

Re-Submittal of IMPROVE Transmissometer Extinction Data (1986 – 2004)
Air Resource Specialists, Inc., August 2006

Summary

In August, 2006, ARS performed additional QA on the IMPROVE Optec LPV-2 transmissometer data set in preparation for re-submittal to CIRA. The goals of this additional QA were as follows:

- Check for completeness and continuity of data
- Verify that reported RH and AT are within instrument specifications
- Verify lamp and calibration information

QA checks prompted some changes in the raw (Level-A) files and in the transmissometer lamp files. ARS reprocessed all historical transmissometer data to include these changes. A total of 1151 files were reprocessed for the years 1987–2004 and are included on the accompanying CD.

File Naming Conventions

Level-1 quarterly data files are named XXXXX_T1W.YYQ, where XXXXX is the site abbreviation, YY is the year, and Q is the calendar quarter:

- 1 = 1st Quarter (January, February, and March)
- 2 = 2nd Quarter (April, May, and June)
- 3 = 3rd Quarter (July, August, and September)
- 4 = 4th Quarter (October, November, and December)

For example, CANY1_T1W.041 contains Canyonlands National Park transmissometer data for the period January 1, 2004 through March 31, 2004.

Figure 1 presents the data file format key for all transmissometer data files. Table 1 is a chart indicating the count of quarterly files per year and per site provided with the data submittal.

Sample file headers and 6 data records

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APPEND_T: 1.5:08-17-2000 12-01-2000 08:33:18-----
LEVEL0_T: 1.6:12-22-2000 01-15-2001 06:22:03-----
LEVEL1_T: 1.6:12-22-2000 01-15-2001 06:22:09-----
WX_T:     12-22-2000 01-15-2001 06:22:23 RH Cutoff = 90-----
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SITE	YYYYMMDD	JD	HHMM	INST	LAMP	BEXT	UC	#	#	UT	DT	MAX	V	A	AT	U	C	RH	U	C	DV
BIBE2	20000901	245	000	004	2159	34	2	1	0	18	10	635	0		28	1	0	36	5	0	122
BIBE2	20000901	245	100	004	2159	36	2	1	0	18	10	635	0		27	1	0	38	5	0	128
BIBE2	20000901	245	200	004	2159	35	1	1	0	18	10	635	0		27	1	0	39	5	0	125
BIBE2	20000901	245	300	004	2159	35	1	1	0	18	10	635	0		27	1	0	39	5	0	125
BIBE2	20000901	245	400	004	2159	33	2	1	0	18	10	635	0		26	1	0	41	5	0	119
BIBE2	20000901	245	500	004	2159	35	2	1	0	18	10	635	0		26	1	0	43	5	0	125

Field	Description
SITE	Site abbreviation
YYYYMMDD	Date (4-digit year/month/day)
JD	Julian Date
HHMM	Time using a 24-hour clock in hour/minute format
INST	Transmissometer serial number
LAMP	Lamp serial number
BEXT	b_{ext} (Mm^{-1})
UC	b_{ext} uncertainty (Mm^{-1})
#	Number of readings in average
#	Number of readings not in average due to weather
UT	Uncertainty threshold (Mm^{-1})
DT	☛ threshold (Mm^{-1})
MAX	Maximum threshold (Mm^{-1})
V	b_{ext} validity code (0 = valid, 1 = interference, 2 = invalid, 9 = suspect)
A	b_{ext} validity interference subcode ¹
AT	Temperature ($^{\circ}C$)
U	Temperature uncertainty ($^{\circ}C$)
C	Temperature validity code
RH	Relative humidity (%)
U	Relative humidity uncertainty (%)
C	Relative humidity validity code
DV	Haziness (dv x 10)

¹ b_{ext} Validity Interference Codes:

Condition	Letter Code														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
RH > RH threshold	x		x		x		x		x		x		x		x
b_{ext} > maximum b_{ext} threshold		x	x			x	x			x	x			x	x
b_{ext} uncertainty > uncertainty threshold				x	x	x	x					x	x	x	x
☛ b_{ext} > delta threshold								x	x	x	x	x	x	x	x
	Z Weather observation between two other weather observations.														

Threshold values may be different for each site.

A -99 in any data field indicates missing or invalid data.

Figure 1. Level-1 Validated Transmissometer Data File Format (Revised April 2001).

Table 1
Reprocessed IMPROVE Transmissometer Files

Site	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	Total Files
ACAD1		1	4	4	4	4	4	2												23
BADL1			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	68
BAND1			1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	65
BIBE1			1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3		60
BIBE2															3	4	4	4	4	19
BRID1			1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	65
CANY1	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	73
CHIR1				4	4	4	4	4	4	4	4	4	4							40
CHIR2														4	4	2				10
CHIR3																2	4	4		10
CRLA1				2	4															6
CRLA2						1														1
GLAC1				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	64
GRBA1							2	4	4	4	4	4	4	4	4	4	4	4	4	50
GRCA1	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	73
GRCW1				1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	61
GUMO1			1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	65
MEVE1			2	4	2															8
MEVE2						2	4	3												9
PEFO1		2																		2
PEFO2		2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	70
PINN1			4	4	4	4	4	3												23
ROMO1		1	4	4	4	4	4	4	4	4	4	3								40
ROMO2													1	4	4	4	4	4	4	25
SAGO1			3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	67
SHEN1			1	4	4	2														11
SHEN2						2	4	4	4	4	4	4	4	4	4	4	4	4		50
TONT1				3	4	3														10
YELL1				2	4	4	4	3												17
YOSE1			1	4	4	4	4	4	4											25
YOSE2								1	4	4	4	4	4	4	4	4	4	4	4	41
Total Files	2	14	39	76	82	78	78	75	65	64	64	63	61	64	67	68	68	67	56	1151

