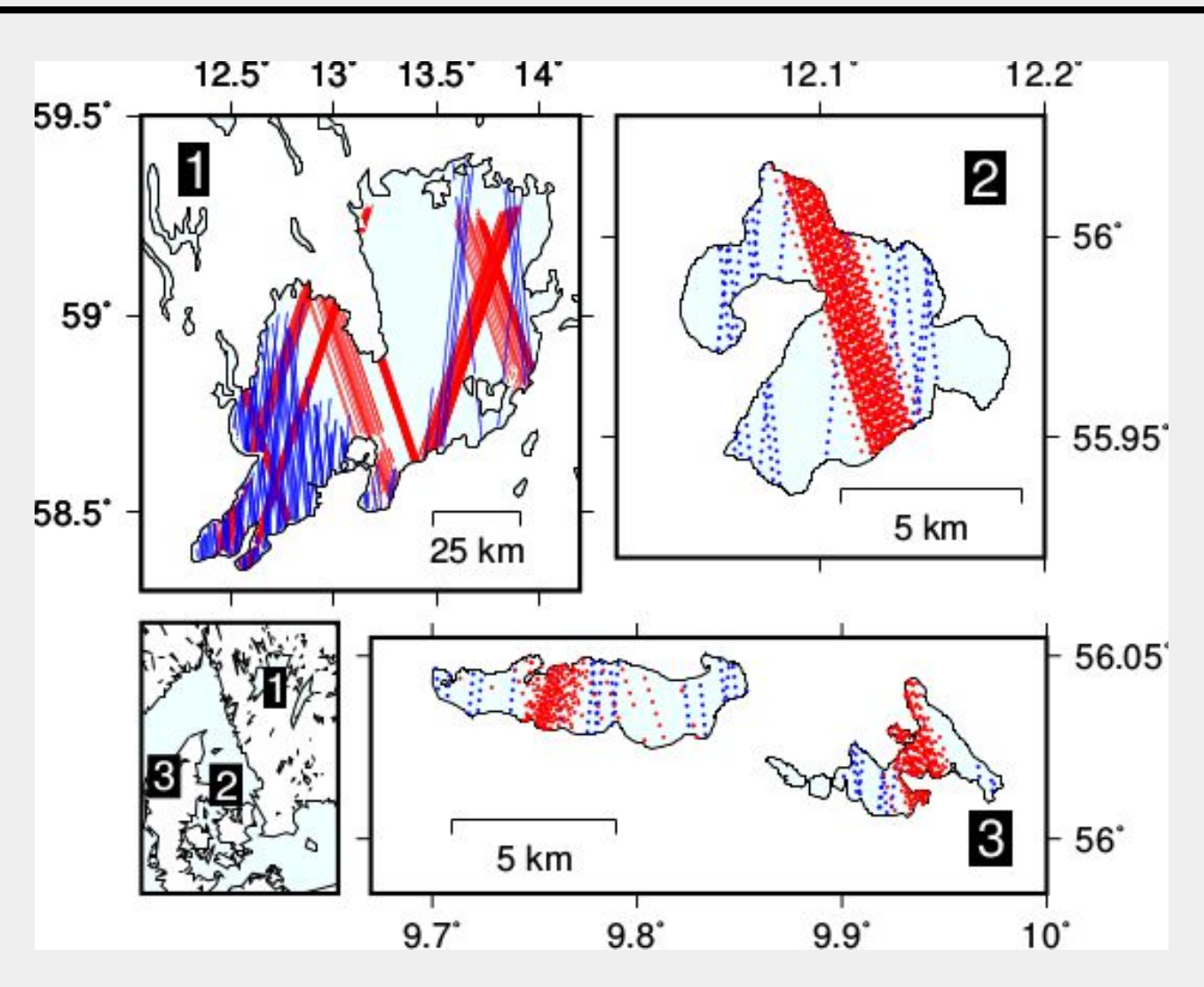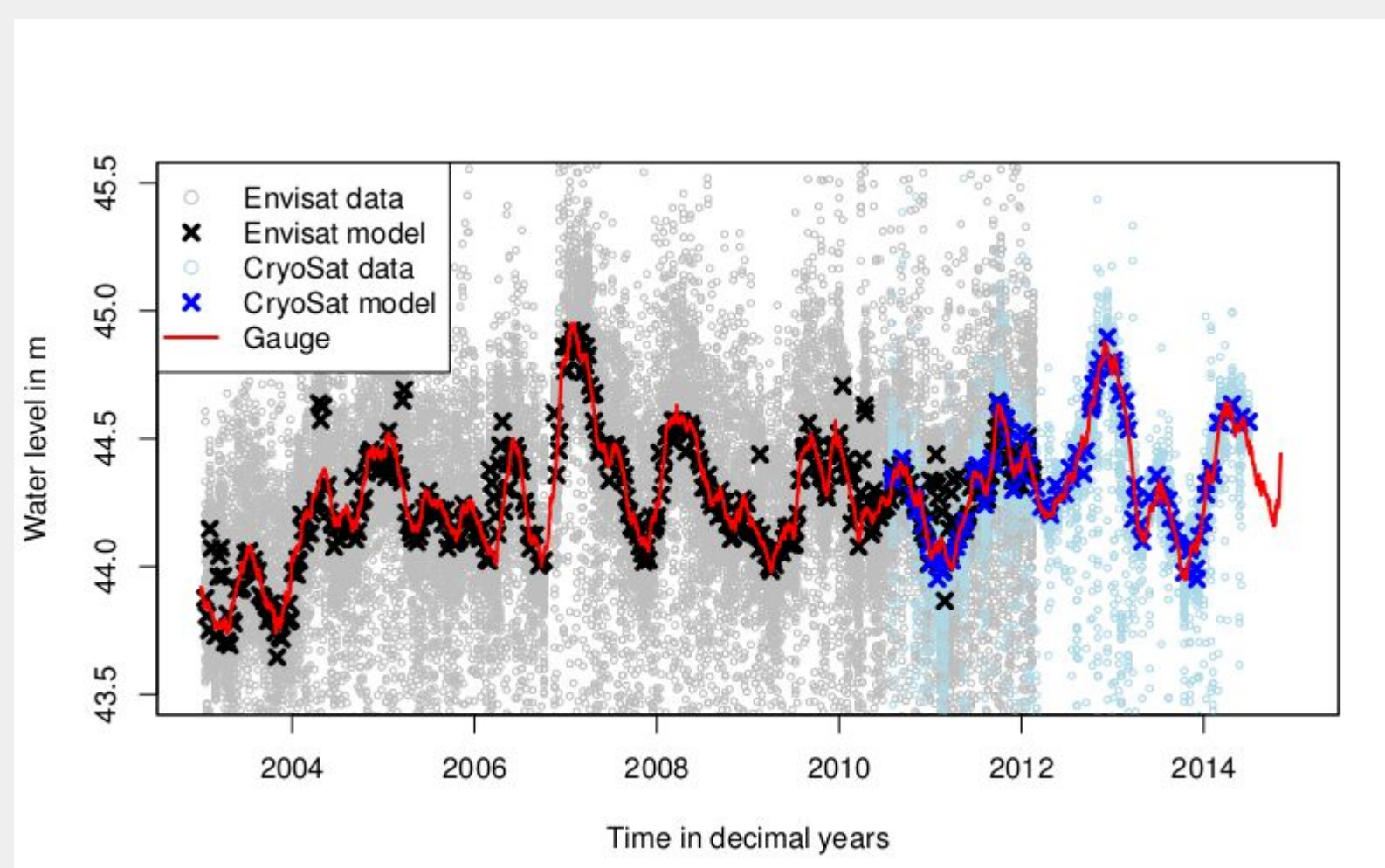