

NWP SAF	AAPP Version 7 Top Level Design	Doc ID : NWPSAF-MO-DS-015 Version : 1.0 Date : 21.10.2011
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Version 1.0

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1. INTRODUCTION

This document defines the top level design for Version 7 of the ATOVS and AVHRR Pre-processing Package (AAPP), in accordance with the requirements of the NWP-SAF.

1.1 Reference documents

- [RD-1] NWPSAF-MO-DS-014, AAPP Version 7 Product Specification
 [RD-2] Design Note: AAPP version 7: Pre-processing of ATMS and CrIS

1.2 Functional requirements

The main requirements for AAPP v7 are detailed in [RD-1]. AAPP v7 will require the presence of the following distinct components:

- The core AAPP task, comprising decommutation, calibration, navigation, pre-processing and format conversion (e.g. BUFR) modules
- Tools to interface the core AAPP with the METOP AHRPT data stream (unchanged from v6)
- The IASI level 1 processor OPS-LRS (as previously issued with AAPP v6).
- Modules for the ingest and pre-processing of Sensor Data Record (SDR) data from NPP. This includes both BUFR data and HDF5 data.

AAPP will not have the capability of ingesting Level 0 data from NPP; for direct readout the user will need to run an external software package such as the *International Polar Orbiter Processing Package* (IPOP) developed by NASA, or the *Community Satellite Processing Package* (CSPP) developed by the University of Wisconsin.

In this document Section 2 presents the main data flows, while subsequent sections provide more details on individual components of AAPP v7.

2. DATA FLOWS

2.1 NOAA satellites

Data from the NOAA satellites are handled by the existing AAPP v6, and the functionality will be unchanged with AAPP v7. The main data flows when processing HRPT data are shown in Figure 1. AAPP is also capable of processing global and regional ATOVS level 1b data generated by NOAA (e.g. made available via the NOAA archive). The data flow in this case is shown in Figure 2.

Different users may choose to configure the AAPP modules in different ways, depending on their requirements. For example:

- Mapping of AVHRR to HIRS is optional
- The user can generate level 1d outputs on the HIRS grid, the AMSU-A grid or the AMSU-B/MHS grid, or any combination of these

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It should be noted that AAPP can also process TOVS data (HIRS and MSU) from the HRPT data stream of the pre-NOAA-K satellites, with 1d output on the HIRS grid. However, it cannot currently process TOVS 1b data from the NOAA archive.

