


# **NWP SAF**

## **NWPSAF 1D-Var Top-Level Design**

Version 1.2

24<sup>th</sup> February 2020

The EUMETSAT Network of Satellite Application Facilities	 <b>NWP SAF</b> Numerical Weather Prediction	NWPSAF 1D-Var Top-Level Design	Doc ID : NWPSAF-MO-DS-026 Version : 1.2 Date : 24/02/2020
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## NWP SAF 1D-Var Top-Level Design

This documentation was developed within the context of the EUMETSAT Satellite Application Facility on Numerical Weather Prediction (NWP SAF), under the Cooperation Agreement dated 7 December 2016, between EUMETSAT and the Met Office, UK, by one or more partners within the NWP SAF. The partners in the NWP SAF are the Met Office, ECMWF, DWD and Meteo France.

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Change record			
Version	Date	Author/changed by	Remarks
0.1	17/02/14	P. Weston	First version, based on the Met Office 1DVar top level design.
0.2	29/05/14	P. Weston	Updated with new header, new document ID, new copyright statement and changed font following comments from B. Conway
1.0	22/08/14	P. Weston	Version valid for NWPSAF 1D-Var v1.0
1.1	16/02/17	F. Smith	Version valid for NWPSAF 1D-Var v1.1
1.2	24/02/20	S. Havemann	Version valid for NWPSAF 1D-Var v1.2

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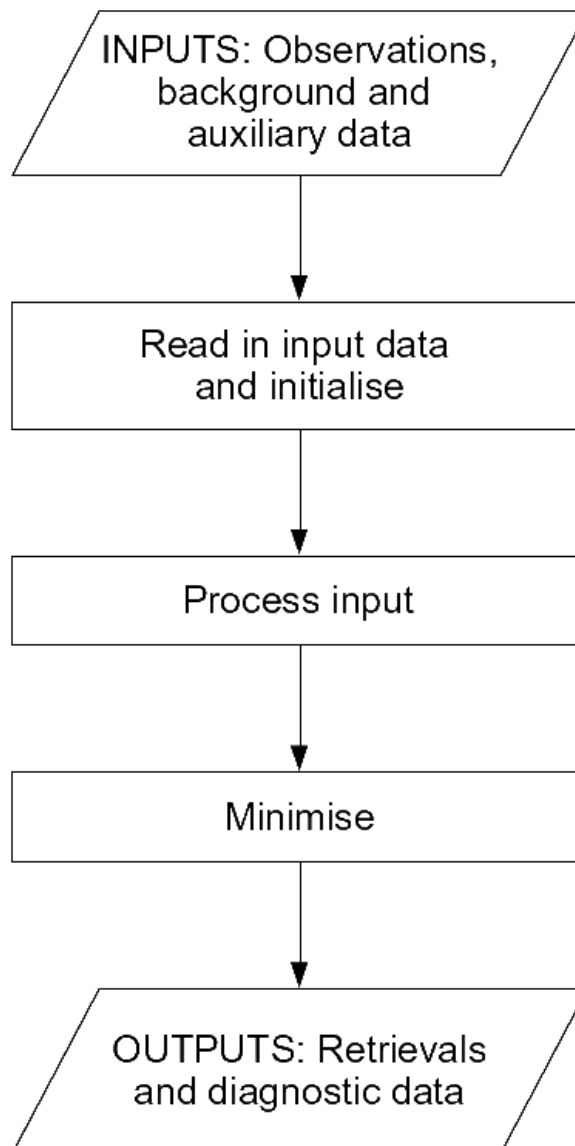
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## 1. INTRODUCTION

The NWPSAF 1D-Var package is designed as a stand-alone retrieval scheme for use with many nadir-viewing passive sounders. It is designed to be flexible in so far as the instrument definition, observations, error covariances, background profiles, channel selection and retrieval parameters are specified in input files. The user may choose which radiative transfer model to use from those supported (RTTOV 11.3, RTTOV 12). If an alternative forward model is required, the user will need to provide their own interface module. The retrieved atmospheric profiles and brightness temperatures are output to an ASCII file.

The overall design of the package is summarised in the following flowcharts.