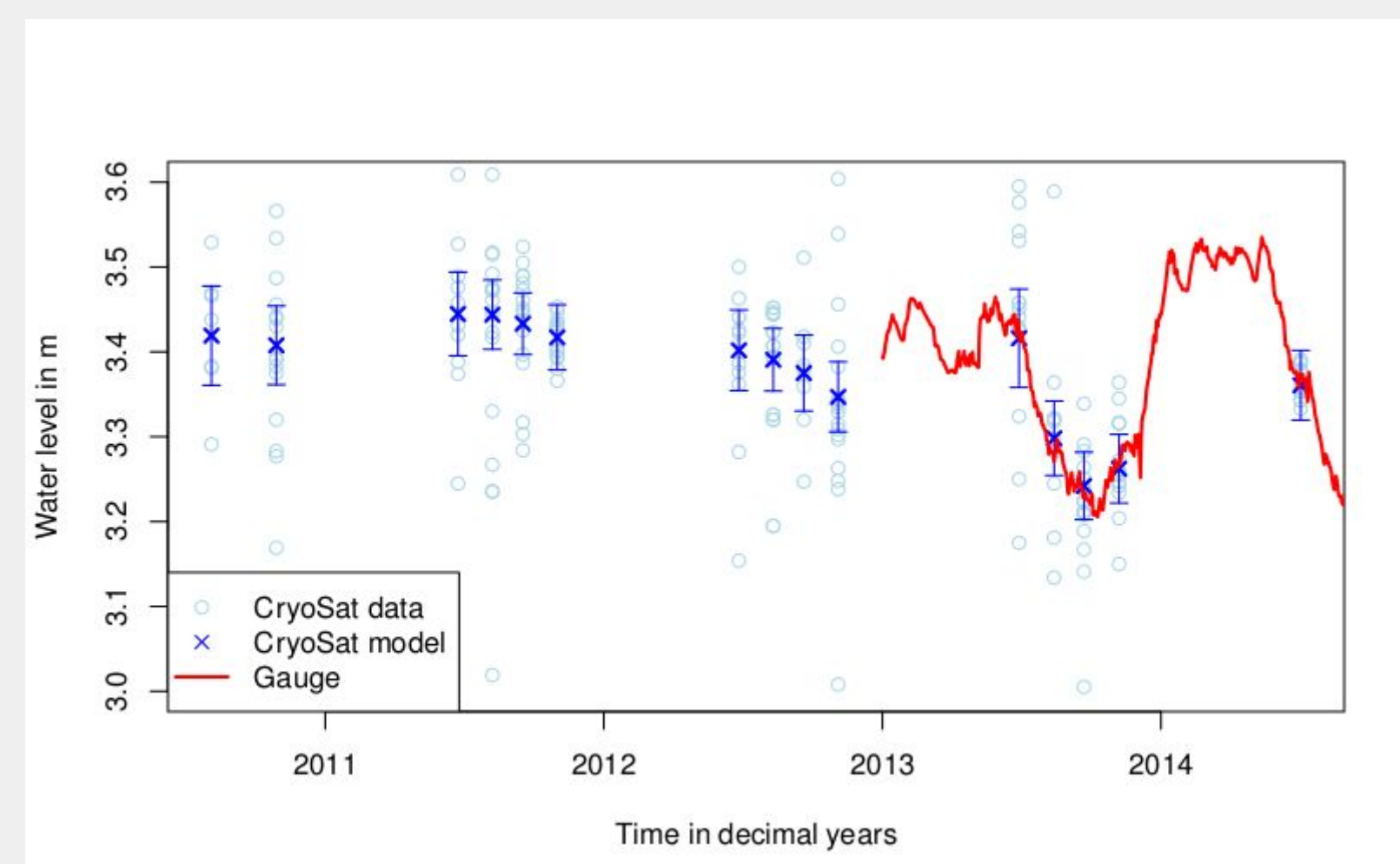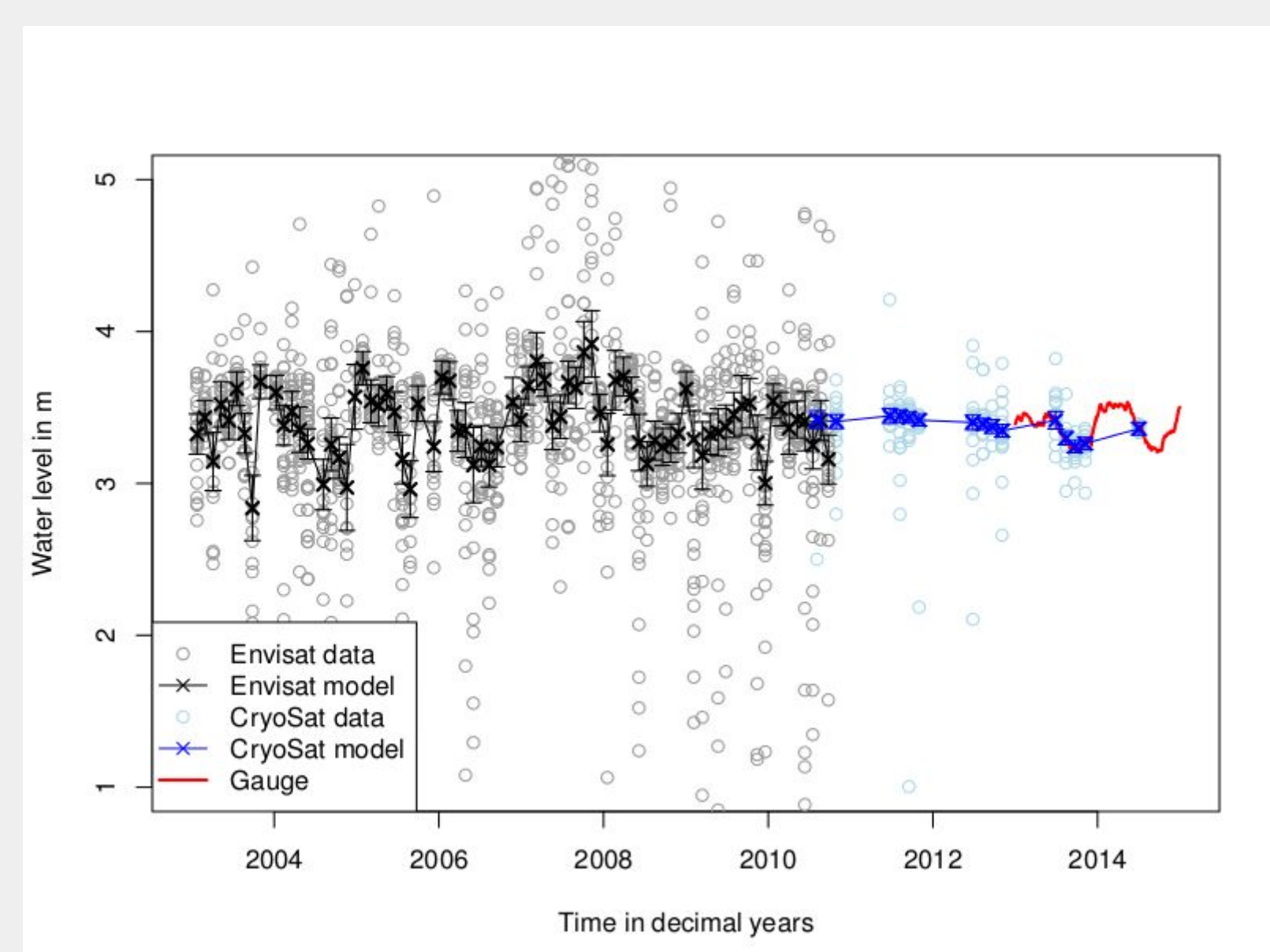

Precision

The plot below displays the precision, which here is defined as the standard deviation of the along-track mean value [1].

A significant improvement is obtained with CryoSat-2 for the small lakes.

