# ccast intro and overview

H. E. Motteler

UMBC Atmospheric Spectroscopy Lab
Joint Center for Earth Systems Technology

August 27, 2014

# introduction

CCAST takes level zero data from the Cross-track Infrared Sounder (CrIS), a Fourier transform spectrometer on the Suomi NPP and JPSS weather satellites, and produce high-quality calibrated radiances. It is written primarily in Matlab, allowing for easy interaction, modification, and data visualization. We give a brief overview of the design, implementation, and use.

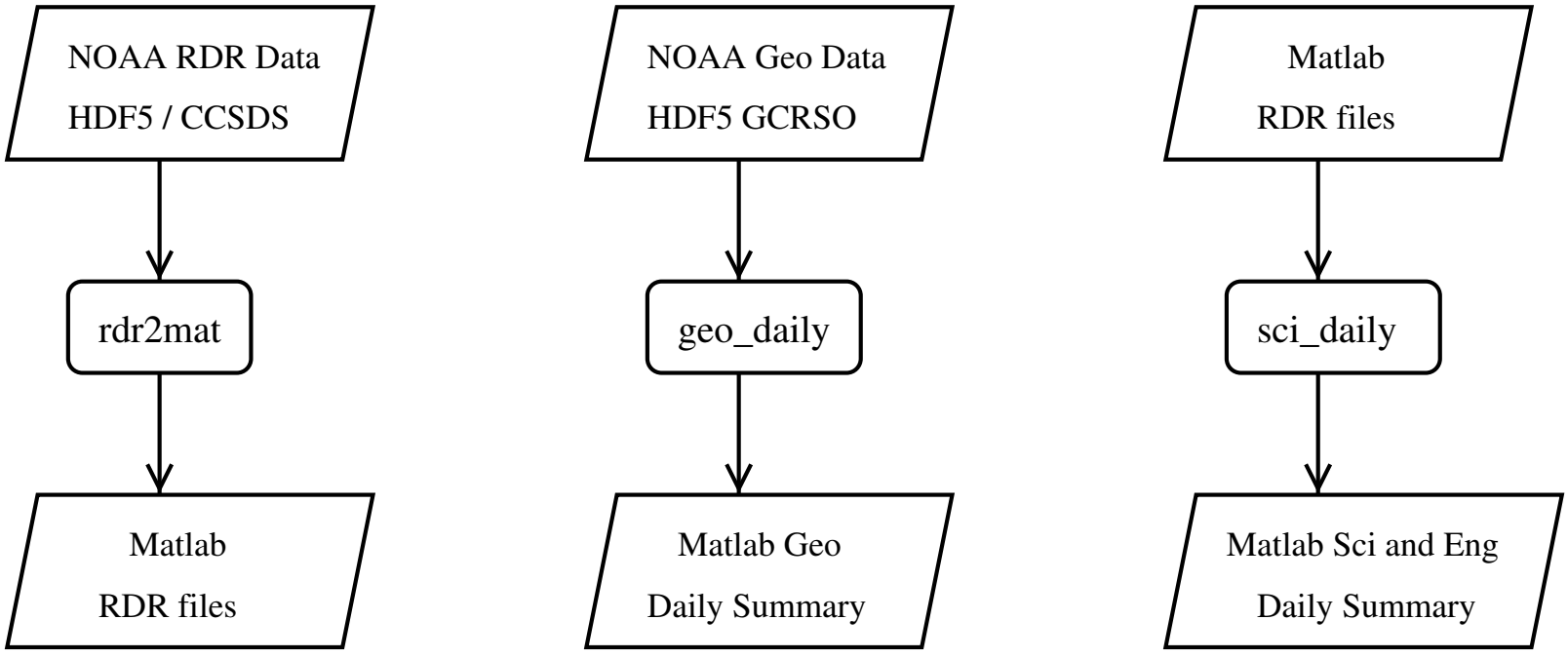
The authors of the UMBC CCAST are Howard E. Motteler, David Tobin, L. Larrabee Strow, and Dan Mooney, with interferometric parameters in spreadsheet form from Joe Predina.

CCAST is available as a GitHub public repository and is distributed under the terms of the GNU GPL v3.

# history

- CCAST started as a collaboration between UMBC and UW in fall 2011, with major components from the 2007-2008 FM1 bench and TVAC tests.
- H. Motteler wrote the L1a processing, starting with Dan Mooney's RDR reader, and L. Strow, Dave Tobin, and H. Motteler all collaborated on the L1b
- this forked into a UW version with Fred Nagel's geo that got first light, and a UMBC version with NOAA geo that got the first high res obs a month later.
- in the summer of 2012 H. Motteler updated the UW code to run in the UMBC environment, and for some time maintained both versions while continuing to develop the UMBC branch.
- major portions of the UW branch, including ICT modeling and the non-linearity correction, were updated and merged into the UMBC branch.