## 2. OVERVIEW



### 3. INITIALISATION

- Read in control data
- Initialise reading in of observations
  - Observations are read in one at a time in the processing stage
- Read in background
- Read in parameters to be retrieved
- Read in channel selection information
- Initialise RT model and read in RT model coefficients
- Read in background error covariance matrix
  - Includes possible matrix inversion
- Read in observation + forward model error



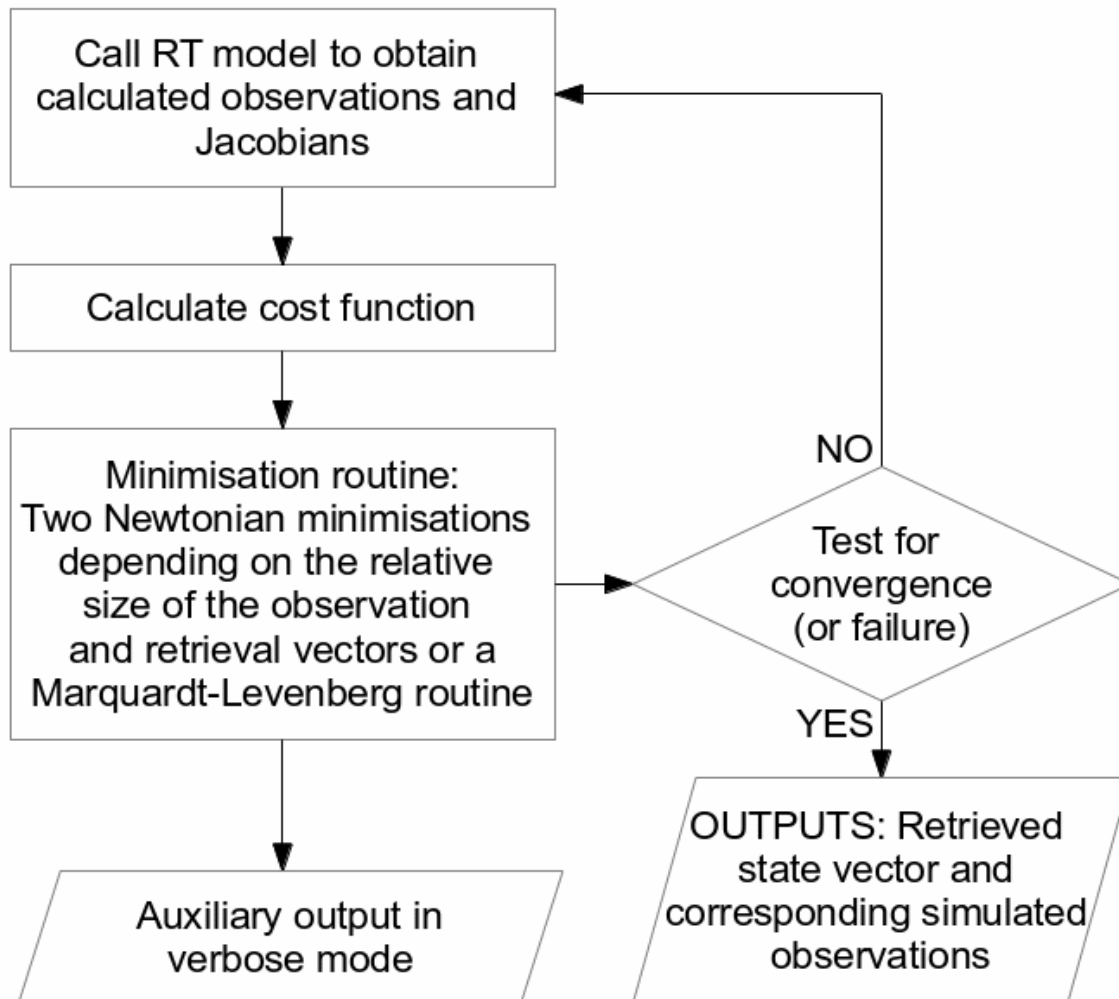
### 4. PROCESSING INPUT


**For each observation:**

- Read in observation
- Space for user supplied bias correction to be added
- Convert background profile to correct units
- Produce simulated radiances from background profile
  - Extrapolate temperature profile at top of atmosphere (optional)
- Do cloud detection (optional)
- Do CO<sub>2</sub> slicing for first guess cloud properties (cloudy retrievals only)
- Obtain emissivity from atlas (optional)
- Do emissivity retrieval (optional)



## 5. MINIMISATION AND OUTPUT



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## 6. SUBROUTINE CALLING TREE

### 6.1 GENERAL NOTES FOR INTERPRETING CALLING TREES

\* Indicates multiple references in calling routine

† indicates that **NWPSAF\_OpenFile.f90** and/or **NWPSAF\_FreeLUN.f90** are called.

