

Optimization of GRASP for the 3MI L2 Aerosol Retrieval

Final Presentation, 15.10.2018

Our Goal for this Project

*Pave the way for GRASP and
MetOp-SG/3MI.*



Project Overview

Assess GRASP in 3 Dimensions:

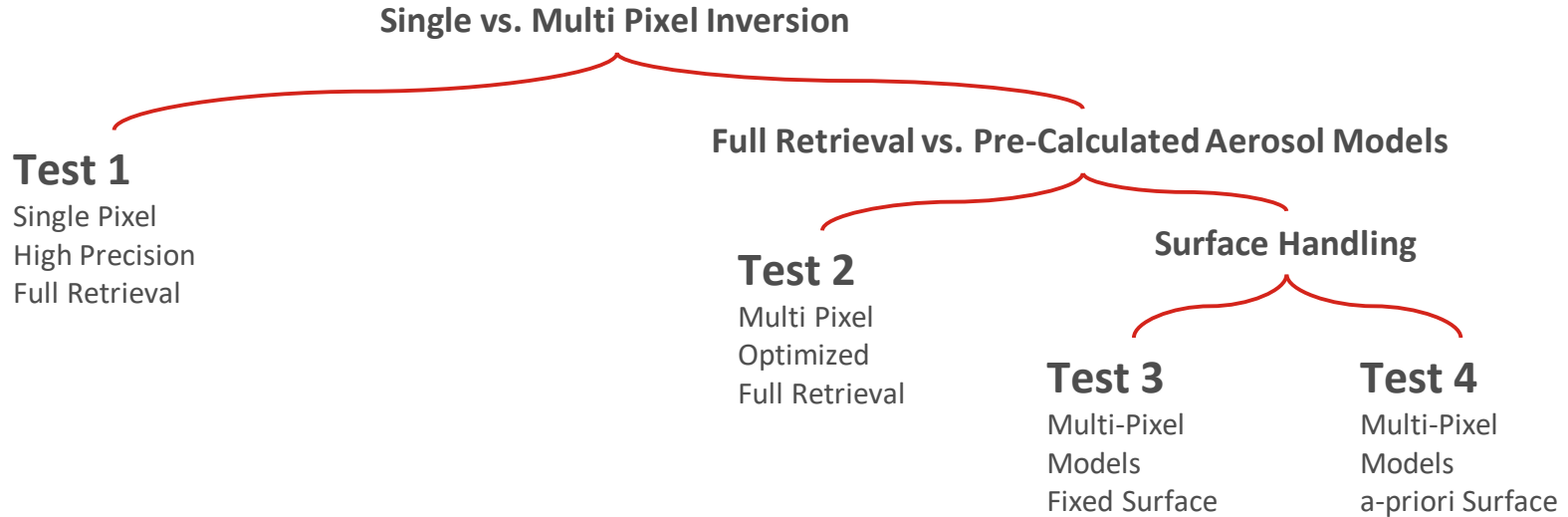
- Computational Performance
- Ground Segment Interface with PDAP
- Documentability

Optionally, Re-Process 1 year of Parasol

- Better understanding of retrieval configuration & performance



Evaluated GRASP Settings



These settings were generated and supplied by another EUM study.
This study only evaluated the computational performance.

Clarification on the Settings

The preferred way of running grasp is in a multi-temporal and multi-spatial multi-pixel setup.

- E.g. grasp retrieves 2x2x20 spatio-temporal pixels in one step.

Here, for 3MI, all settings use a single-day setup.

- There is only 1 time layer included, i.e. 2x2x1 pixels.

Hence, even when referring to multi-pixels, it only applies to multiple spatial pixels.



Performance Assessment

Assumptions	
pixel per orbit	1.89M
cloud cover	60%
maximum time	45 min

Cores needed for 45 minutes per orbit target	mean s/px average case	Q95 s/px worst case
test 1: full retrieval high quality	925	1594
test 2: full retrieval optimized	94	114
test 4: a-priori surface	66	85
test 3: fixed surface	40	56

MTG L2PF threshold is at 100 cores

Excludes time for PDAP and co-reg!

Numbers and orbit statistics are based on single EUM simulated orbit.

Optional activity to validate the metrics on 1 year of PARASOL was not activated.

Optimal Segment Sizes

Segment Size (N x N)	test1	test2	test3	test4
2 x 2	3.33	0.34	0.16	0.26
10 x 10	3.30	0.33	0.14	0.23
15 x 15	3.44	0.36	0.14	0.24
20 x 20	3.79	0.38	0.15	0.24
25 x 25	4.42	0.42	0.15	0.26

There is little variation in processing time when varying the segment sizes.
It is suggested to optimize this for retrieval accuracy.



