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The statistical analysis of geodetic deformation (velocity and strain rate) derived from the space geodetic measurements of BIFROST project in Fennoscandia

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With the new space geodetic techniques, such as GPS, VLBI, SLR and DORIS, positions and change rates of network stations can be accurately determined from the regular measurement campaign, which is acknowledged as an accurate and reliable source of information in Earth deformation studies. This fact suggests that the components of deformation measures (such as the stress or strain tensor, etc.) can be estimated from the highly accurate geodetic data and analyzed by means of the proper statistical testing procedures. While station velocity diagrams demonstrate relative motions among stations, strain rate diagrams show the in-situ strain concentration rate which is directly connected to local stress concentration rates and possibly also to seismic hazard potentials. Therefore, the strain analysis can be considered as a basis of a dynamic model whereas the classical deformation analysis is similar to a kinematic model. We begin with discussion of the geodynamic setting of the selected investigated regions: Fennoscandia. Then the space geodetic observations in the frame of the BIFROST Project are introduced. Thirdly the methods of derivation the two-dimensional geodetic strain rates tensor are introduced and applied to derive the strain rates from the surface residual velocities, which are based on the Finite-Element-Method (FEM). In a case study the strain rates tensors in Fennoscandia and the variance-covariances of their eigenspace components are derived. Further detailed analysis of the results is also performed with respect to geodynamical and statistical aspects.