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Space Administration

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California Institute of Technology
Pasadena, California

Consistent Level 2 and 3 Products from AIRS, CrIMSS, Part II

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Sounder Discipline Telecon
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From February: My Ranking of Challenges *Hard to Easy*

1. **Providing *consistent information content* from different instrument suites on separate platforms.**
   - ***Not something our community has done in the past.***

2. **Organizing that information in a way that is useful to ALL users.**
   - ***Many lessons learned already.***

3. **Implementing a common data format.**
   - ***Very familiar.***

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Challenge 1:
More Questions on Information Content

- **How do we interpret quality flags from non-identical instruments in different orbits?**
- **How do we convey vertical resolution from those different instruments?**
- **What about uncertainties?**
- **How might clouds affect their sampling?**
- ***What about fundamentally different retrieval algorithms?***

SORRY, NO DEFINITIVE ANSWERS TODAY!

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Issue 1: Inconsistent Pressure Coordinates

- **<u>AIRS Standard</u>: 1100, 1000, 925, 850, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 15, 10, 7, 5, 3, 2, 1.5, 1, 0.5, 0.2, 0.1**
- **<u>AIRS Support</u>: …904.866, 931.524, 958.591, 986.067, 1013.95, 1042.23, 1070.92, 1100.0**

- **CrIMSS**
  - ***<u>Temperature</u>: 0.5, 0.7, 0.9, 1, 3, 5, 7, 9, 10, 30, 50, 70, 90, 100, 125, 150, 175, 200, 225, 250, 275, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 870, 890, 900, 920, 940, 960, 980, 1000, 1020 hPa***
  - ***<u>Water Vapor</u>: 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 870, 890, 910, 930, 950, 970***

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From February
Challenge 2:
Organizing Variables

- **We know how our communities use our data.**
  - ***Over a decade of experience with levels vs. layers, mixing ratios vs. column densities, etc…***

- **The GES DISC (Goddard DAAC) will support subsetting services.**

⇒ **Organize data into "menu" items by science AND technical themes. Some suggestions:**
  - ***Moist thermodynamics:*** ***Temperature, water vapor and clouds.***
  - ***Composition:*** ***ozone, carbon monoxide.***
  - ***Surface properties:*** ***SST, LST, emissivity.***
  - ***Diagnostic variables:*** ***First guess, intermediate output, etc.***
  - ***Custom orders:*** ***User chooses.***
  - ***Etc…***

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AIRS
Atmospheric Infrared Sounder

AIRS Version 6.0
Released Files Description

January 2014
Version 1.0.1

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This is a prototype for grouping L2 data by science user themes. Similar CrIMSS docs.

A1-7. L2 Standard Atmospheric/ Surface Product Interface Specification

	integer		pressure (i.e. lowest altitude)for which Quality = 0 or 1. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
Surface Property Retrievals			
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfStd_QC	16-bit unsigned integer	None	Quality flag for TSurfStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TSurfStdErr	32-bit floating-point	None	Error estimate for TSurfStd
numHingeSurf	16-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity
freqEmis	32-bit floating-point	HingeSurf (= 100)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd_QC	16-bit unsigned integer	HingeSurf (= 100)	Quality Control for emisIRStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
emisIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for emisIRStd
Air Temperature Retrievals			
TAirStd	32-bit floating-point	StdPressureLev (= 28)	Atmospheric Temperature at StdPressLev in Kelvins.
TAirStd_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for TAirStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TAirStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirStd
TSurfAir	32-bit floating-point	None	Surface air temperature in Kelvins
TSurfAir_QC	16-bit unsigned integer	None	Quality Control for TSurfAir.; 0: Highest Quality; 1: Good Quality;

FROM STEVE FRIEDMAN'S SOUNDER SCIENCE TEAM MEETING TALK

Introducing:

The SounderCDF data model

**an extensible data model
for sounder data products**

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Use CF naming convention whenever possible

- **See http://cfconventions.org**
- **NOTE: Developed for climate model output, not satellite data.**
- **<u>Why?</u> This what much of the *modeling* community uses.**
- **<u>Why not?</u> Driven by modeling needs, not necessarily remote sensing needs.**
  - ***We can adapt…***

NetCDF Climate and Forecast (CF) Metadata Conventions

Version 1.7.2 DRAFT, 28 March, 2014

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Examples

From http://cfconventions.org/Data/cf-standard-names/27/build/cf-standard-name-table.html

View by Category

Atmospheric Chemistry	Atmosphere Dynamics	Carbon Cycle	Cloud	Hydrology
Ocean Dynamics	Radiation	Sea Ice	Surface	

Standard Name	Canonical Units	AMIP	GRIB
age of sea ice	year		
age of stratospheric air	s		
age of surface snow	day		
air density	kg m-3		
air potential temperature	K	theta	13
air pressure	Pa	plev	1
air pressure anomaly	Pa		26
air pressure at cloud base	Pa		
air pressure at cloud top	Pa		
air pressure at convective cloud base	Pa		
air pressure at convective cloud top	Pa		
air pressure at freezing level	Pa		
air pressure at sea level	Pa	psl	2 E151
air temperature	K	ta	11 E130
air temperature anomaly	K		25
air temperature at cloud top	K		
air temperature lapse rate	K m-1		19
air temperature threshold	K		
altimeter range	m		
altimeter range correction due to dry troposphere	m		
altimeter range correction due to ionosphere	m		
altimeter range correction due to wet troposphere	m		
altitude	m		8
altitude at top of dry convection	m		
ambient aerosol particle diameter	m		
amplitude of global average sea level change	m		

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PROPOSED
Common Variable Names

AIRS Name	***CrIMSS Name***	***Proposed Name***
latAIRS	Latitude	latitude
lonAIRS	Longitude	longitude
solzen	SolarZenithAngle	solar_zenith_angle
solazi	SolarAzimuthAngle	solar_azimuth_angle
PSurfStd	SurfacePressure	surface_pressure
PSurfStd_QC	?	?
…		
PBest	?	?
PGood	?	?
…		
TSurfStd	N/A?	surface_temperature
TSurfStd_QC	N/A?	?
…		
TAirSup	Temperature	air_temperature
TAirSup_QC	?	?
…		
TSurfAir	Not defined?	surface_air_temperature
…		
num_Temp_Func	?	?
…		
Temp_ave_kern	?	?
…		
H2OCDSup	H2O	water_vapor
RelHum	N/A	relative_humidity

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Concerns

- **Not addressing physical consistency between products!**
  - ***However, common formatting will simplify this.***

- **High Priority / Unresolved**
  - ***Pressure coordinate choice.***
  - ***Consistent information; averaging kernels.***
  - ***Quality flags.***

- **Lower Priority**
  - ***Common names (follow CF convention).***
  - ***Groupings by 'themes' (general agreement here).***