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Computation and evaluation of new consistent orbits of Envisat, ERS-1 and ERS-2 in the ITRF2008 reference frame

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New orbits of Envisat (Environmental Satellite) and the European Remote Sensing Satellites ERS-1 and ERS-2 have been derived in the same for all satellites ITRF2008 terrestrial reference frame using consistent models based mainly on the IERS Conventions (2010) within the Sea Level project of the European Space Agency (ESA) Climate Change Initiative. The orbits are computed using satellite laser ranging (SLR) and altimeter crossover data for ERS-1, additionally Precise Range And Range-rate Equipment (PRARE) measurements for ERS-2 and using SLR and Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) observations for Envisat. The orbit solutions cover the time spans August 1991 to July 1996 for ERS-1, May 1995 to July 2003 for ERS-2 and April 2002 to December 2010 for Envisat. The paper describes the models and processing algorithms used for precise orbit determination and the results obtained. The quality of these new orbit solutions is presented in the comparison with the quality of the previous orbit solutions computed in the ITRF2000 within "Sea Level Variations - Prospects from the Past to the Present (SEAVAR)' project and in the ITRF2005 within the ESA project "Reprocessing of Altimeter Products for ERS (REAPER)" for ERS satellites and some external orbits for Envisat. The results of the orbit evaluation and examples of applications of the new orbit solutions for the sea level investigations are given.