AAPP status report and review of developments for NOAA-N and METOP

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AAPP – a reminder

- Pre-processing package for polar orbiter data
- Maintained by EUMETSAT Satellite Applications Facility for Numerical Weather Prediction (NWP-SAF)
- Lead institute - Met Office
- ~200 licensed users worldwide
- Runs on a range of Unix and Linux computer platforms

Updates to AAPP v4.0

- ## Update 4.4, 31/8/04:

    1) Linux compatibility (also Windows via MS Services For Unix)

    2) Improved rubustness in decommutation

    3) Utility to compare output files from different platforms (*atovsCompare*)

    4) Big/little-endian conversions

    5) Processing of NOAA-17 to level 1d

    6) 1d flag for fewer co-locations than expected in re-mapping AMSU-A to HIRS

- ## Update 4.5, 03/02/05:

    - Updated AMSU-B calibration parameters file (gross limits)

- See also list of bugs on web page
- New NESDIS 1b formats (from 28/4/05) are compatible with AAPP-4

Administrative changes

- Now distributed by NWP-SAF (previously by EUMETSAT)

- Enquiries and licensing handled by NAP-SAF helpdesk

- AAPP web site is via
  http://www.metoffice.com/research/interproj/nwpsaf/

- FTP server for update versions: **thorn.metoffice.gov.uk**
  (command line ftp only)

- User email forum is still operated by EUMETSAT
  - L-aapp@listserv.eumetsat.int (note recent address change)
  - Subscribe via listserv@listserv.eumetsat.int

- Separate registered user email list held at Met Office

AAPP Version 5

- Includes the following enhancements:
  - ➢ NOAA-N capability (including MHS)
  - ➢ New HIRS calibration method (based on NOAA v4)
  - ➢ Updated navigation – ability to use 2-line elements
  - ➢ Allow for moon contamination in AMSU-B and MHS
  - ➢ Added NWC-SAF scattering index (Bennartz) to AMSU-B level 1d
  - ➢ Use of instrument-specific scan characteristics, and removal of many hard-coded parameters

- V5.01 distributed to beta testers 28/4/05

- To be released as V5.1 following validation with NOAA-N data (approx 2 months after launch)

NOAA-N capability

- New calibration module *mhscl*
- New MHS 1b format (same as NOAA format)
- 1c format same as AMSU-B – with different instrument identifier
- Allow for non-ideal antenna reflectivity (small scan dependence)
- No change at level 1d

HIRS calibration

- Based on NOAA 'version 4' algorithm
- Can be used with HIRS/3 and HIRS/4
- Accumulate statistics of slope/offset and telescope temperature from previous overpasses
- Should improve results in partial super-swaths
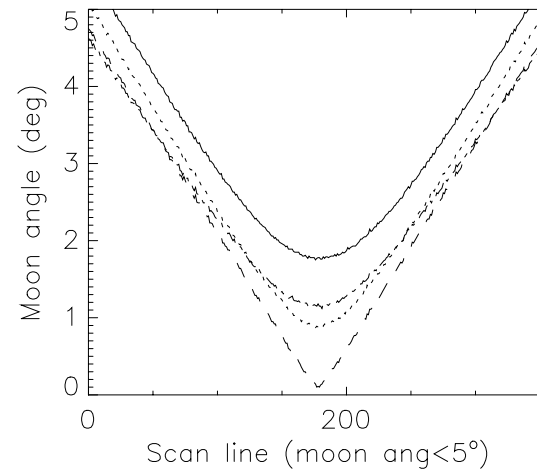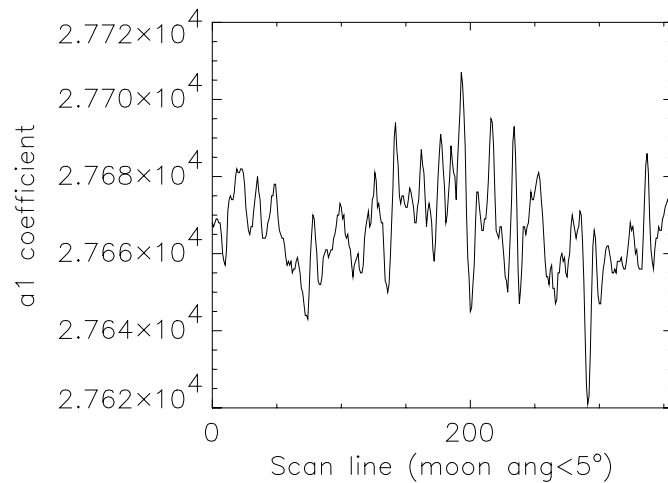