**NWPSAF\_OpenFile.f90** calls **NWPSAF\_GetUnit.f90**

**NWPSAF\_Report.f90** is called by many routines to generate error or information messages

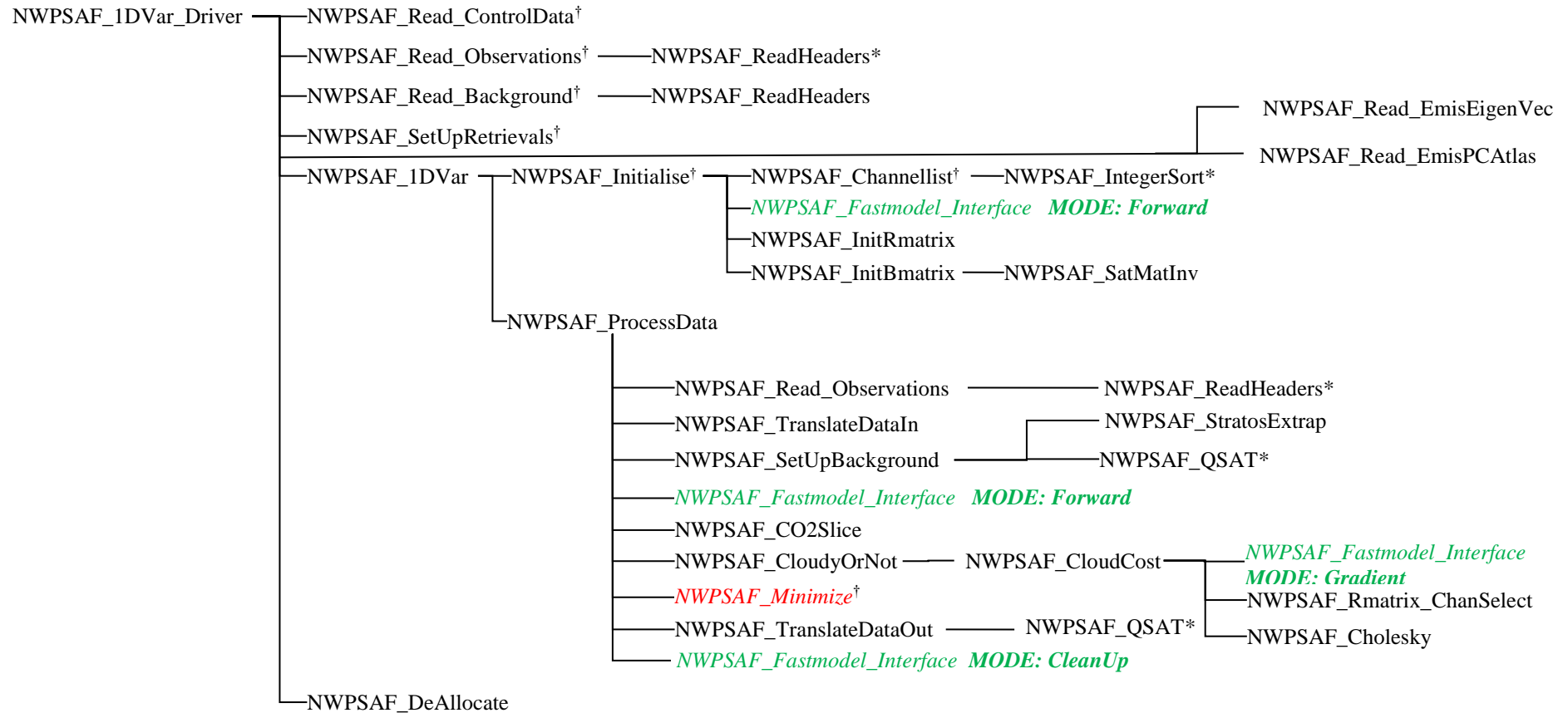
In the following calling trees, please follow on to the sub-tree on the next pages when you see a coloured routine, namely:

- **NWPSAF\_Minimize**
- **NWPSAF\_Fastmodel\_Interface**

In addition to the subroutines listed below, the following modules are used in the code:

