UNIVERSITY OF WISCONSIN HIGH SPECTRAL RESOLUTION LIDAR OPERATIONS SINCE AUGUST 21, 1993

The HSRL operations since August 21, 1993 are listed. This list includes data taken in Madison, WI during routine data taking and data from a field experiment in Cottonwood, AZ, 1995.

Days and times are in UT.

Location of the HSRL:	Madison, WI:	43.0705, -89.4069 @ 265 m
	Cottonwood, AZ:	34.7325, 112.0356 @ 1045 m

1993 Operations

Date	**Start**	**End**	**Cloud Type/Comments**
08/21/93	00:50	02:40	cirrus 7.5 - 11 km
08/24/93	01:25	01:55	water with virga at 8.5 km, cirrus 12.5 km
09/02/93	01:25	03:05	cirrus 7.5 - 10.5 km
09/08/93	00:30	02:21	multi-layer ice and water 3 - 10 km
09/09/93	01:05	01:54	ice and water 4 - 10 km
10/01/93	20:30	21:51	cirrus 7.5 - 11 km
10/01/93	23:50	→	thick cirrus 4 - 11 km
10/02/93	→	01:39	
10/12/93	00:00	01:39	cirrus 7.5 - 11 km
10/24/93	23:40	→	scattered cirrus 11-12 km
10/25/93	→	01:09	
10/26/93	00:25	01:33	cirrus 9 - 11.2 km
10/28/93	01:10	02:15	thick cirrus 4 - 10.5 km
11/02/93	01:00	02:20	cirrus 4.8 - 12 km, water cloud 3.8 km
11/09/93	23:40	→	multi layer ice and
11/10/93	→	00:38	water from 1.5 km to 8 km
11/11/93	01:13	02:13	multi-layer case, water cloud
			with ice virga 5.5 - 5.8 km,
			cirrus 6.5 - 10 km
12/13/93	00:30	02:46	multi layer water clouds
			3.5 - 7 km with virga, cirrus 7.5 - 11 km
12/16/93	02:40	04:03	water clouds 5-6 km with virga

1994 Operations

Date	Start	End	Cloud Type/Comments
01/12/94	00:20	01:06	cirrus 6.2 - 11 km
02/04/94	00:05	01:07	cirrus 3.6 - 7.5 km, water at 3.5 km
02/14/94	23:40	→	thin scattered cirrus 7.5 - 10 km
02/15/95	→	00:52	
02/17/94	00:00	01:45	thin, scattered cirrus 7.5 - 12 km
02/19/94	00:00	02:07	ice and water 3 - 8 km, cirrus 10 km
03/04/94	00:20	01:27	cirrus 7.5 - 10.5 km
03/08/94	01:00	02:16	water cloud at 4.2 km with virga,
			cirrus 6 - 9 km
03/16/94	02:30	03:28	clear
03/17/94	00:30	01:40	couple thin cirrus clouds, clear
03/26/94	00:15	01:10	cirrus 3.2 - 9.5 km
	01:47	02:11	layer of water at 4.5 km, ice 3.2 - 9.5 km
04/07/94	00:10	00:44	thin cirrus 6.5 - 8.3 km
04/07/94	23:45	→	cirrus 5.7 - 9.5 km
04/08/94	→	00:45	
04/10/94	01:10	02:00	cirrus 6 - 11 km
04/11/94	00:20	00:52	cirrus 8 - 11.5 km
04/12/94	00:10	00:35	thick layer of water 4 - 6 km with some ice
			some cirrus 7 - 9 km
04/15/94	00:20	02:25	water and ice with strong aerosol layer
04/17/94	02:00	10:23	clear, strong aerosols
04/21/94	23:40	0:26	water at 3.5 - 4 km with virga
04/23/94	01:15	03:32	clear
04/24/94	03:05	03:32	clear
04/26/94	02:30	03:34	thick cirrus 3.7 - 7 km
04/30/94	01:10	02:16	cirrus 6 - 11 km
05/06/94	16:45	19:31	cirrus 5.5 - 11 km
05/10/94	20:00	22:10	cirrus 7.5 - 11 km
05/13/94	02:00	03:19	thin cirrus 11-12.5 km
05/14/94	21:50	23:56	thin, scattered cirrus 12.5 km
05/17/94	02:55	04:00	clear
05/18/94	01:10	02:52	cirrus 8 - 11.5 km
05/19/94	01:40	04:02	cirrus 10.5 - 13 km
05/20/94	01:25	03:21	very thin, scattered cirrus 11-13 km
05/21/94	01:20	02:58	thin cirrus, clear
	20:00	21:31	clear

