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Present-day low-orbit constellations of Earth remote sensing spacecraft with synthetic aperture radar

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The purpose of this work is to determine the current trends in the development of low-orbit constellations of spacecraft with synthetic aperture radar (SAR), which have a number of significant advantages in Earth remote sensing. It is shown that the demand for Earth remote sensing data and products and services based thereon continues to grow worldwide. The applicability of SAR to Earth remote sensing is considered. The main differences and advantages of image acquisition using SAR spacecraft in comparison with optical spacecraft are shown. The main directions of using low-orbit SAR spacecraft in Earth remote sensing are identified. Land and water surface observation using SAR spacecraft is shown to be one of the most effective remote sensing methods. In particular, it is shown that low-orbit spacecraft constellations can be used to advantage in solving many tasks in the socio-economic sector and tasks aimed at continuous real-time monitoring of various objects. The characteristics of the various Earth remote sensing spacecraft constellations, in particular low-orbit commercial ones, launched into orbit during the past decade are considered. Problems in and prospects for the development of low-orbit SAR spacecraft constellations are elucidated. Existing and planned SAR spacecraft constellations with traditional and mini-satellite platform technologies are overviewed. It is shown that the performance characteristics continue to improve, thus allowing one to get data from any area of the Earth at any time. It is shown that small spacecraft in low and ultralow orbits have significant benefits over traditional spacecraft in power characteristics, but are outperformed by them in the duration of communication sessions and active life. The results obtained make it possible to work out recommendations on the designing of low-orbit constellations of domestic Earth remote sensing spacecraft, in particular on the development of orbit determination models and algorithms and spacecraft dynamics models.

Keywords: *Earth remote sensing, low-orbit spacecraft constellations, synthetic aperture radar, spatial resolution, swath width, scene, revisit time.*

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