

Landsat-7 ETM+ and Landsat-5 TM Cross-Calibration Based on Tandem Data Sets

Status Report for CEOS WGCV-16, Bangalore, India, February 2000

P.M. Teillet¹, B.L. Markham¹, J.L. Barker¹, and J.C. Storey²

¹ Landsat Project Science Office (LPSO), Code 923
NASA's Goddard Space Flight Center
Greenbelt, MD 20771

² Landsat-7 Data Handling Facility
USGS EROS Data Center (EDC)
Sioux Falls, SD 57198-0001

Background

The Landsat data record is a key data set for terrestrial remote sensing and global change research because of its relatively fine spatial resolution, extensive terrestrial coverage, and temporal baseline over a time when significant anthropogenic terrestrial change has occurred. In order to benefit fully from such a data record, steps are needed to ensure that the data over time are on the same radiometric scale. Additional processing steps to retrieve surface parameters then become possible.

The launch of Landsat-7 on April 15, 1999 placed the spacecraft in a "tandem" orbit very close to that of the Landsat-5 spacecraft in order to facilitate the establishment of data consistency between the Landsat-7 Enhanced Thematic Mapper Plus (ETM+) and Landsat-5 Thematic Mapper (TM) sensors. Subsequently, the Landsat-7 orbit was changed for nominal operations such that its 16-day repeat coverage cycle is offset from that of Landsat-5 by 8 days. The tandem configuration period was from June 1 (18:06) to June 4 (00:53) 1999, during which 791 closely matching scenes were recorded by both the Landsat-7 ETM+ and, in cooperation with international ground stations (IGS), the Landsat-5 TM as well (Figure 1, Table 1). Approaching the one-year point in its mission, Landsat-7 ETM+ performance continues to be excellent.

The user community deserves to have a consistent Landsat data record as soon as possible and the success of Landsat-7 is an excellent opportunity to achieve this goal. Some elements of the cross-calibration effort correspond to funded investigations by the Landsat Science Team members and these will be completed accordingly. However, the main goal of long-term consistency of the Landsat data record relies heavily on the best efforts and cooperation of several agencies and universities for success.

Landsat-7 ETM+ and Landsat-5 TM Cross-Calibration Planning

A plan entitled "Long-Term Consistency of the Landsat Data Record: Landsat-7 ETM+ and Landsat-5 TM Cross-Calibration Plan" (Version 1.0, 17 December 1999) has generated by the LPSO. Landsat Science Team Principal Investigators (PIs) were briefed on data acquired during the tandem configuration period at the Landsat Science Team meeting of October 12-14, 1999. Specific requests for tandem data pairs by Landsat Science Team PIs are currently being processed. The international Landsat community has been briefed on data acquired during the tandem configuration period and the cross-calibration plan via Landsat Technical Working Group (LTWG) meetings among others. EDC is currently distributing relevant Landsat-7 ETM+ imagery from the tandem configuration period to the IGS participants. EDC also plans to issue a letter inviting the IGS recipients of Landsat-7 ETM+ data to share science results based on tandem data analyses at a possible special conference session in 2001. More general access to tandem data sets may take the form of a small number of sample tandem data sets available from EDC and encompassing a diversity of land cover types.

LPSO Data Preprocessing and Cross-Calibration Analyses

Preprocessing steps to ensure that ETM+ and TM tandem data sets are in compatible radiometric, geometric, and spectral domains have been specified, as have various cross-calibration analysis approaches. An initial subset of three matching scene pairs is being used by the LPSO to test these preprocessing and analysis procedures: Railroad Valley Playa, Nevada (June 1, 1999), Niobrara, Nebraska (June 2, 1999), and Maryland / Washington, DC area (June 2, 1999). Ground reference data are available for the first two of these data sets. First results will be presented at the SPIE AeroSense Conference in Orlando, Florida in April 2000.

Points of Contact for Cross-Calibrations Involving Landsat Sensor Data

The points of contact for cross-calibrations involving Landsat sensor data are Brian Markham (markham@highwire.gsfc.nasa.gov) and Grant Mah (mah@edcmail.cr.usgs.gov) at GSFC and EDC, respectively.