1994 Operations Continues

Date	Start	End	Cloud Type/Comments
05/21/94	23:20	→	clear
09/22/94	→	01:09	
05/23/94	01:50	03:39	clear
05/24/94	02:40	03:04	water at 2.3 - 3 km and precip.
05/27/94	02:00	03:14	one low water cloud at 2 km, clear
05/27/94	23:00	→	scattered cirrus 7 - 10 km
05/28/94	→	00:49	
05/29/94	01:50	02:58	clear
05/30/94	02:25	03:44	cirrus 8 - 12 km
05/31/94	01:40	02:43	cirrus 5.7 - 12 km
06/01/94	01:50	02:50	clear
06/02/94	01:45	02:45	water and ice 4 - 7.5 km
06/05/94	00:20	01:14	thin, scattered cirrus 8.5 - 12 km
06/07/94	03:30	04:26	cirrus 10 - 13 km
			water 2 km
06/09/94	00:40	01:40	thin cirrus 11 - 12,5 km
06/13/94	00:25	01:30	water 4 km, cirrus 6 - 12.5 km
06/14/94	04:10	05:03	water 1.5 - 2 km and 2.5 - 3 km
06/20/94	02:15	02:47	cirrus 8 - 11 km
06/23/94	00:20	01:23	cirrus 5 - 12.5 km
	02:15	04:30	water and ice 3.5 - 7 km
	05:25	05:36	water and ice 3 - 7 km
06/28/94	02:10	02:54	water 3 - 3.5 km
07/12/94	01:55	03:02	scattered cirrus 6.5 - 8 km,
			scattered water clouds 5 - 5.5 km
07/13/94	02:55	04:17	water at 4 km and 6.7 km with virga,
			precip.
07/16/94	02:20	03:20	scattered cirrus 7.5 - 12 km
07/20/94	01:00	02:00	water 4 - 6 km,
			some cirrus 8 - 9 km
07/29/94	02:30	04:20	clear
07/31/94	02:05	02:55	clear
08/03/94	02:48	03:44	cirrus 10 - 11 km
08/10/94	01:00	02:40	water at 6 with virga , precip.
08/30/94	01:50	04:49	scattered cirrus 6 - 11 km, aerosols
09/13/94	01:00	06:16	cirrus 6 - 13 km,
			water with virga at 6 km
09/21/94			
09/22/94	02:30	04:01	cirrus 7 - 12 km

1994 Operations Continues

Date	Start	End	Cloud Type/Comments
10/01/94	02:45	02:51	cirrus 4 - 12 km, water 3 km
10/12/94	02:40	03:50	cirrus 10 - 12.5 km
10/17/94	00:00	05:09	cirrus 7.5 - 12 km
10/24/94	23:05	$\rightarrow$	water and ice 2.2- 6.7 km
10/25/94	$\rightarrow$	00:10	cirrus 9 - 10 km
10/26/94	23:40	00:38	cirrus 7.3 - 10 km
10/26/94	23:55	$\rightarrow$	cirrus 6 - 10 km,
10/27/94	$\rightarrow$	00:42	water 0.7 km and 4.5 km
12/01/94	01:50	02:22	thin cirrus 10 - 11 km
12/02/94	00:00	01:51	cirrus 9-12 km
12/08/94	01:40	03:30	cirrus 5.5 - 8 km, section of clear
12/12/94	02:20	02:38	cirrus 6.5 - 11 km