Reprocessed Transmissometer Data

ARS reprocessed all historical Optec LPV-2 transmissometer data to reflect additional QA performed on the dataset. Raw Level-A transmissometer files were blank-filled to provide complete quarterly files regardless of instrument begin/end time. Level-A files were also adjusted to exclude AT and RH values for time periods when these sensors were not functioning correctly. Additional QA affected RH and/or AT values for 5,298 out of 2,520,625 hourly values (0.2 %).

Occasionally, transmissometer calibration, lamp change, or other diagnostic information is received after data have been reported and instrument-specific calibration and lamp databases are revised. These revisions affect the application of lamp brightening curves and other processing algorithms. Due to these revisions, reprocessing the transmissometer data introduced changes in reported extinction values for 35,147 out of 2,520,625 hourly values (1.4%). Figure 2 presents a distribution of the differences observed between previously reported and reprocessed extinction values for these hourly values. 58% of these differences are within $\pm 5 \text{ Mm}^{-1}$.

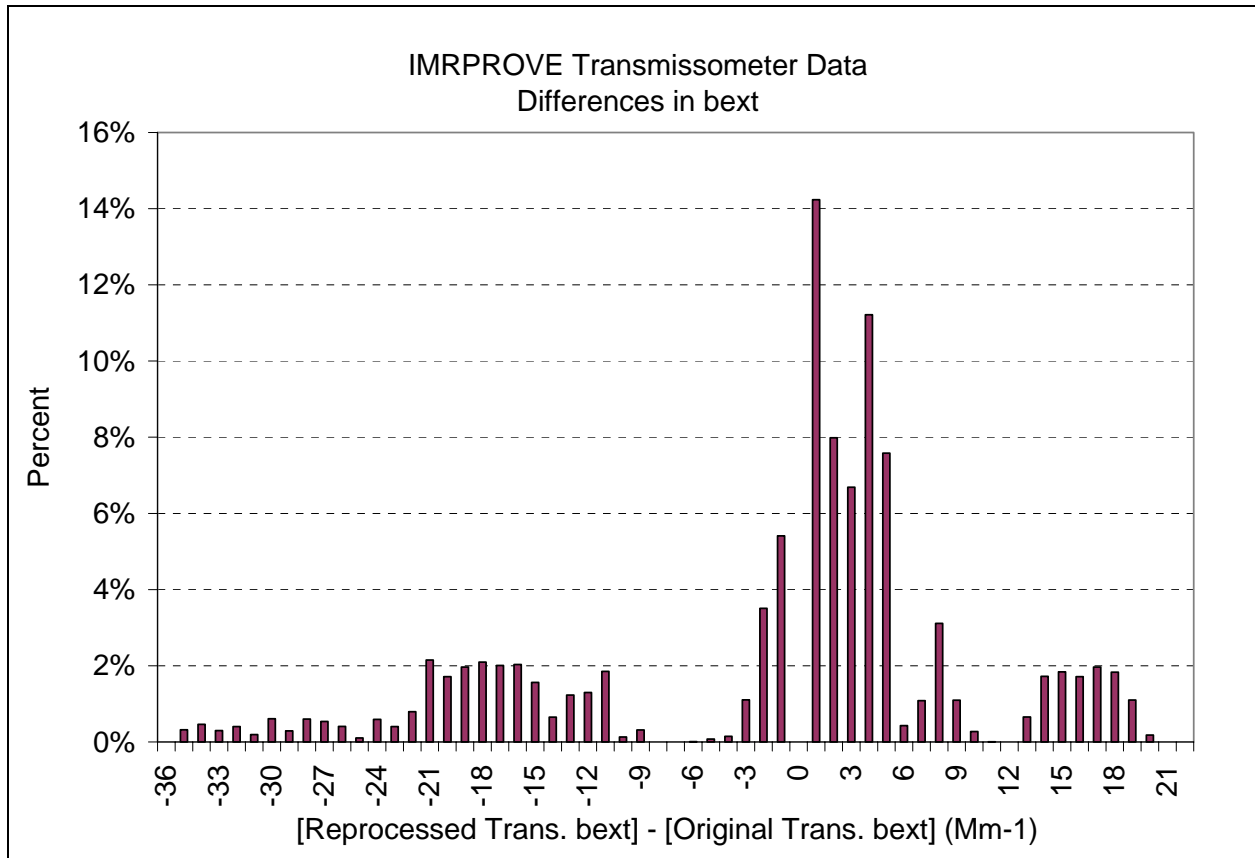


Figure 2. Distribution of the difference between reprocessed transmissometer b_{ext} and originally reported transmissometer b_{ext} . Distribution counts only b_{ext} values with differences. Most values (98.6%) were unaffected by reprocessing.