Table 1: Landsat-7 ETM+ and Landsat-5 TM Tandem Data Coverage

Tandem Scene Coverage (June 1-4, 1999)						Receiving Stations
WRS Path	WRS Row	Station	WRS Path	WRS Row	Station	
6	21-29	GNC	159		RSA	ASA ACRES, Alice Springs, Australia
6	57-71	CUB	159	69-78	JSA	COA Cordoba, Argentina
6	67-71	COA	168	19-27	KIS	CUB INPE, Cuiaba, Brazil
15	12-44	GNC	168		RSA	FUI ESA, Fucino, Italy
15	27-45	NOK	168	62-83	JSA	GNC CCRS, Gatineau, Canada
22	10-43	GNC	175	19-26	KIS	JSA Johannesburg, South Africa
22	26-49	NOK	175	23-42	FUI	KIS ESA, Kiruna, Sweden
31	7-40	PAC	175		RSA	LBG DLR, Libreville, Gabon
31	25-46	NOK	175	62-85	JSA	NOK SI/EOSAT, Norman, Oklahoma
38	6-39	PAC	184	22-44	FUI	PAC CCRS, Prince Albert, Canada
38	25-40	NOK	184	44-77	LBG	RSA Saudia Arabia (for SI/Dubai)
40	25-38	NOK	191	14-24	KIS	
47	4-30	PAC	191	17-43	FUI	
47	25-30	NOK	200	17-40	FUI	
54	4-25	PAC	207	19-24	FUI	
95	65-87	ASA	216	63-76	CUB	
102	69-83	ASA	223	60-86	CUB	
104	62-82	ASA	223	68-98	COA	
111	64-84	ASA	232	54-85	CUB	
152		RSA	232	66-97	COA	

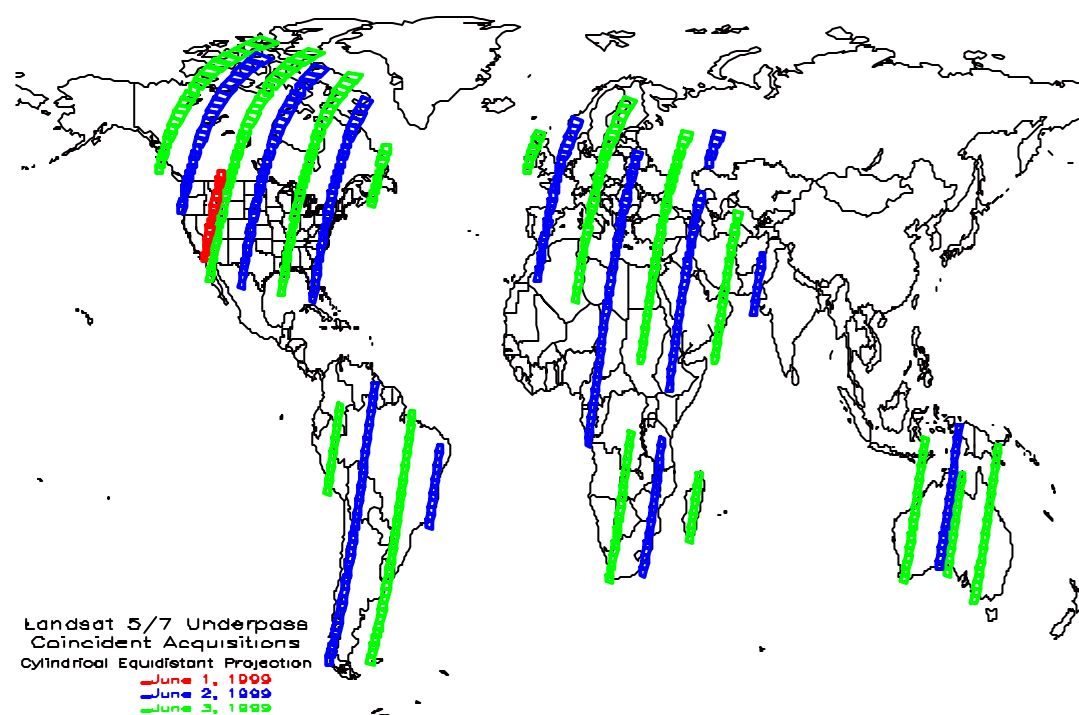


Figure 1. Landsat-7 ETM+ and Landsat-5 TM data acquired during the tandem configuration period.