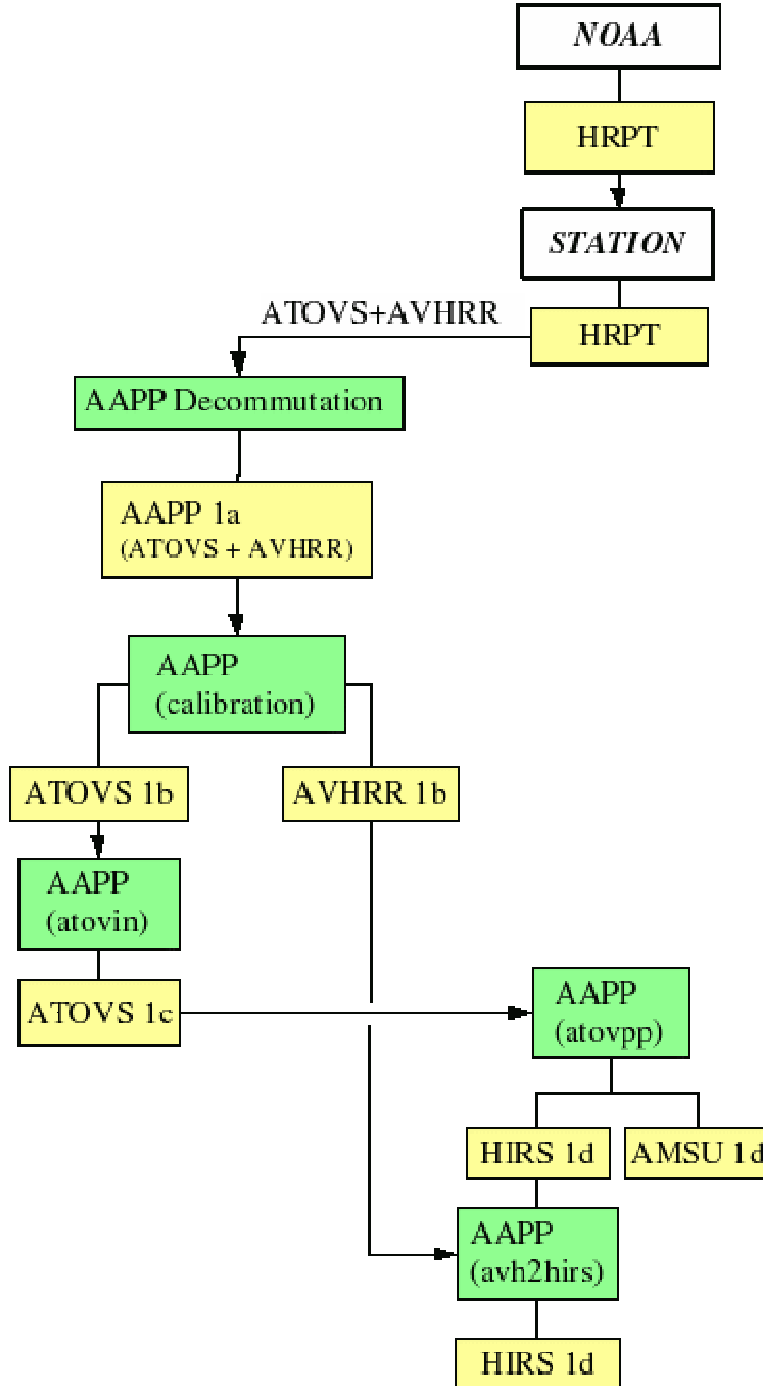


Figure 1: Data flows for processing HRPT data from the NOAA satellites. AAPP modules are shown in green; data files in yellow.

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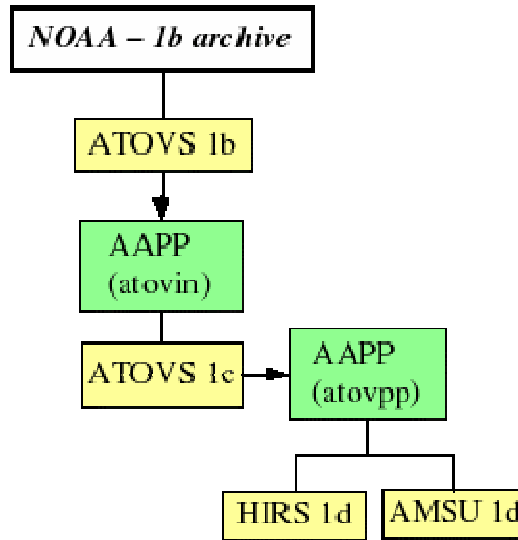


Figure 2: Data flows for processing global or regional NOAA level 1b

2.2 METOP satellites

Direct broadcast data from the METOP satellite are transmitted via the Advanced HRPT, or AHRPT. It is the responsibility of the reception system to convert the received raw HRPT to “EPS Level 0” format, defined by EUMETSAT.

For users who wish to process both ATOVS and IASI, the data flows are shown in Figure 3. As with the NOAA satellites, users are expected to customise the AAPP v7 modules according to their requirements:

- It is anticipated that relatively few users will wish to run OPS-LRS (because of its complexity and its need for a fairly powerful computer).
- Mapping of AVHRR to HIRS is optional.
- The user can generate level 1d outputs on the HIRS grid, the AMSU-A grid, the MHS grid or the IASI grid, or any combination of these.

AAPP also ingests data in BUFR format (e.g. RARS or global METOP) and AVHRR data in EPS format. Data flows for processing global METOP data are shown in Figure 4.