Ground Segment Assessment

How can GRASP fit in the PDAP?

- Three integration concepts
- Checked static data tables
- No change to ICD/IRD necessary

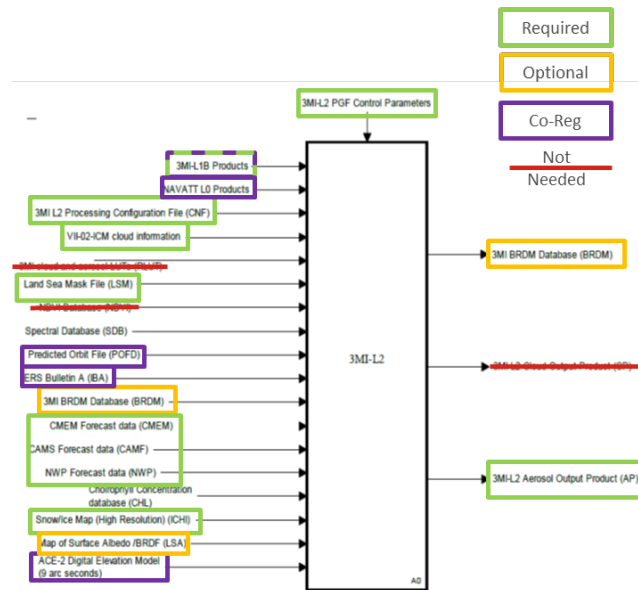
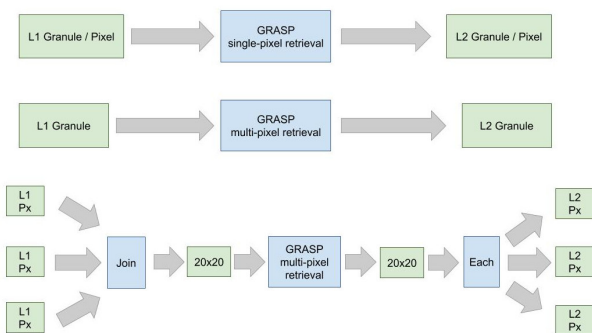


Figure 15: Generic Context Diagram for the 3MI-L2 PGF



Documentation Assessment

How can GRASP be documented?

- Selected reference function
- Prepared PGS for ref. function
- Minimized GRASP source code
- Generated Code Metrics
- Extrapolated metrics and effort

Reference Function ORDN

- Order of Scattering Calculations
- One of the most complicated ones
- 400 LoC, 35 parameters

Function	Parameters	Lines	Executable	Complexity	Pages	Effort
ORDN	35	400	300	57	3	5-6 man days



GRASP Tailoring

Automated Tailoring

- Run retrieval with given config
- Remove all un-called functions

Code-Analysis on Tailored Code

- Lines of Code
- Number of Parameters
- Cyclomatic complexity
- ...

Configuration	Functions	Total Lines	Executable Lines	Parameters input, output
Test 1	165	17392	8875	2006, 1033
Test 2	172	18613	9650	2097, 1091
Test 3	158	16703	8738	1825, 994
Test 4	162	16854	8763	1849, 1004

Configuration	Cumulative Cyclomatic Complexity
Test 1	2051
Test 2	2245
Test 3	2035
Test 4	2043



Extrapolation

We expect approx.:

- 300 pages of input parameter description,
- 300-600 pages of code description,
- 300-500 pages of introduction and general explanations.

Total: 1000-1500 pages

Approach to documenting each function:

1. Understanding the routine
2. Simplifying the routine
3. Writing the actual specification
4. Independently review the specification



Ways to reduce code-size

Addtl. Tailoring

- Remove unreachable branches
- Remove boilerplate code
 - Internal/External interfaces
 - Library Wrappers
 - Data Handling

Extract CFI/COTS

- Spheroid Package
- Forward Model
 - Surface, aerosol modelling
 - Radiative transfer
- Inversion

We expect 400-500 pages reduction



Assessment Summary

Is GRASP Performance good enough?

- yes for MP+Models approach
- likely yes for SP approach



Can GRASP be integrated in PDAP?

- yes in terms of GRASP retrieval in Stream Processing
- yes in terms of data tables
- yes in terms of In/Out/Aux data sets



Can GRASP be documented?

- yes as shown via ORDN reference function
- yes in terms of size + effort



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