Improved orbit solutions of the European Remote Sensing Satellites ERS-1 and ERS-2 have been computed in the ITRF2005 terrestrial reference frame using the recent models based mainly on IERS Conventions 2003. These solutions cover the periods 3 August 1991 to 8 July 1996 for ERS-1, and 3 May 1995 to 4 July 2003 for ERS-2. For each satellite, the final orbit solution is based on a combination of three separate orbit solutions independently computed at the Delft Institute of Earth Observation and Space Systems (DEOS) of the Delft University of Technology (The Netherlands), the Navigation Support Office of the European Space Operations Centre (ESOC, Germany) and the Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences (Germany) using three different software packages for precise orbit determination, but using the same models in the same terrestrial reference frame within the European Space Agency (ESA) project ‘Reprocessing of Altimeter Products for ERS (REAPER)’. Validation using radar altimeter data indicates that the new combined orbits of ERS-1 and ERS-2 computed by us are significantly more accurate, approaching the 2–3 cm level in radial direction, than previously available orbit solutions.