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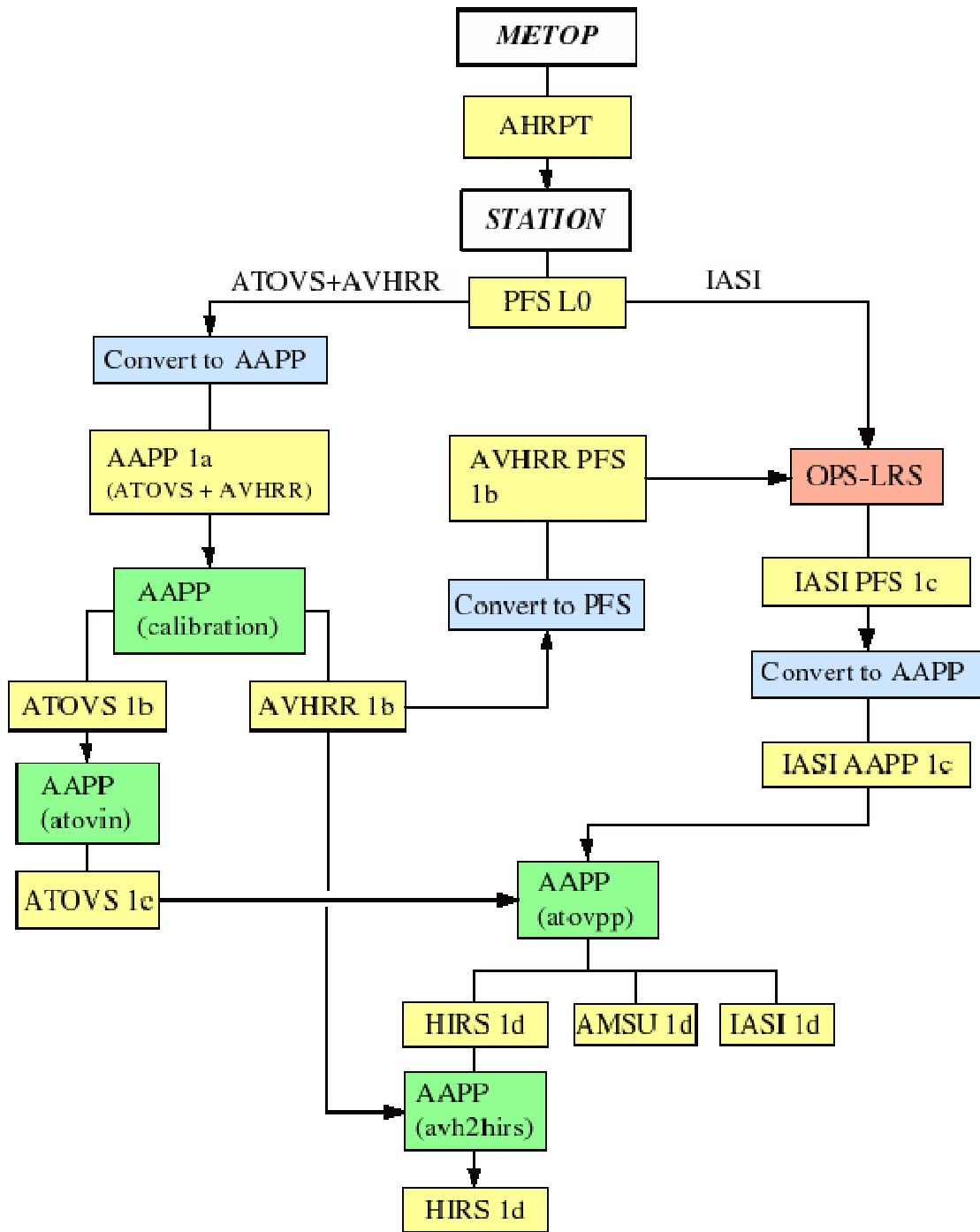


Figure 3: Data flows for processing the METOP AHRPT data stream. AAPP modules are shown in green; data files in yellow; METOP/IASI tools in blue; OPS-LRS in red

