The marginal seas of the Arctic Ocean are well recognized as strong ice producers and might gain special attention regarding ice volume changes in the Arctic Ocean. Hence, quantifying the ice production taking place on Arctic shelves inside leads polynyas and over extensive thin ice areas is one of the major challenges of current polar research. Aim of this study is to investigate different satellite-based methodologies with respect to their applicability for operational investigations of shelf sea ice formation. First we provide an overview of the existing methods currently in use to detect polynya/lead features and to number associated ice formation. Second, we compare satellite-derived characteristics with helicopter-borne ice thickness measurements and aerial photography acquired during field campaigns. We further assess the applicability of the newly launched Soil Moisture and Ocean Salinity (SMOS) satellite for investigations of shelf sea ice. The spatial resolution of the MIRAS instrument is of course too low to observe leads or polynyas, but the high temporal coverage makes it a valuable tool to monitor extensive thin ice areas.