REDUCING THE COMPLEXITY OF SATELLITE THERMAL IMAGERS THROUGH DENOISING ALGORITHMS

R. E. Ryan, M. Pagnutti, K. Holekmap
Innovative Imaging and Research, Stennis Space Center Mississippi USA (rryan@i2rcorp.com)

Commission I

KEY WORDS: Infrared imaging, Landsat, Denoising, Uncooled detectors

ABSTRACT:

While Landsat thermal infrared imaging is valuable for many applications, expensive thermal sensors are difficult to include in land imaging satellites. Traditional infrared satellite-based sensors use exotic semiconductor detectors that operate at cryogenic temperatures. The need for these types of detectors contributes to the high cost and complexity of thermal land imagers. Uncooled thermal detectors like silicon microbolometers have been proposed as a low cost alternative. These sensors work at room temperature and are commonly used in many terrestrial applications. Uncooled detectors, however, are less sensitive than cooled detectors and need relatively long integration times to achieve the necessary sensitivity for satellite-based thermal land imaging applications. At a nominal 100 m spatial resolution, uncooled detectors aboard a low earth orbiting satellite need some form of forward-motion-compensation to achieve a long integration time while still preserving spatial resolution. The need for forward-motion-compensation can drive detector architecture, processing and satellite pointing stability. In this paper, we discuss how sensitivity can be improved with denoising processing algorithms, which lower the effective image noise while preserving spatial resolution, reducing the need for long integration times and the amount of forward-motion-compensation. Since the denoising processing can be done on the ground, the on-board sensor and satellite operation can be less complex, thus reducing on-board costs.