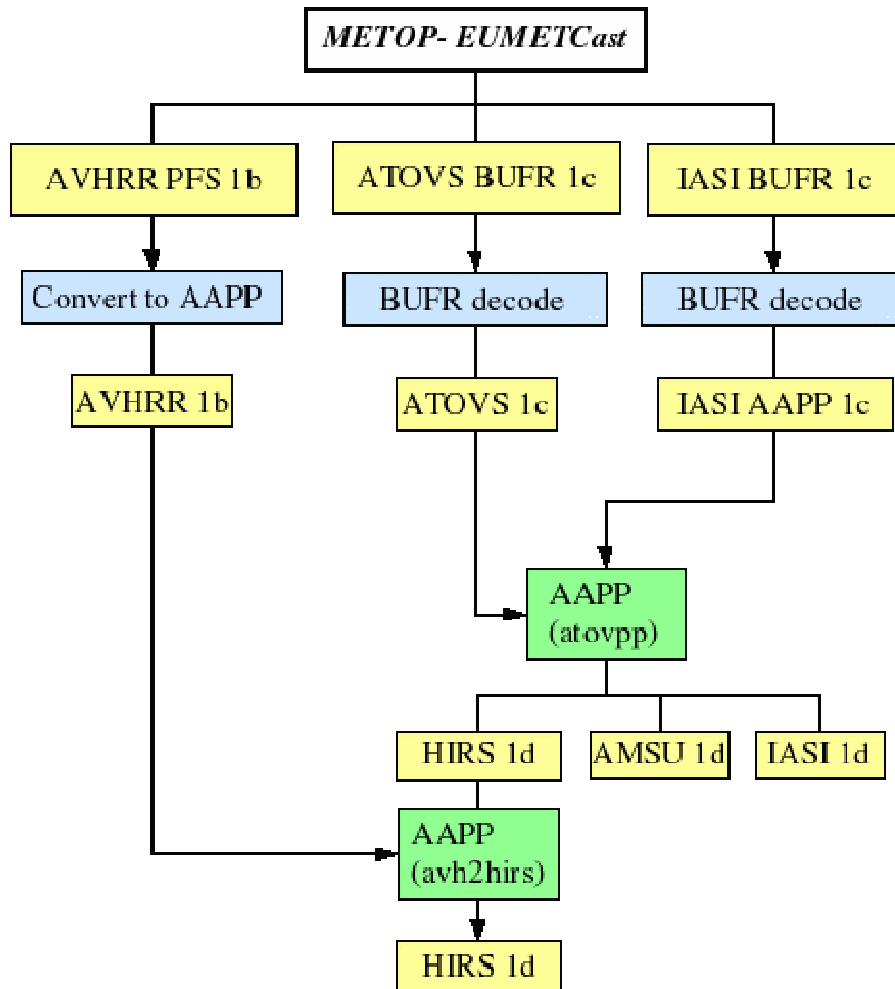


Figure 4: Data flows for processing METOP data received via EUMETCast

2.3 NPP and JPSS satellites

AAPP will ingest the ATMS and CrIS BUFR files to be distributed by NOAA and by EUMETSAT (see Figure 5). AAPP will also ingest the Sensor Data Record files in HDF5 format, from direct broadcast (via an external level 1 processing package such as IPOPP or IMAPP) or from an archive source such as CLASS (see Figure 6).

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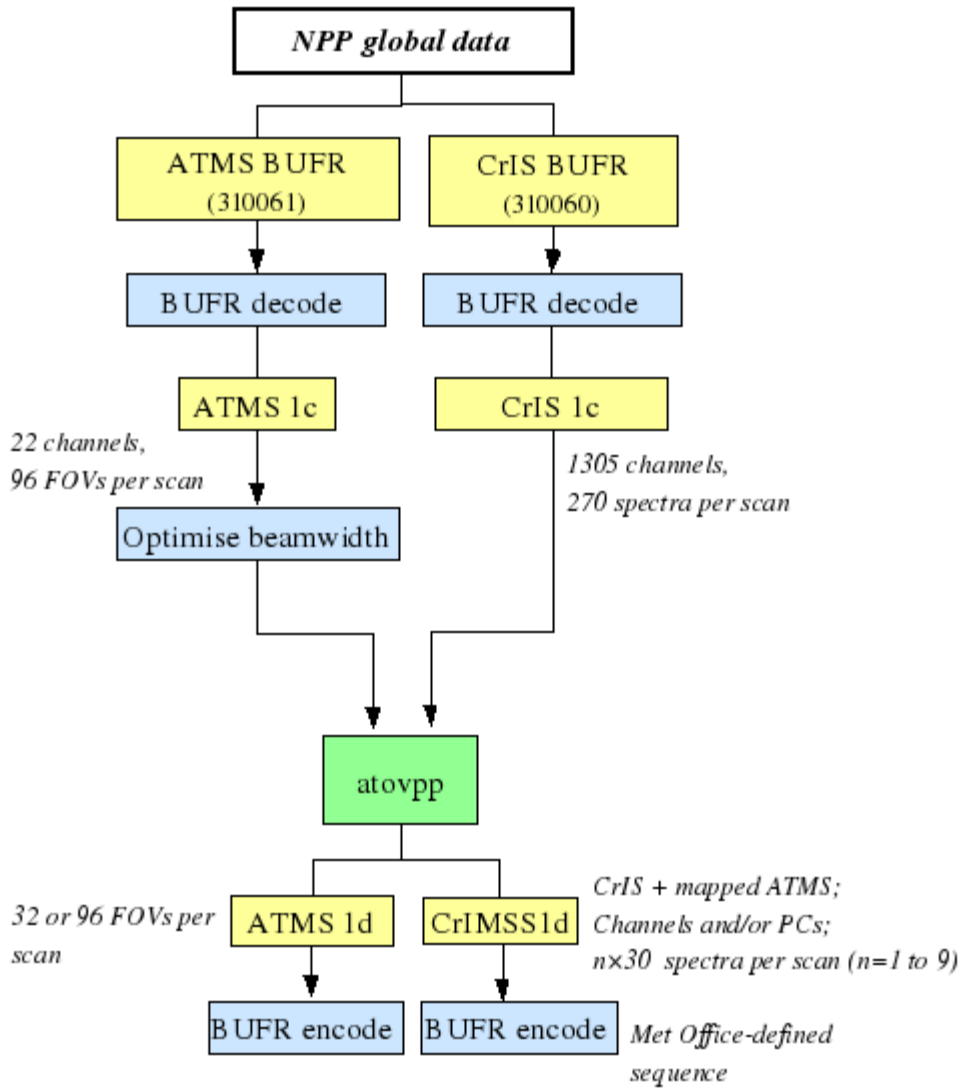