# preprocessing




main ccast processing

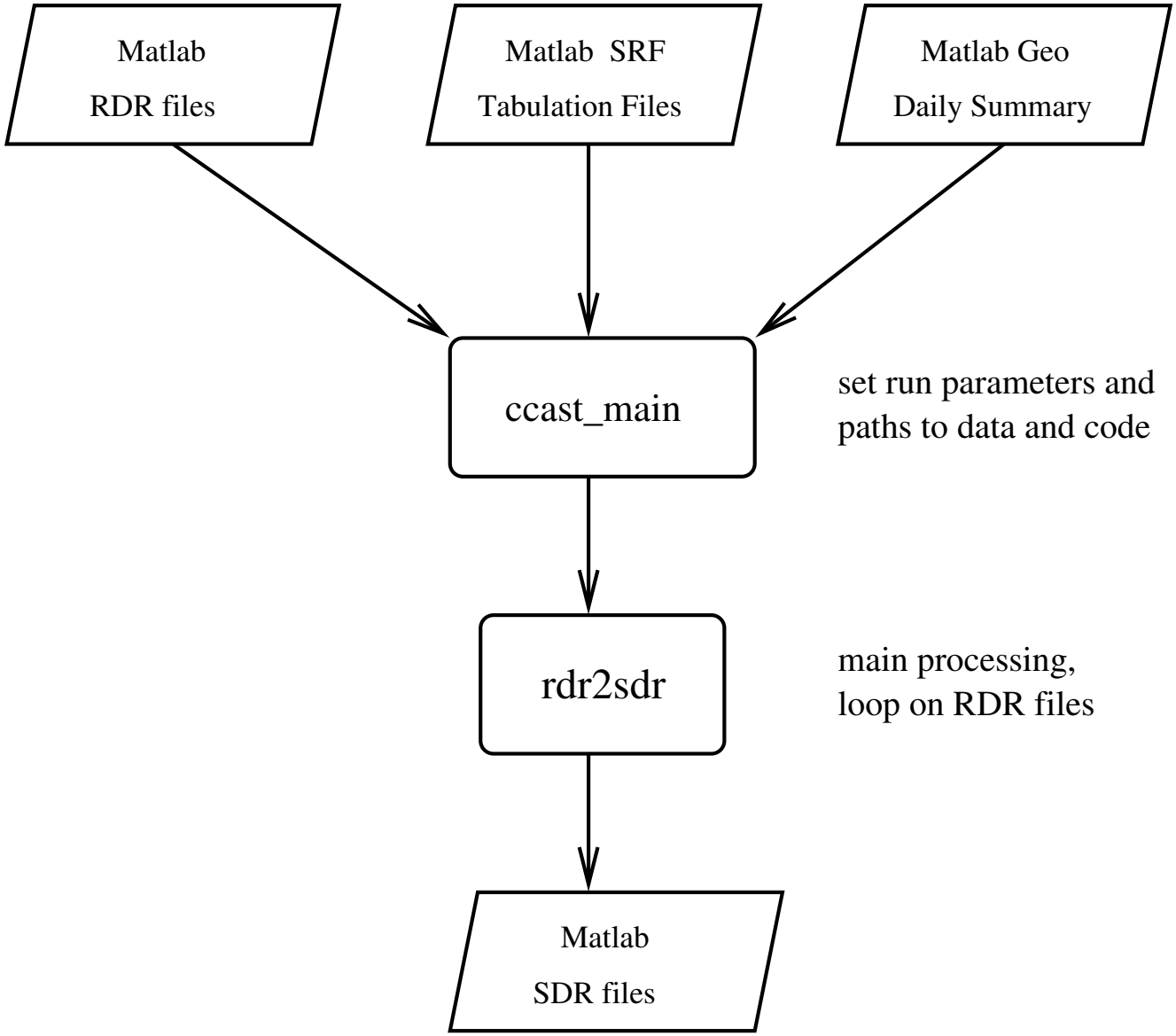
support

# preprocessing

CCAST processing is done in two passes—the first takes HDF and CCSDS data to Matlab files, and the second takes the Matlab files to calibrated radiances. The top-level preprocessing script is ccast_prepro. The main steps there are

- rdr2mat – read NOAA RDR files (CCSDS level 0 data with an HDF-5 wrapper) and produce Matlab RDR files, our working level 0 format.
- geo_daily – read NOAA GCRSO HDF-5 geo files and produce daily abstracts of CrIS geo data, as Matlab files.
- sci_daily – read Matlab RDR files and produce daily abstracts of "science" (8 second) and "engineering" (4 minute) support data, as Matlab files.

# main processing



# main processing

ccast_main sets parameters and paths and calls rdr2sdr, which loops on Matlab RDR files, typically one set per day. The main processing steps in rdr2sdr are

- load the matlab RDR data
- process sci and eng support data
- order and validate interferogram data
- group interferogram data into scans
- take interferograms to count spectra
- take ICT and space look moving averages
- radiometric and spectral calibration
- save the matlab SDR data

# design notes

- control flow is transparent, with almost no control flags and no global variables
- interferometric and instrument parameters are set in the function inst_params, and runtime parameters in ccast_main.
- data is organized by scans rather than granules. The output SDR files follow the NOAA RDR input files but shift the data so that the SDR files always start with FOR 1.
- there is extensive L0 to L1a quality control but currently no explicit QC for the final calibrated product beyond keeping the complex residual

# performance

- CCAST produces high-quality calibrated radiances and high resolution processing has been an option from the start
- although it borrows significantly from the NOAA ATBD, key features such as the ILS, SA interpolation, and the form of the calibration equation were developed independently and in many cases have been adopted by other groups.
- runtime performance is good. Running as a single task rdr2sdr takes just over a minute to processes a 60-scan file
- reliability is good. We have repeatedly reprocessed all data from mission start with no problems.

# getting started

- to download the ccast repo
  git clone https://github.com/strow/ccast.git
- to update a local copy of the ccast repo
  git pull origin master
- see ccast/README for info on installation and testing, and for URLS to test data and sample SRF tabulations
- see ccast/doc for
  - ccast_intro.pdf – this document
  - ccast_eqns.pdf – ILS and main calibration equations
  - matlab_sdr.txt – output data format and fields
  - finterp.pdf – notes on Fourier interpolation