The EPS-UG, EUMETSAT Polar System: Second Generation, will provide continuity of observations after EPS in the 2020-2040 timeframe. It is Europe’s contribution to the future Polar Satellite System (EPS), which is agreed to be established together with the National Oceanic and Atmospheric Administration (NOAA) of the United States, following on from the Initial Polar Satellite System (IPSS).

The IASI-NG, Infrared Atmospheric Sounding Interferometer - New Generation, is the successor instrument of the IASI instruments flown on the EPS-Metop satellites. It will provide hyper-spectral infrared soundings of temperature, water vapour, and trace gases with a spectral resolution of 0.25 cm⁻¹ (twice the spectral resolution of IASI) within the spectral range from 645 to 2760 cm⁻¹. The noise figures of the IASI-NG are half the ones of IASI. As for IASI, the footprint at Nadir is about 12 km and the observations will be performed at an average spatial sampling distance of 25 km. Similarly as in EPS, IASI-NG will be accompanied by a microwave sounder (MWS) and a high spatial resolution radiometer (MET) TEMPE. The IASI-NG L2 processor has a direct heritage from the operational IASI L2 v6 processor, including BRESICIA and FORLI retrieval functions to generate the EUMETSAT AC SAF products.

**IASI-NG Measurements**
IASI-NG measurements consist of signal and noise. The IASI-NG L1C measurements are represented as radiances at 16921 wave-numbers, which are spectrally highly correlated. This correlation comes from the signal itself as the noise is spectrally uncorrelated. This redundancy means that the effective rank of the subspaces spanned by the signal within the measurements is much lower than the number of channels, or in other words, the number of independent pieces of information within the IASI measurements is much smaller than 16921. These are the principal components scores (PCS) computed with the leading eigenvectors representing the variance and covariance of the measurements. Reconstructed radiances can be computed from the PCS, effectively projecting the measurements onto the signal subspace with the result that the signal is preserved while a major part of the noise is suppressed. The difference between the original and the reconstructed radiances is called the reconstruction residuals and essentially contain random instrument noise. The residuals are used to compute reconstruction scores. If the reconstruction score for a given spectrum is too high (i.e. exceeds a configurable threshold), there is suspicion that some atmospheric signal could not be represented by the selected leading principal components. An outlier between the original and the reconstructed radiances is called the reconstruction score.

The iterative minimization method is the Newton descent method. Where $\mathbf{x}$ is the state vectors to be retrieved in PC scores, $\mathbf{y}$ is the ozone profile ($n$ number of PC scores), $\mathbf{F}$ is the number of PC scores to reconstruct the temperature profile, $\mathbf{O}$ is the ozone profile ($n$ number of PC scores), $\mathbf{C}$ is the ozone profile ($n$ number of PC scores), $\mathbf{E}$ is the a priori state vector ($n$ number of PC scores), $\mathbf{v}$ is the observation vectors and $\mathbf{S}$ is a subset of reconstructed radiances ($e.g.$, WGS and MHS radiance). $\mathbf{f}$ is the simulated observation vectors using the forward model (RTTOV).

The iterative minimization method is the Newton descent algorithm. Surface emissivity (06/2016). The idealized minimumization method is the Newton descent algorithm. Surface emissivity (06/2016).

***PreP***
The purpose of the input data preparation is to gather IASI-NG LID measurements and relevant collocated data in a common file, which serves as input for the further sub-functions. The collocated data includes METimg cluster radiance mean standard and deviations (already included in the IASI-NG L1C file), MHS radiances, ECMWF forecasts data as well as land fraction and surface elevation mean and standard deviation within each IASI-NG field of view.

**PWLR**
PWLR is a fast, accurate and precise, all sky retrieval of temperature, water vapour, ozone, emissivity and green-house gases profiles using IASI-NG with collocated MHS radiances.

PWLR is used as quality indicators. An estimation of the absolute retrieval error for each field of view, which are used as quality indicators.

PWLR is an evolution of the PWLR scheme. PWLR preserves the single field of view retrievals, but exploits horizontal correlation by using measurements from all four fields of view within each EOF jointly. A number of further enhancements have also been made, for example a finer classification based on k-means clustering. The PWLR all sky statistical retrievals were introduced operationally the 2nd June 2016 with version 6.2 of EUMETSAT IASI L2 products.

**FORLI and BRESICIA**
Profiles of CO, NH3 and O3 are retrieved by the FORLI library. The SO2 columnar amount is retrieved by the BRESICIA library. These two libraries are provided by the EUMETSAT AC SAF and take raw radiance from the L2C as input, rather than the reconstructed radiances from L1D and are built for IASI spectra rather than IASI-NG spectra. In order to invoke them it is therefore necessary to convert the IASI-NG spectra to IASI-like spectra. After this transformation, the FORLI and BRESICIA libraries has to be applied. The input profiles of temperature and water vapor are taken from the optimal estimation retrieval (or PWLR).