Figure 5: Data flows for processing NPP global BUFR data for ATMS and CrIS

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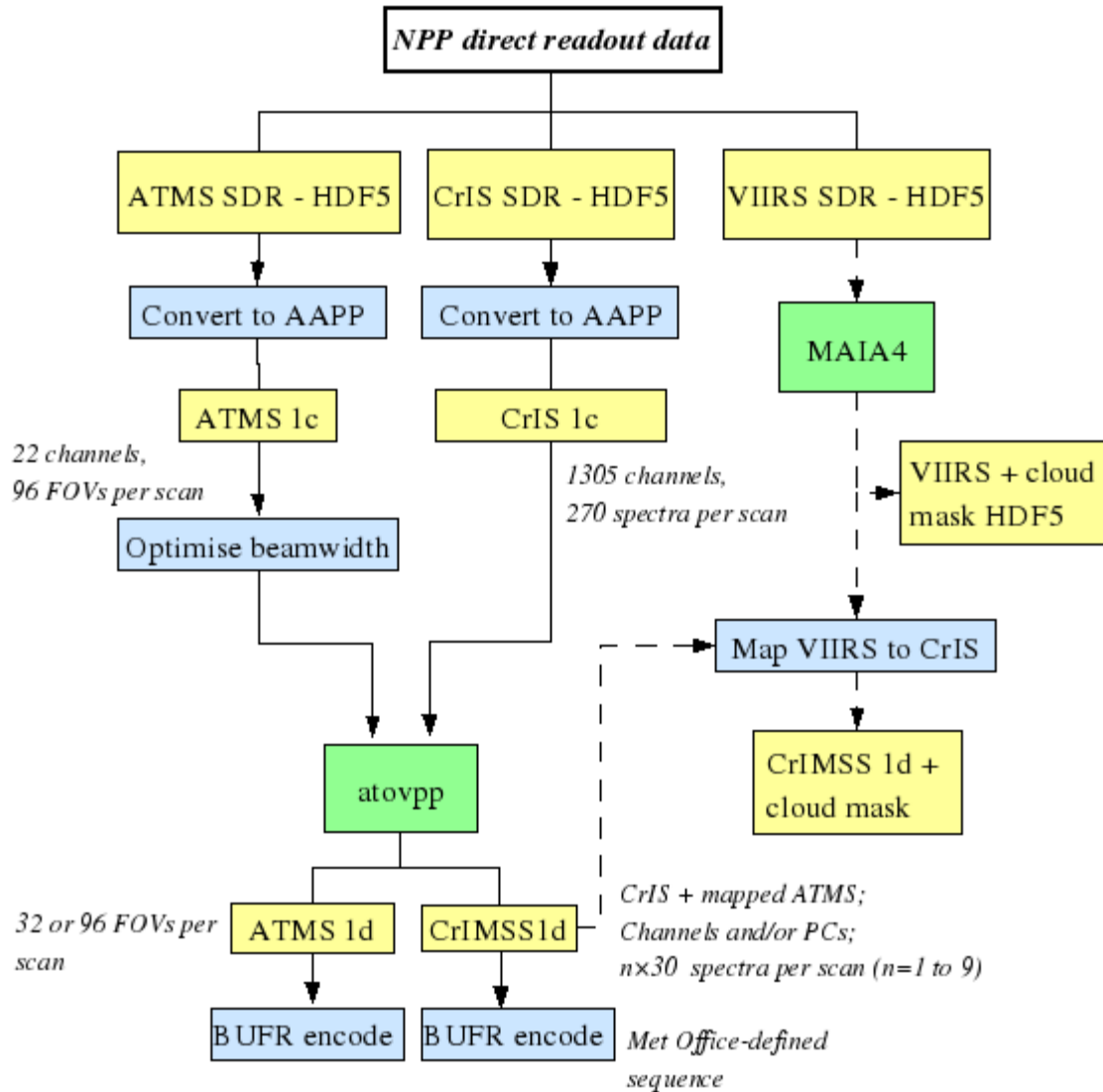