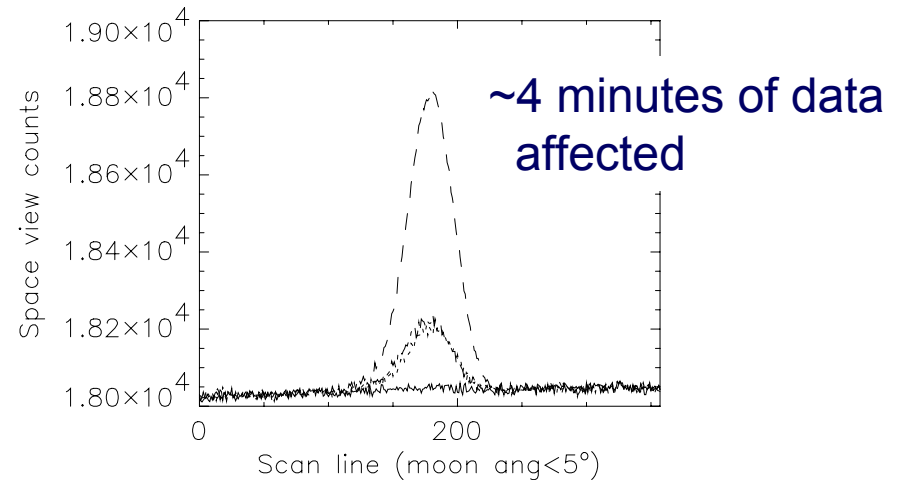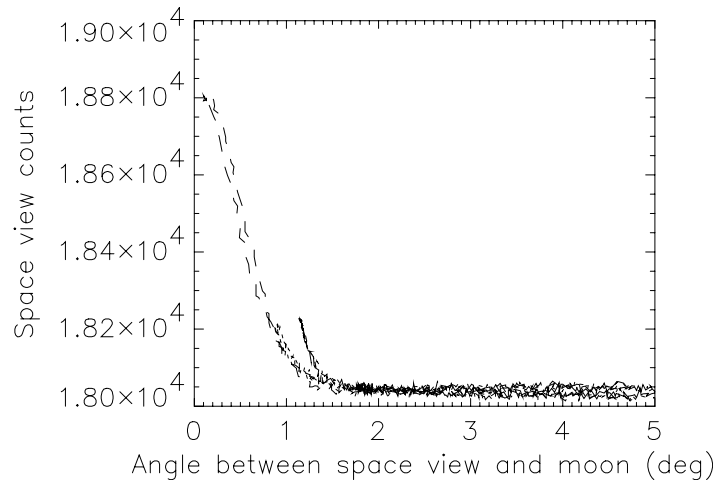Channel 19
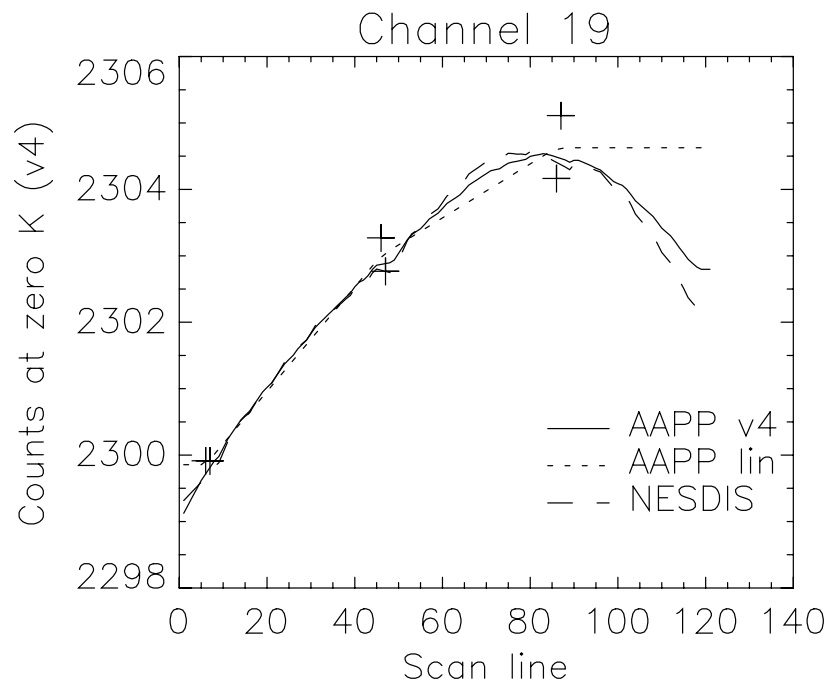
Moon in AMSU-B/MHS