Time series

Lake levels of Arresø (left) and Vänern (down) based on CryoSat-2 (blue) and Envisat (black) compared to in-situ data (red) [1].


Methodology

The time series are constructed with a state-space model, where the process model is described by a random walk and the observation model is given by the true water level plus an error term. The error term follow a mixture distribution (Normal + Cauchy), which enable us to account for erroneous observations [1, 2, and 3].
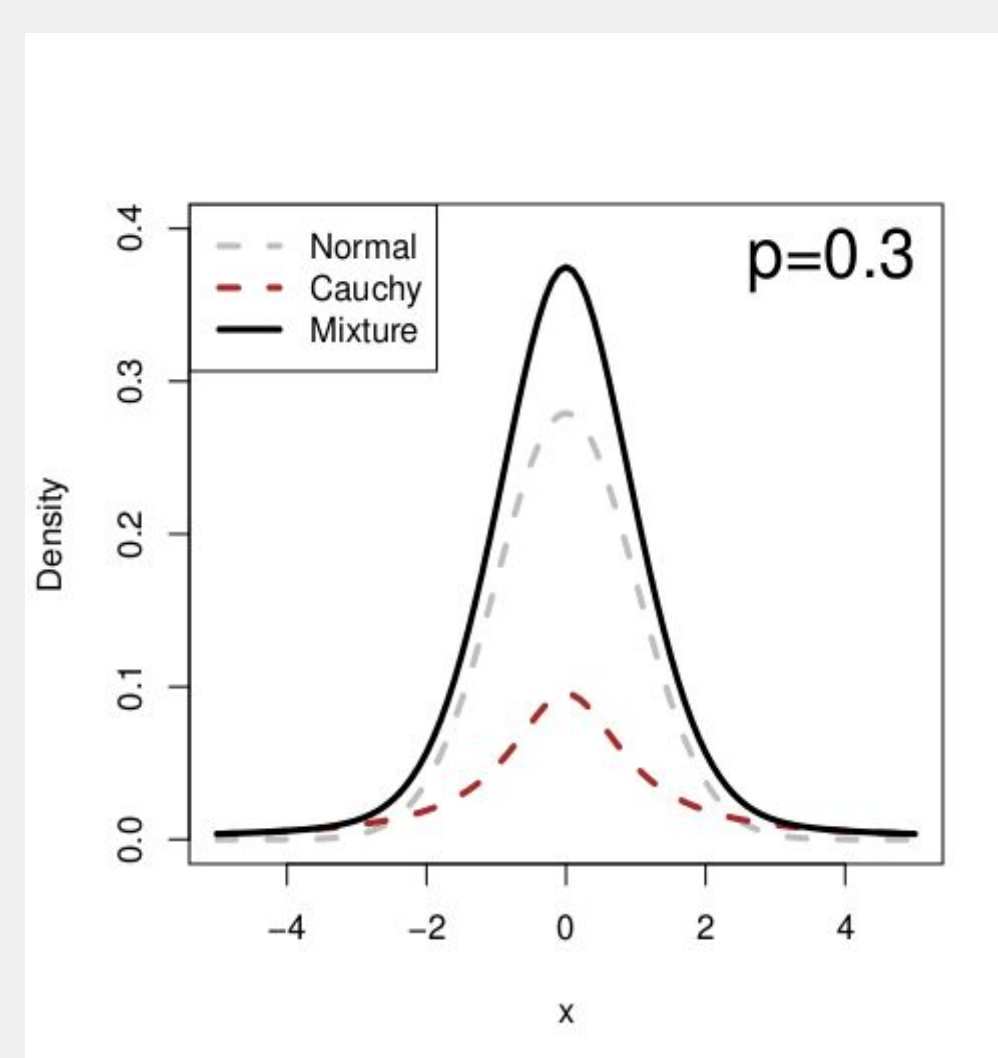
The mixture distributions has heavier tails, which makes it more robust
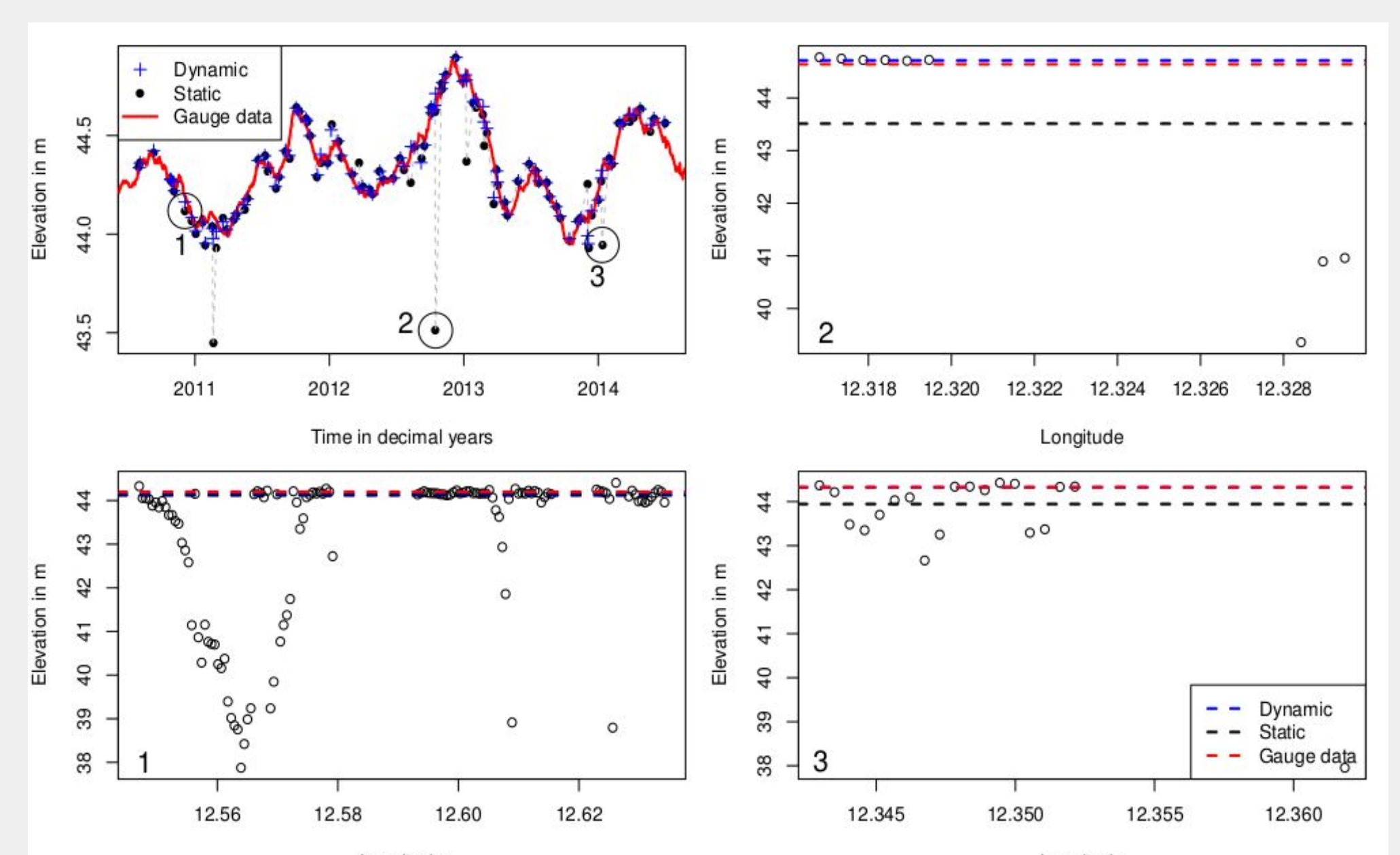
Taking the temporal correlation into account, in the time series, improves the water level estimates

References
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