Figure 6: Data flows for processing NPP Sensor Data Records from Direct Readout or from an archive source. Note: The VIIRS processing, including MAIA4, is planned as a Day-2 extension to AAPP v7.

Note that the module to optimise the ATMS beam width must be run before the data are mapped to CrIS and before any spatial thinning of the ATMS (see RD-2). The combination of ATMS and CrIS, on the same sampling grid, is known as CrIMSS.

In Figure 5 and Figure 6 it is stated that CrIS level 1c comprises 1305 channels. The number of channels to be downlinked from the spacecraft is actually 1317, but it is expected that most users (including NOAA) will discard 2 points at the edge of each band after apodization. In the future (i.e. in the JPSS era) it is possible that more channels will be downlinked; this eventuality can be accommodated in AAPP by changing the value of a parameter in the `cris1c.h` file.

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During the post launch evaluation phase it is quite likely that ATMS and CrIS data streams will be released at different times. Therefore the above scheme allows the processing of ATMS only, or CrIS only, if required.

The atovpp module will include generation of ATMS cloud and precipitation indices, similar to those used for ATMS/MHS. Some changes will be necessary to the coefficient files due to channel frequency and polarisation differences in ATMS as compared with AMSU.

The Met Office-defined BUFR sequence for level 1d is the same for ATMS and CrIMSS. The data are not intended for international dissemination as the sequence includes a number of local descriptors. However this output option is included in the expectation that it may prove useful to other centres.

3. IMPLEMENTATION ASPECTS

3.1 HDF5 libraries

From AAPP v6.12 there has been provision to call HDF5 library routines within AAPP (in the context of IASI eigenvectors). The C versions of the library routines are used. For more information on HDF5, see <http://www.hdfgroup.org/HDF5/> .

3.2 BUFR libraries

As in AAPP v6, the ECMWF BUFR library will be used. For more information, see <http://www.ecmwf.int/products/data/software/bufr.html> .

3.3 GRIB libraries

AAPP v6 supported the ECMWF GRIBEX library. For AAPP v7 the GRIB API will be used, see http://www.ecmwf.int/products/data/software/grib_api.html . The GRIB API supports GRIB and GRIB2, whereas the older GRIBEX library does not support GRIB2. The library is used to read in forecast files for MAIA.

3.4 Fortran compilers

The majority of AAPP is currently written in FORTRAN77 style code, and it is not planned to change this with AAPP v7. However, some parts are written in Fortran 90, notably MAIA v3. MAIA v4 (planned as a Day-2 enhancement to AAPP v7) will also be in Fortran 90. The build scripts will ensure that compilation will not fail if using a FORTRAN77 compiler (e.g. g77), but those components that rely on Fortran 90 will not be built.

3.5 Scripts and C compilers

As with previous versions of AAPP, AAPP v7 will use scripts (Korn shell and Perl) and a standard C compiler. The OPS-LRS will also use C++. The appropriate compiler will be specified by the user during configuration.