- In previous versions of AAPP, moon-contaminated AMSU-B scans were discarded by QC
- For V5, use astronomical formula to predict which (if any) of the 4 space view samples are contaminated
- Same method now used by NESDIS

4 space views

Not to scale!

Earth views
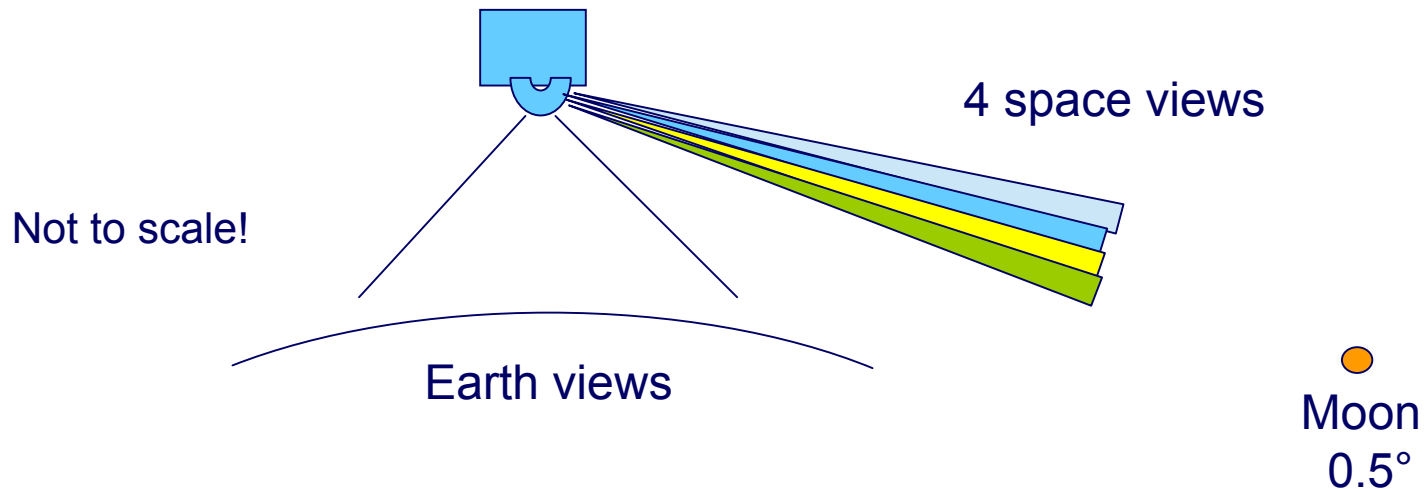
Moon
0.5°

NSS.AMBX.NK.D03283.S1446.E1630.B2811213.GC
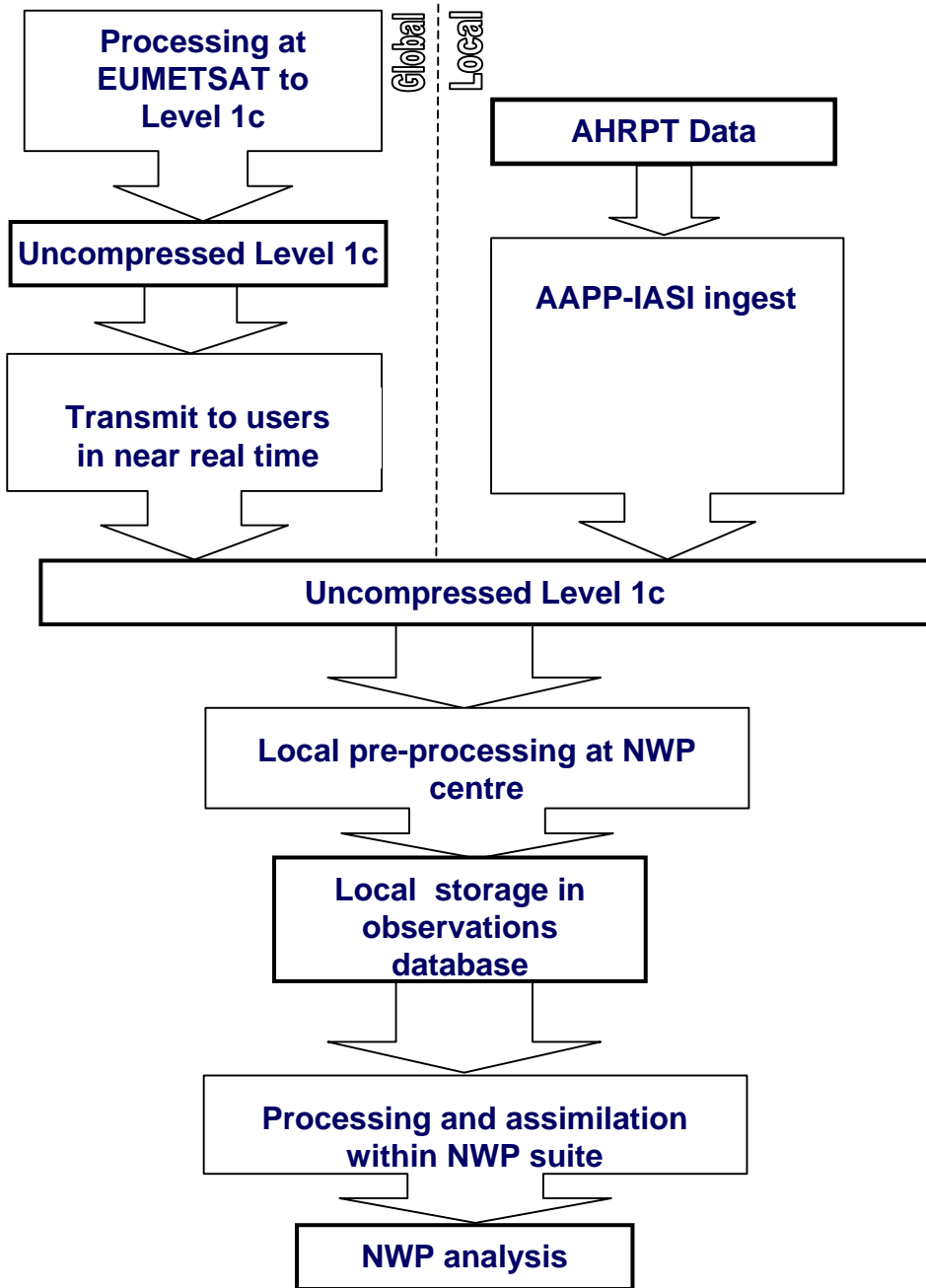

~4 minutes of data affected

Worst case: 3 samples out of 4 see moon,
But *a1* coefficient still computed OK.

