Integrated Polar-Geostationary Physical Collocation System for GOES-R

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1. INTRODUCTION

From a system point of view, geo-stationary satellite observations can ensure coverage with high temporal sampling and fairly high ground resolution, but with a lower signal-to-noise ratio and a lack of spectral resolution needed to obtain highly accurate atmosphere property retrievals. Polar satellites have a relatively high signal-to-noise ratio, high spectral resolution, and wide spectral coverage but they have a fairly poor temporal resolution. The Integrated Polar-Geostationary Observation System project for GOES-R aims at a combined product using observation data/derived products from GOES-R with observation/derived products from polar observation systems (AIRS, IASI, CrIS et .al) of complementary specifications.

The Integrated Polar-Geostationary Satellite system will be used in two ways. It will provide the polar processing system with high spatial resolution (sub pixels level) and high temporal resolution Advanced Baseline Imager (ABI) observations/derived products to improve the polar system retrieval. Also, the integration system will provide the GOES-R processing system with high spectral resolution and high signal-to-noise ratio polar observations/derived products for GOES-R instrument inter-calibration, system performance monitoring and retrieval algorithms evaluation.

2. METHODOLOGY

The Integrated Polar-Geostationary Satellite system includes two basic processing steps: observation collocation and observation regulation.

Collocation: Observation collocation processing is to select the polar and geostationary pixels that are spatially collocated, temporally concurrent, and geometrically aligned. GOES-R ABI data will be stored on a fixed grid. This allows the collocation to be accomplished using polar observation geo-location information and spatial response function information [1]. The fixed grid GOES-R point is mapped to the polar observation spatial response matrix to get the weight of its contribution. The fixed grids with non zero weight will be collocated.

Regulation : Observation regulation is when collocated GOES-R data are 'regulated' to the same physical target of the polar observation. This includes unification of the spatial characteristics of the observations in which the collocated fixed grids point data are averaged with the contribution weight applied. This unification may be applied to the spectral and temporal data information as well.

3. POLAR-GEOSTATIONARY OBSERVATION

Geostationary fixed grid frame observation: The geometric correction and registration of ABI observations to a fixed grid are achieved by resampling. Resampling is an interpolation process that estimates the value of a pixel as the weighted sum of surrounding detector samples. The general resampling algorithm process averages a 4x4 subset of detector of samples around the fixed grid. Two resampler kernels functions are provided for each spectral channel to assign a weight to each detector sample included in the interpolating sum. One kernel operates along the rows of detector samples and the other operates independently along the columns of detector samples.

The GOES-R ABI spatial resolution is defined by the sensor system sinusoidal Modulation Transfer Function (MTF). The MTF values are consistent with 0.5 kilometer resolution in the 0.64 micron channel, 1.0 kilometer resolution in the 0.47 micron channel, 1.0 kilometer resolution in the 0.86 micron channel, 1.0 kilometer resolution in the 1.61 micron channel, and 2.0 kilometer resolution in all other channels. The ABI system MTF shall meet the requirements when averaged over all resampling phases of the detector sample grid to pixel grid.

Polar observations: Polar satellite observations generally have low spatial resolution. The effective field of view (EFOV) spatial response function(SRF) of the polar observation is applied in collocation processing and regulating processing. The effective spatial response function is defined by an instrument instantaneous field of view (IFOV) spatial resolution function and an instrument scan-integration pattern. For continual scanning and integration type instrument (AIRS) a general processing scheme for calculating EFOV from IFOV has been discussed in another paper [1]. For stepwise instruments (IASI), the IFOV SRF can be used directly.

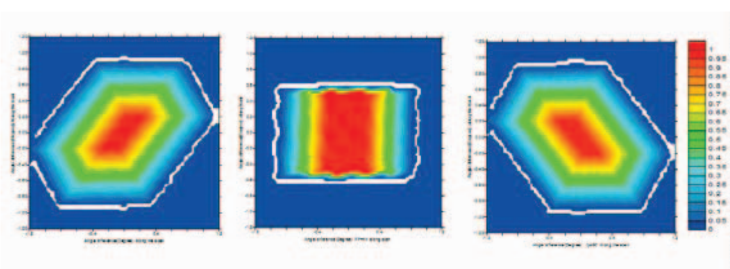

Figure 1.0 AIRS SRF

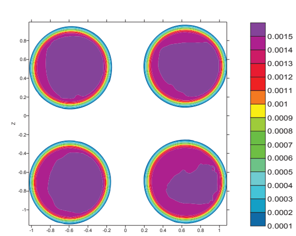

Figure 2.0 IASI SRF

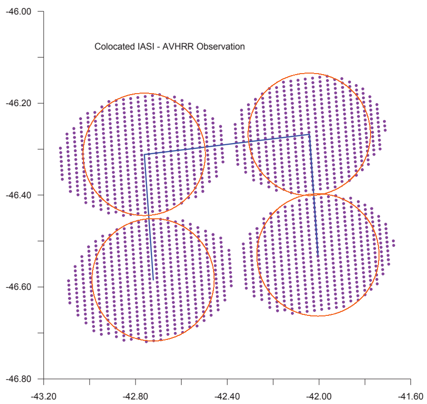

Figure 3.0 IASI Co-location

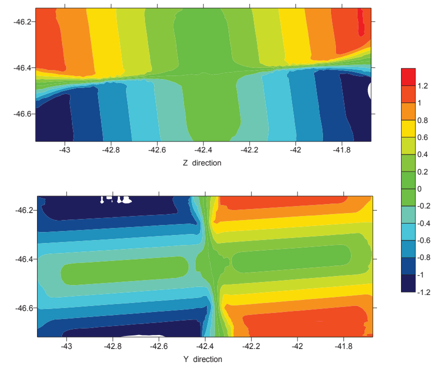

Figure 4.0 IASI SRF Mapping

4. CONCLUSION

An integrated Polar-Geostationary satellite system that integrates ABI observations/derived products with observations/derived products from polar satellites is currently under development. The integrated dataset will be used for retrieval algorithm development, instrument inter-calibration and GOES-R retrieval product validation. The current integration system can be used to process IASI–SEVIRI collocations.

5. BIBLIOGRAPHY

[1] Haibing Sun ,Walter wolf, Co-location algorithms for satellite observations. (14th Conference on Satellite Meteorology and Oceanography p6.25 2007)