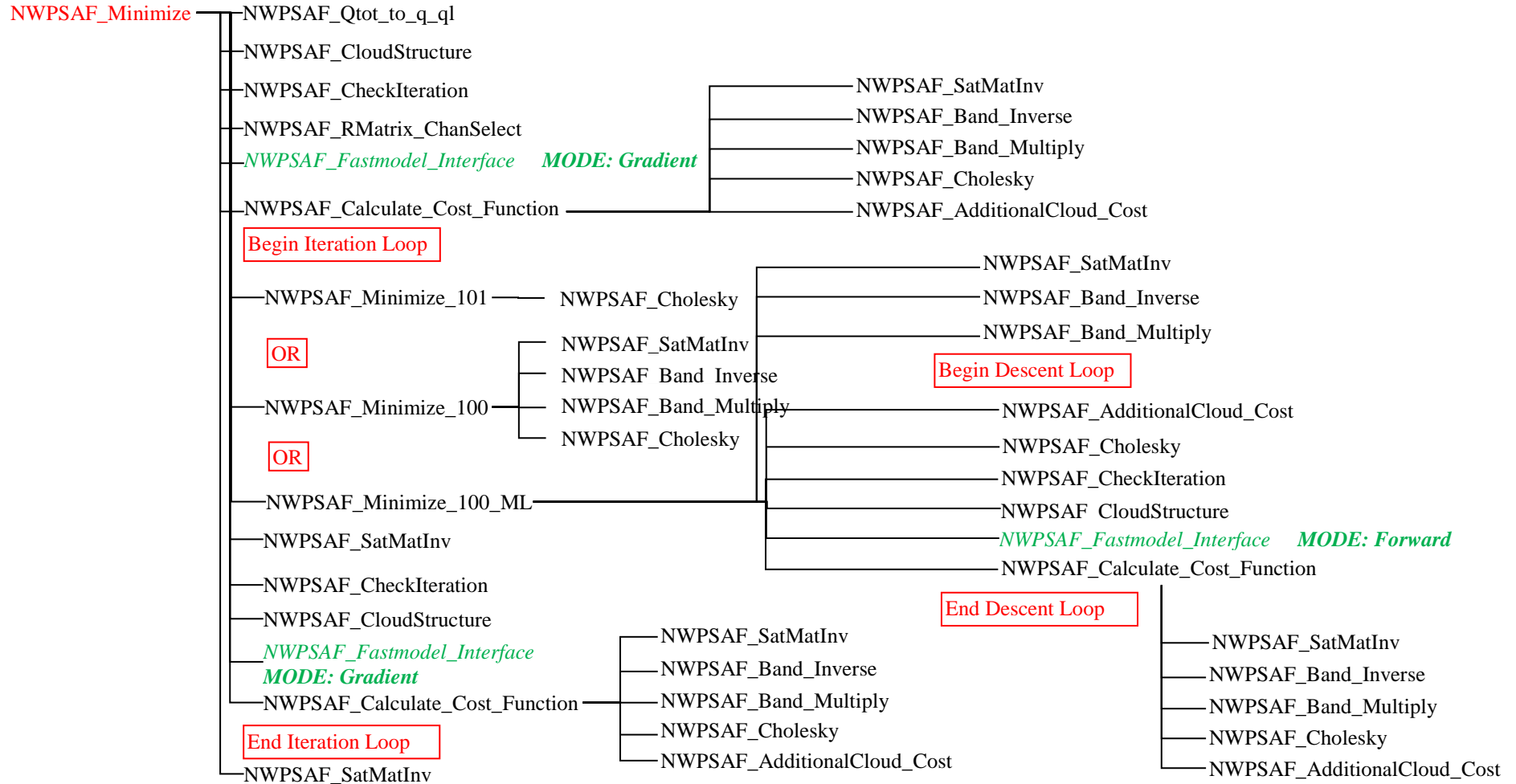
- **NWPSAFMod\_Constants.f90** (contains various constants used in the code)
- **NWPSAFMod\_Params.f90** (contains all of the set up options and the Control namelist)
- **NWPSAFMod\_RTModel.f90** (contains the RTTOV coefficients, options and chanprof structures, and the emissivity atlas if required)
- **NWPSAFMod\_Channellist.f90** (contains the channel selection type structure)
- **NWPSAFMod\_CovarianceMatrices.f90** (contains all of the covariance matrices used in the code)
- **NWPSAFMod\_ObsInfo.f90** (contains the profile and observation type structures)
- **NWPSAFMod\_LiquidWater.f90** (contains various functions related to retrieval of liquid water)

## 6.2 MAIN CALLING TREE





## 6.3 NWPSAF\_MINIMIZE CALLING TREE



## 6.4 NWPSAF\_FASTMODEL\_INTERFACE CALLING TREE