2-line elements

- Alternative to TBUS
- Improved navigation accuracy for AVHRR
- Data available from **http://www.space-track.org** (need to register)
- AAPP-5 contains script for automatic download (using *wget*)

Satellite	Method	bias	sigma	r.m.s
noaa16	tbus	-2.92	1.25	3.17
	2line	-0.05	0.76	0.77
	argos	0.61	0.80	1.01
noaa17	tbus	4.70	1.95	5.09
	2line	-0.06	0.66	0.67
	argos	0.78	1.00	1.27

Extrapolation error in km per day, from 2003/09/22 to 2004/03/15

- Availability will be announced via

  l-aapp@listserv.eumetsat.int

  and http://www.metoffice.com/research/interproj/nwpsaf/

- Users will need to register via NWP-SAF web page

- Distribution will be on CD-ROM, as for previous releases

Global | Local

Processing at EUMETSAT to Level 1c

AHRPT Data

Uncompressed Level 1c

AAPP-IASI ingest

Transmit to users in near real time

Uncompressed Level 1c

Local pre-processing at NWP centre

Local storage in observations database

Processing and assimilation within NWP suite

NWP analysis

Requirements for METOP:

IASI data processing overview

As presented to EUMETSAT Science Working Group

AAPP Version 6 - METOP

EUMETCAST Global ATOVS + EARS

METOP AHRPT (CCSDS packets)   X-band

EUMETCAST Global IASI

or GTN

or GTN

BUFR decode

ATOVS

IASI 'level 0'

BUFR decode

AAPP

ATOVS 1a/b

OPS (CNES)

ATOVS 1c

IASI 1c

ATOVS 1d

NB: IASI 1c = calibrated, corrected & Gaussian apodised

ATOVS/IASI 1d

User options (flexible):
- AMSU mapped to IASI
- Spatial thinning
- Reduced channel set and/or
- Eigenvector scores

Met Office plans for IASI

- Cannot store all IASI channels (or process in NWP)

- Plan to store ~300 channels initially

  - ➢ Channel selection work in progress

- Also ~300 Eigenvector scores (sig/noise) $c = U^T N y$

  - ➢ 8641 point radiance spectrum **y**

  - ➢ Eigenvectors **U** to be computed off-line from training dataset (self apodised, noise normalised)

  - ➢ **N** does the noise normalisation for **y** (NEΔR + de-apodisation)

- Initially spatially thinned to 1 spot in 4 (1 detector per scan pos)

- Data rate factor 30 less than raw IASI, but still ~10 times that of ATOVS 1d!

- An internal BUFR format has been devised for IASI (+ AMSU) level 1d

X-band reception
System at Exeter

AAPP – future developments

- **NPP and NPOESS**
  - AAPP development effort will concentrate on METOP, but would like to process NPP
  - New instruments – CrIS, ATMS, VIIRS
  - X-band direct broadcast – interface AAPP with output from NASA's direct broadcast software?
  - Global data distribution via NOAA? Details not yet clear
  - Need information on formats ASAP

Conclusions

- AAPP is used worldwide to pre-process direct-readout and global polar orbiter data

- Available via NWP-SAF web site

- Version 5 is being beta-tested and will be released ~2 months after launch of NOAA-N

- Preparations well underway for METOP-compatible version, including IASI

- Plan to extend for NPP and NPOESS – but need detailed information on instruments and formats as soon as possible

Thanks to CMS (Météo-France) for their contributions to AAPP development