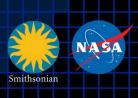


- Starting point: OMI Raman-scattering cloud code (OMCLDRR)
- > Modification for TEMPO
 - > Changes common to all science codes
 - Cloud-specific changes
- > Testing
- > Resource usage
- > Further work



OMCLDRR



- ➤ Main products:
 - Cloud Fraction
 - Cloud Pressure (optical centroid pressure)
- Code characteristics:
 - > ~10000 lines of Fortran90, ~120 subroutines / functions
 - > Inputs:
 - HDF-EOS2/HDF4 radiance and irradiance
 - > ASCII and fortran binary format calibration files (climatologies, cross-sections, lookup tables, etc.)
 - > Output: HDF-EOS5/HDF5
- > Fast code: ~70s to process one OMI orbit.

3



Modifications for TEMPO: common to all codes



- > File format changes:
 - > TEMPO will use netCDF4/HDF5 throughout
 - Replace HDF-EOS with TEMPO I/O library built on netCDF4 (libtio)
- Error handling and logging:
 - > ECS SDP Toolkit over-complicated for our needs
 - Replace with dedicated error handling and logging library (libtell)
- > Compilers:
 - OMCLDRR built using PGI compiler
 - > TEMPO software development uses GNU and Intel compilers



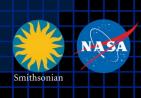
Modifications for TEMPO: Cloud-specific



- > Remove/disable unused experimental/test code
- Remove OMI-specific features
 - > Spatial zoom mode, small pixel data, row anomaly, etc.
- Reformat fortran binary calibration files to netCDF
 - > Smaller, human readable files with no significant loss of speed
- **Results:**
 - > ~1000 lines of code removed,
 - netCDF I/O added but HDF-EOS I/O retained for testing,
 - > Speed of code retained.
- > Refactoring for TEMPO mostly complete



Testing



> Regression testing

- ➤ Nightly build compiles and runs GNU and Intel versions of code every weekday, using OMI data
- > Output compared with baseline file "blessed" by GSFC developers
- Cross-comparison of HDF-EOS and netCDF inputs/outputs
- Tests specific capabilities: spline and linear interpolation, wavelength shift & squeeze, output of residuals

Integration testing

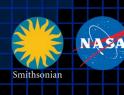
➤ Reduced-size TEMPO-format granule processed through Cloud, NO₂, HCHO codes, using pipeline manager prototype

> Throughput tests

Tests with full-size TEMPO granule - no problems identified



Resource Usage



- ➤ Time to process one OMI orbit: ~70s (Intel Xeon 2.8 GHz)
- ➤ Memory usage: ~112 MB
- Compare to other science codes:
 - \rightarrow Total O₃: ~70s
 - Trace gas (HCHO, NO₂): ~1 hour
 - O₃ profile (not yet updated for TEMPO): several hours
- > TEMPO 6-minute granule size equivalent to ~2.5 OMI orbits
 - > Tests confirm equivalent scale-up in processing time.
- Conclusion: Cloud code will be a minor resource user, no problems expected even with increased capabilities



Further work / TBD



- Incorporate improvements from GSFC developers:
 - > Uncertainty estimation
 - Improved surface reflectance climatology
- Issues to be resolved:
 - > Test data
 - > Cloud mask product
- ➤ CDR-level review of Cloud, Trace gas, and Total O₃ codes scheduled for October
 - We expect to have a prototype pipeline including all three codes, updated for TEMPO, ready for the review
- ➤ Take-home message: Cloud code modifications for TEMPO on schedule, no problems expected