Description of the High Altitude MMIC Sounding Radiometer (HAMSR) Level 2 data format

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Overview

The High Altitude MMIC Sounding Radiometer (HAMSR) is a 25 channel cross-track scanning microwave sounder with channels near the 60 and 118 GHz oxygen lines and the 183 GHz water vapor line. A detailed description of the instrument and a characterization of its performance are found in Brown et al. 2011. The Level2 product contains time-ordered and geo-located brightness temperatures for the Earth scan for each of the 25 HAMSR channels along with retrieved products, including temperature and water vapor profiles, precipitable water vapor and integrated cloud liquid water and derived reflectivity. There are three flags of note, a land flag, sea ice flag and retrieval quality flag which are described below. The retrieved products are only valid when the land flag and sea ice flag are equal to zero. The HAMSR Level2 data files are in netCDF format.

Level2 Contents

Level 2 Product

The contents of the Level 2 files are shown in the following table. The variables in the netCDF file are also fully attributed and self describing. The cross track dimension is 42 and the along track dimension varies from flight to flight.

Variable Name	Variable Description	Variable Dimensions
HAMSR time	seconds since 2000-01-01 00:00:00.0	along track
pixel latitude	Latitude for each HAMSR pixel [-90:90]	cross track x along track
pixel longitude	Longitude for each HAMSR pixel [-180:180]	cross track x along track
altitude	Aircraft altitude from GPS in meters	along track
Re-sampled brightness temperature	Calibrated Brightness Temperature for the Earth scene resampled to a uniform posting. Default value is -1.	channel x cross track x along track
pixel Earth incidence angle	Earth incidence angle for each HAMSR pixel [0:89.9]	cross track x along track
aircraft latitude	Aircraft Latitude [-90:90]	along track
aircraft longitude	Aircraft Longitude [-180:180]	along track
aircraft roll	Aircraft Roll [-180:180]	along track

aircraft pitch	Aircraft Pitch [-180:180]	along track
aircraft heading	Aircraft Heading [-180:180]	along track
Land flag	0 – ocean >0- not ocean (retrievals currently not valid over land)	cross track x along track
Sea Ice Flag derived from NCEP	0 – no sea ice 1- sea ice present (retrievals not valid)	along track
Ancillary surface temperature	Surface temperature from NCEP (K)	along track
Ancillary surface elevation	Surface elevation from NCEP (m)	along track
Ancillary surface pressure	Surface pressure from NCEP (mb)	along track
Ancillary surface wind speed	Surface wind speed from NCEP (m/s)	along track
HAMSR precipitable water vapor –regression algorithm	Integrated water vapor in cm	cross track x along track
HAMSR cloud liquid water – regression algorithm	Integrated cloud liquid water in mm	cross track x along track
HAMSR Air Temperature Profile	Vertical air temperature from HAMSR at 33 levels [K]	cross track x along track x vertical
HAMSR Absolute Humidity Profile	Vertical Absolute Humidity from HAMSR at 33 levels [g/m^3]	cross track x along track x vertical
HAMSR Cloud Liquid Water Profile	Vertical cloud liquid water density from HAMSR at 33 levels [g/m^3]	cross track x along track x vertical
HAMSR Relative Humidity Profile	Vertical relative humidity from HAMSR at 33 levels [%]	cross track x along track x vertical
HAMSR Potential Temperature Profile	Vertical potential temperature derived from HAMSR profiles at 33 levels [K]	cross track x along track x vertical
HAMSR Equivalent Potential Temperature Profile	Vertical equivalent potential temperature derived from HAMSR profiles at 33 levels [K]	cross track x along track x vertical
HAMSR Lifting Condensation Level	Lifting condensation level derived from HAMSR profiles [mb]	cross track x along track
HAMSR Level of Free Convection	Level of free convection derived from HAMSR profiles [mb]	cross track x along track
HAMSR precipitable water vapor from profile	Integrated water vapor derived from HAMSR absolute humidity profile in cm	cross track x along track
HAMSR cloud liquid water from profile	Integrated cloud liquid water derived from HAMSR cloud water profile in cm	cross track x along track
HAMSR air temperature at the surface	Air temperature at surface retrieved from HAMSR [K]	cross track x along track
HAMSR relative humidity at the surface	Relative humidity at surface retrieved from HAMSR [%]	cross track x along track
HAMSR absolute humidity at the surface	Absolute humidity at surface retrieved from HAMSR [K]	cross track x along track
HAMSR air temperature at the flight altitude	Air temperature at flight altitude retrieved from HAMSR [K]	cross track x along track

HAMSR relative humidity at the flight altitude	Relative humidity at flight altitude retrieved from HAMSR [%]	cross track x along track
HAMSR absolute humidity at the flight altitude	Absolute humidity at flight altitude retrieved from HAMSR [K]	cross track x along track
HAMSR Profile Retrieval Quality Flag	0-good convergence and low residual error 1-converged with higher residual error (use with caution) 2-did not converge (use not recommended)	cross track x along track
HAMSR Profile Pressure Levels	Pressure at each of the 33 levels for the HAMSR vertical profiles [mb]	33 levels
HAMSR Height of Pressure Levels	Height at each of the 33 pressure levels for the HAMSR vertical thermodynamic profiles [m]	33 levels
HAMSR derived radar reflectivity profile	X-band reflectivity derived from HAMSR TBs at 33 levels [dBZ]	cross track x along track x vertical
HAMSR Height of Reflectivity Profile Levels	Height at each of the 15 levels where reflectivity is retrieved from HAMSR [m]	33 levels

References

Brown, S. T.; Lambrigtsen, B.; Denning, R. F.; Gaier, T.; Kangaslahti, P.; Lim, B. H.; Tanabe, J. M.; Tanner, A. B.; , "The High-Altitude MMIC Sounding Radiometer for the Global Hawk Unmanned Aerial Vehicle: Instrument Description and Performance," *IEEE Transactions on Geoscience and Remote Sensing,*; doi: 10.1109/TGRS.2011.2125973

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