Automatic
Cloud Cover Assessment
(ACCA)

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Operational Procedure

- **The Landsat Processing System performs ACCA on every image prior to archiving**
- **Cloud cover scores (percentages) are tabulated and reported on a quarter scene and full scene basis**
- **Cloud cover scores are recorded in scene metadata records**

Purpose

- **ACCA scores are available to users for identifying candidate imagery**
- **Cloud cover scores are reviewed daily by the Mission Operations Center to determine image acquisition success or failure (based on long term acquisition plan criteria)**
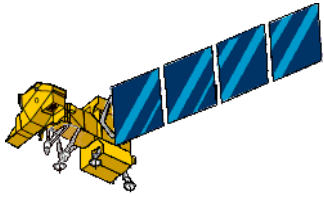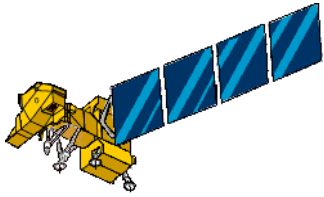
Landsat 5 ACCA Algorithm

Description

- **Threshold based - 3 filters**
  - band 3 is first used to eliminate dark image features
  - band 6 is used to eliminate warm image features
  - band 5 is used to eliminate snow
  - remaining image areas are cloud
- **Band 6 threshold varies according to latitude and snow cover percentage of the imaged scene**
- **Operates on calibrated data (pre-launch gains and offsets)**

Known Weaknesses

- **Trouble with cold, highly reflective landscapes (e.g. tundra, deserts)**
- **Imperfect snow/cloud discriminator**
- **Insensitive to warm clouds**
- **Performance suffers at low sun elevation angles**

Landsat 7 ACCA Algorithm

Description

- A scene dependent approach that employs two passes using thresholds, ratios, and indices
- Bands 2, 3, 4, 5, and 6 in low gain mode utilized (format 1)
- Operates on calibrated data - post launch gains and biases
- Calibrated data converted to planetary reflectance for bands 2-5
- Band 6 is converted to temperature prior to assessment

Known Weaknesses

- Thin cirrus is elusive
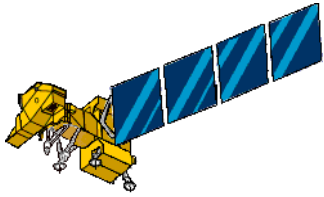
Pass One

Six conservative filters are used to identify clouds. A primary goal is to minimize errors of commission.

| Filter	Function
– Band 3 threshold	Eliminates dark image features
– Normalized Snow Difference Index (NDSI) (band 2 - band5) / (band2 + band5)	Eliminates many types of snow
– Band 6 threshold	Eliminates warm image features
– Band 5/6 separator (1 - band5) * band6	Eliminates numerous categories including ice
– Band 4/3 ratio	Eliminates bright vegetation and soil
– Band 4/5 ratio	Eliminates rocks and desert

Pass one is designed to trap only clouds. Errors of omission are accepted.
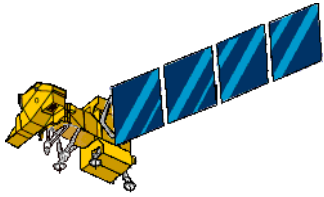
Pass Two

Thermal properties of clouds identified during the initial pass are characterized and used to identify remaining clouds during the second image pass.

- **Band 6 descriptive statistics (mean, standard deviation, skew) are computed for clouds identified during the first pass**
- **The 95th percentile becomes the new thermal threshold for pass two**
- **Image pixels that survive the first three pass one filters are classified as clouds if they fall below the new thermal threshold**
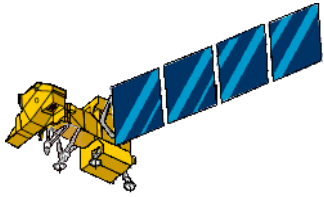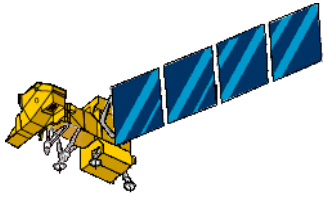
Pass Two Verification
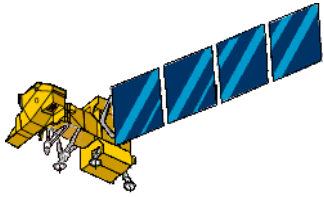
Pass two results are accepted as accurate providing:

- the pass two net effect is less than 40% (large cloud jump percentages result when pass one commission errors occur)

otherwise, the cloud cover score reverts to pass one results

Post Past Filtering

- **A cloud mask assembled during the two pass cloud identification process is examined**
- **Cloud holes are reclassified as clouds if 50% of a pixel's immediate neighbors are clouds**
- **Single pixel clouds are left untouched**
- **Cloud cover percentage is updated**

Results

- **200 images processed using the Landsat 5 & 7 algorithms**
- **Improvements observed in 90% of tested imagery**
- **Algorithm now part of EDC's Thematic Mapper Archive and Copy System (TMACS)**
- **Publication of algorithm forthcoming**