Radiometric Differences Between AIRS, CrIS and IASI Derived for the CHIRP

AIRS Science Team Meeting

L. Larrabee Strow[1,2], C. L. Hepplewhite[1,2], H.M.Motteler[1,2], Sergio DeSouza-Machado[1,2], S. Buczkowski[1,2]

September 25, 2019

[1] UMBC Physics Dept.

[2] UMBC JCET

Overview

Overview of talk

- Definition of the CHIRP
- Establish the framework for determining radiometric records from the different sensors.
- Attribute quality and uncertainty for each channel.
- Utilization of large data sets of overlapping observations to quantify radiometric offsets between the sensors.
- Examples of results for single footprint observations.
- Issues concerning spatial & temporal sampling and gridded are not covered here.

CHIRP

The Climate Hyperspectral Infra-red Radiance Product

- Spectrally equivalent to CrIS in medium resolution - which for the CrIS sub-bands relates to 0.8/0.6/0.4cm OPD (LW/MW/SW resp.)
- The total number of channels available to use depends on the overlap of the parent sensor, for example AIRS L1C with 2645 channels to the CrIS MSR with 1683 with two guard channels per band edge.
- Covers the time period from AIRS L1C data availability (Sep 2002) to the present, with a transition from AIRS to CrIS proposed on Sep 2016.
- Operational overlap between sensors is now considerable: AIRS:CrIS Since 2012, AIRS:IASI from 2007 etc.
- The AIRS L1C currently includes cleaned and filled channels, the CHIRP will use drift corrected AIRS spectral radiance.

The CHIRP cont.

- CHIRP channels will carry the AIRS L1C noise, quality flag and L1C processing information (up to the transition date).
- CHIRP will have the same stability characteristucs as the parent sensor (AIRS before and CrIS after the transition date).
- Each CHIRP channel has information from close neighbor parent AIRS channels (through the deconvolution/translation algorithm) so quality information will be weighted accordingly.
- The AIRS fill channels are used and the corresponding CHIRP channels retained but will be flagged for the user. (See below for more details).
- After the transition date (Sep 2016) CrIS-NPP L1C data have been available in FSR (0.8/0.8/0.8cm LW/MW/SW OPD) resolution and therefore the translation to the MSR grid is straightforward and carrying quality data to CHIRP simpler.

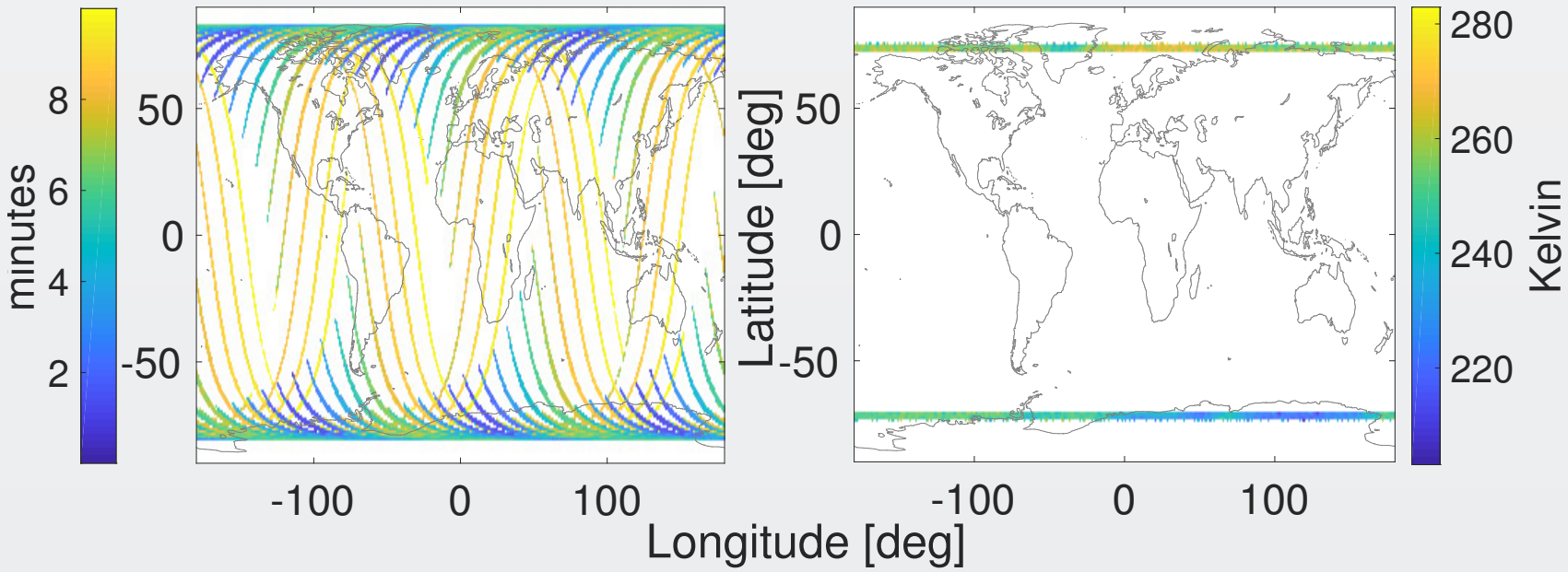
Data Sets

SNO and Global Random Data Sets

- Simultaneous nadir overpass (SNO) sets of observations have been accumulated for each pair of sensors: AIRS&CrIS (NPP and N20), AIRS&IASI (MetOp-A and B), CrIS&IASI (two sets).
- SNOs are best for precise intercomparison but are weighted to high latitudes.
- Global random observations are available for several years. Not restricted to field of view/regard, year long statistics (to capture all scene types) and corrected for mean view angle differences.
- Global random sets are sampled so that equal areas have equal numbers of observations (uniformly weighted with latitude).

Recap SNOs

- SNOs availability is dependent upon the relationship between the orbits of the two spacecraft. AIRS&Cris SNOs and IASI&CrIS SNOs are distributed as shown here:



Recap SNOs 2

- The different data sets cover slightly different ranges of scenes: more evident in the window channels than optically think channels.