Wide-field Infrared Survey Explorer (WISE)

WSDC Quality Assurance Plan

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Revision History

Date	Version	Author	Description
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1. INTRODUCTION

1.1 Purpose of this Document

The WISE mission will produce a large volume of imaging data over a very short time frame. The processing pipelines at the WSDC will create products from these data for eventual use by the scientific community. Because of the data volume and the short timescale on which data are to be made available to the general public, rapid processing is required. Quick and efficient data quality assurance is vital to success.

Data not meeting the science requirements of the WISE mission will be flagged and alerts given to the SOC/MOS/EOS. Data meeting the science requirements will be characterized so that after their public release they can be correctly interpreted by the scientific community.

Some parameters that affect data quality will be tracked by the processing pipeline subcomponents, but others parameters can be assembled only after all subcomponents are run, particularly when overall comparisons to previous data sets are needed. In this vein, a comprehensive quality assurance (QA) system in which all of the data quality parameters are tracked and assembled is necessary. It is vital that this system be as automated as possible so that the final arbiter of quality (the human reviewing the data) can quickly assess and bless those data meeting the project's specifications, while spending most of his/her time on the small fraction of data most needing detailed scrutiny. The QA system will also provide an interface for this detailed follow-up so that the QA scientists can efficiently analyze and troubleshoot issues and feed this knowledge back into the automated system.

The QA system will collect summary reports for all of the data processing subsystems and compile them into a single concise report to be reviewed by the QA scientist. These summaries consist of software completion status reports, statistical analyses, and other tabular and graphical material on which data quality can be judged. The QA system collects parameters, compares them to concise metrics, and presents the results in a web-based form.

This document serves as an overview of the components comprising the QA system for each data processing pipeline at the WSDC.

1.2 Overview of WSDC Quality Assurance

WISE data will be processed through a number of different pipelines, and quality assurance (QA) will be performed as an integral part of each of these. For completeness, the purpose of each of these QA systems is listed below along with the timescale on which the QA is to be performed and the actions resulting from each QA assessment:

A. Ingest QA
    a. Purpose: To verify integrity of science and engineering data from WISE (both from White Sands and MOS/EOS?) and compare against observing plan from SOC
    b. Timescale: Following each data transfer
    c. Action: WSDC to inform MOS/EOS and SOC of anomalies
B. Science Data Quicklook QA
    a. Purpose: To provide quick feedback of health checks (on ~5% of data) for each downlink
    b. Timescale: Within 24 hours of end of data transfer to WSDC
    c. Action: SOC to review web-based report
C. Science Data Processing QA (both single-orbit and multi-orbit)
    a. Purpose: To check for successful completion, scrutinize output of processing pipeline and compare performance to science metrics
    b. Timescale: Following run of each single-orbit or multi-orbit run
    c. Action: WSDC to assign quality scores to each frame of frame collection for Final Products; PI responsible for signing off
D. Archive QA
    a. Purpose: To validate accuracy of source/metadata database loadings; to verify integrity of database tables (e.g, checksums and RTB queries)
    b. Timescale: After each database load; run periodically on static tables
    c. Action: WSDC does checks in cooperation with IRSA
E. Final Products QA

a. Purpose: To assess properties of the final Atlas Images and Source Catalogs relative to the Level 1 and 1.5 requirements and to give overall characterization of public data products
b. Timescale: After Final Product Generation but before public release
c. Action: WSDC and Science Team to provide analyses; final release approval given by PI

2. FUNCTIONAL OVERVIEW

There are five pipelines through with WISE data are processed at the WSDC.

2.1 Ingest QA

(Outline TBD)

2.2 Single-orbit QA (quicklook and full processing)

a. Summary of input data
    i. Report log file and results of ingestion QA
    ii. (For full processing, report QA results for quicklook processing)
b. Instrumental image calibration
    i. Compare flat-fields to fiducials
    ii. Compare sky-offsets to fiducials
    iii. Monitor dark images/overscans
    iv. Monitor hot pixel masks – changes, # of pixels
    v. Monitor illumination profile corrections
    vi. Flag outlying noisy frames; plot noise histograms
    vii. Flag outlying point-source-filtered noise frames; plot histograms
c. Source characterization
    i. Monitor source shape, scan mirror synchronization
    ii. Monitor mean aperture photometry curves-of-growth
d. Bandmerging
    i. Monitor band-to-band positional offsets

ii. Monitor % sources seen in all bands vs. single-band missing sources vs. two-band missing, etc.

e. Position reconstruction
    i. Flag outliers in % match to 2MASS PSC; plot histograms of astrometric deltas
    ii. Tabulate sources with large deltas or no 2MASS matches (at least in W1 and W2) modulo minor planet associations
f. Artifact identification
    i. Perform semi-automated visual spot checks of a few examples of each?
        1. Latents
        2. Dichroic/filter glints
        3. Diffraction spikes
        4. Bright star halo contamination
        5. Optical ghosts
        6. Electronic ghosts
        7. Others
g. Solar system objects identification
    i. Plot # of solar system objects vs. ecliptic latitude
    ii. Perform semi-automated visual spot checks of brighter examples?
    iii. Color-color plots
    iv. Detection fraction vs. visual mag
h. Frame detection statistics
    i. Plot log(N)-log(S) and other statistics
    ii. Plot counts vs. ecliptic latitude (check for rad hits)
    iii. Tabulate/plot mean photometric offsets from in-scan overlaps
    iv. Tabulate/plot image shape and asymmetry
i. Photometric calibration
    i. Tabulate/plot mean/RMS differences between truth and derived photometry for standard stars in the orbit.
    ii. Tabulate/plot mean/RMS differences between stars in this orbit and those observed in previous overlapping orbits (trending).
    iii. Tabulate/plot zero-point drifts frame-to-frame.
j. QA summary
    i. Report processing completion
    ii. Provide web-accessible page with tables and plots listed above

iii. Generate auto-filled QA report as starting point for human review

2.3 Multi-orbit QA (full processing only)

a. Summary of input data
    a. Summarize characteristics (QA grades) for each orbit considered for image stacking
b. Single-orbit image combination
    a. Perform semi-automated visual checks of combined images
c. Source characterization

(Rest of outline TBD…)

2.4 Archive QA

(Outline TBD…)

2.5 Final Products QA

(Outline TBD…)

3. OPERATIONAL PLAN

Staffing, etc. – TBD.

4. ANOMALY RESPONSE PLAN

TBD. How is info on anomalies to be disseminated to the rest of the WISE team (MOS/EOS/SOC), their resolutions tracked, and investigations closed.

5. SUMMARY

TBD