Abstract. Sensors on satellites provide unprecedented understanding of the Earth's climate system by measuring incoming solar radiation, as well as both passive and active observations of the entire Earth with outstanding spatial and temporal coverage. A common challenge with satellite observations is to quantify their ability to provide well-calibrated, long-term, stable records of the parameters they measure. Ground-based intercomparisons offer some insight, while reference observations and internal calibrations give further assistance for understanding long-term stability. A valuable tool for evaluating and developing long-term records from satellites is the examination of data from overlapping satellite missions. This paper addresses how the length of overlap affects the ability to identify an offset or a drift in the overlap of data between two sensors. Ozone and temperature datasets are used as examples showing that overlap data can differ by latitude and can change over time. New results are presented for the general case of sensor overlap by using SORCE SIM and SOLSTICE solar irradiance data as an example. To achieve a 1% uncertainty in estimating the offset for these two instruments' measurement of the Mg II core (280 nm) requires approximately 5 months of overlap. For relative drift to be identified within 0.1% per year uncertainty (0.00008 watts m^{-2} nm^{-1} yr^{-1}, the overlap for these two satellites would need to be 2.5 years. Additional overlap of satellite measurements is needed if, as is the case for solar monitoring, unexpected jumps occur adding uncertainty to both offsets and drifts; the additional length of time needed to account for a single jump in the overlap data may be as large as 50% of the original overlap period in order to achieve the same desired confidence in the stability of the merged dataset. Results presented here are directly applicable to satellite Earth observations. Approaches for Earth observations offer additional challenges due to the complexity of the observations but Earth observations may also benefit from ancillary observations taken from ground-based and in situ sources. Difficult choices need to be made when monitoring approaches are considered; we outline some attempts at optimizing networks based on economic principles. The careful evaluation of monitoring overlap is important to the appropriate application of observational resources and to the usefulness of current and future observations.