OMI NEAR REAL TIME DATA PROCESSING

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1. INTRODUCTION

The Ozone Monitoring Instrument (OMI) is a Dutch-Finnish instrument on board NASA's Aura Satellite, launched in July 2004. OMI is a wide swath, nadir viewing, near-UV and visible spectrograph that measures ozone columns and profiles, aerosols, clouds, surface ultraviolet (UV) irradiance, and the trace gases Nitrogen Dioxide (NO2), Sulfuric Dioxide (SO2), and Formaldehyde (OHCLO)[1]. For this data to be used in forecast models it needs to be processed and sent to customers within 3 hours from the first measurement of a 100 minute orbit , which leaves 80 minutes for processing and distribution. In addition, the data received is raw, unfiltered data from the Spacecraft Contact Session, which is of varying lengths and includes duplicate packets. In order to produce quality data within the time constraints, algorithms need to be tuned to run faster, processing parallelized, and data distributed to customers in a timely manner.

2. ALGORITHM OPTIMIZATION

The OMI Near-Real-Time (NRT) capability is a joint development of NASA and the Royal Netherlands Meteorological Institute (KNMI) . The OMI NRT capability is part of the NASA's new Land Atmosphere Near Real-time Capability for EOS (LANCE) system. The Level 1B processing software is provided by KNMI and run by NASA. In order to speed up the Level 1 B processing, a number of internal algorithms are bypassed in the Level 1 Processor as compared to forward processing. These include spectral calibration, solar stray light corrections, and some dark current corrections. This speeds up the Level 1B software by about 20%. The OMI NRT Level 1B and Level 2 products are based on space craft contact sessions and estimated orbit definitions. This means the length of a granule can be either larger or smaller than the standard science products. By inferring that the spacecraft contact session intersects with orbit and using existing orbit definitions, the start and end times can be estimated, thus avoiding another preprocessing step of reading the files to get the start and end times.

3. CLUSTER OPTIMIZATIONS

The OMI team takes advantage of the flexibility and distributed nature of the existing processing system (Atmospheric Composition Processing System[2]) to implement the Near-Real-Time capability. By distributing the workload among processing hosts in the cluster and reserving hosts for jobs at a higher priority, the level 2 algorithms can run parallelly, thus reducing processing time. Additionally, the cluster uses a data driven scheduler to initiate processing upon receipt of the Level 0 data. A redundant processing system will increase the reliability of the system and availability of the products. This will enable us to continue to process data during maintenance periods.

4. LATENCY

The latency of the data is measured as the sum of the arrival time from the EOS Data and Operations System (EDOS) plus the Level 1B processing time plus the sum of the level 2 algorithm and precursor level 2 algorithms and any other delays (including maintenance) . Table 1 is the results from a typical 2 week period of November 1-14 , 2009. Note that it includes delays due to maintenance.

Product	Percentage Delivered under 3 hours
OMCLDO2	96.04
OMDOAO3	94.55
OMNO2A	90.1
OMAERO	85.64
OMCLDRR	96.26
OMAERUV	96.26
OMTO3	93.58
OMSO2	93.58
Total:	92.76

Table 1: Percentage of products delivered in less than 3 hours from first measurement.

5. QUALITY DIFFERENCES BETWEEN NRT AND STANDARD SCIENCE PRODUCTS

The quality of OMI NRT Level 2 products compares favorably to the standard products. There appears to be some variances at high latitudes with high solar zenith angles. In Table 2 we display the maximum differences for a single day and averaged over a week.

Product	Variable	Daily Maximum Percentage Difference	Weekly Average Maximum Percentage Difference
OMTO3	Total Ozone Column	2.64%	1.40%
OMDOAO3	Total Ozone Column	3.60%	0.30%
OMCLDRR	Cloud Fraction	6.02%	1.42%
	Cloud Pressure	2.82%	0.67%
OMCLDO2	Cloud Fraction	8.83%	1.98%
	Cloud Pressure	3.49%	0.59%
OMAERO	AOD (388 nm)	18.16%	4.56%
OMAERUV	AOD (388 nm)	5.95%	2.31%

Table 2: Maximum differences between NRT and standard products.

6. DATA DISTRIBUTION

OMI data is distributed to a number of customers using both pull and push technology over high speed networks. Data is provided to users on the basis of approval from the OMI Science Advisory Board. Currently, data is provided only through a subscription based model with support for scp or sftp pull and ftp or http push. KNMI uses the data for assimilation[3] and provides NRT NO2 maps of Europe through their Troposhperic Emission Monitoring Internet Service (TEMIS) website[4]. Data is also sent to the National Oceanic and Atmospheric Administration (NOAA) for use in volcano monitoring[5]. Our Data Downloader (dado) tool offers users a high speed option to pull data to their machines organized by user defined metadata.

8. REFERENCES

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