1995 Operations

ARIZONA-program, Cottonwood, AZ

Date	Start	End	Cloud Type/Comments
01/18/95	→	→	down due to water pump failure
01/20/95			
01/21/95	15:00	16:45	clouds and rain up to 2 km
01/21/95	17:45	20:15	clouds and rain up to 1.5 km
01/24/95	15:10	19:05	clouds between 2-10 km, phase changes
	19:25	21:25	clouds between 2-10 km
01/25/95	02:25	02:55	cirrus 4-5 km, 7-9 km, 9-11km, water layer at 5 km
	14:15	16:40	clouds and rain up to 3 km, clear melting layer
	17:30	18:10	clouds and rain up to 2 km, aircraft measurement 18:10 UT
01/26/95	15:45	17:00	clouds and rain below 500 m
01/28/95	01:04	03:10	scattered thin cirrus 6-8 km
01/30/95	00:36	02:50	cirrus 7-12 km
01/31/95	02:40	03:10	cirrus 7-11 km
02/01/95	→	→	laser problem
02/02/95			
02/02/95	01:53	03:20	testing the lidar
02/05/95	02:06	03:20	thin, scattered cirrus 8-10 km
02/07/95	19:35	22:35	cirrus 7-10 km
02/08/95	16:05	18:25	water 3,4,and 5km, ice precip, melting at about 1.5km
02/09/95	18:50	20:43	thin water layer at 6.6 km with some ice virga
	21:13	21:49	broken cloud layers and clear
02/12/95			testing MFOV-channel
02/13/95	18:25	20:52	low clouds with some precipitation
	21:45	→	
02/14/95	→	01:44	broken low clouds with some precip.
	15:30	20:45	data from rain showers with dropplet size samples
02/15/95	15:46	18:45	light drizzle occasionally, low clouds very good change in cloud phase from ice to water
	19:55	21:50	water at 2 km
02/16/95	23:25	→	broken cirrus 7-11 km

1995 Operations Continues

ARIZONA-program, Cottonwood, AZ

Date	Start	End	Cloud Type/Comments
02/17/95	→	07:30	
	23:15	→	
02/18/95	→	02:10	cirrus 7-10 km
02/21/95	00:40	07:40	cirrus and water, ice 3-10 km
			patches of water 5-7 km
			aircraft measurements of particle sizes
02/22/95	21:30	23:30	convective system measurements,
			ice+water+precip.
02/24/95	20:15	20:50	convective system measurements,
			ice+water+precip.
	22:30	→	cirrus from convective systems
02/25/95	→	02:50	and start of a thunderstorm
02/27/95	02:25	03:29	cirrus and low water cloud patches
	19:25	→	low scattered water and broken cirrus
02/28/95	→	00:45	
02/28/95	17:30	→	low broken water cloud at 1.5-3 km,
03/01/95	→	03:20	cirrus 7-9 km, replicator
	16:10	20:20	broken cloud layer at 600 and
			cirrus at 7-11 km, precip.
03/02/95	18:30	→	low cloud layer braking at sundown
03/03/95	→	04:45	particle size measurements of varying
			water and ice layers with replicator
			and aircraft
03/04/95	01:30	06:45	low clouds breaking up during aircraft meas.
			low cloud deck during replicator sounding
	16:59	19:00	broken low clouds, no ice
	22:58	→	daytime cirrus
03/05/95	→	01:30	
03/05/95	20:35	→	low clouds with few short brakes
03/06/95	→	01:35	and precipitation
	02:10	08:30	low clouds and rain
03/08/95	23:48	→	cirrus 4-10 km, water layers at 6 km
03/09/95	→	04:25	

1995 Operations Continues

ARIZONA-program, Cottonwood, AZ

Date	Start	End	Cloud Type/Comments
03/10/95	23:45	→	water layer at 5 km, ice precip
03/11/95	→	03:15	
	14:50	15:45	ice 1.8-5 km, rain
	16:33	17:07	ice 1.5-5 km, rain
	17:17	18:10	cirrus at 8 km, ice 1.3-5, signs of water layers 1.8-4 km
	20:14	20:25	ice 1.2-3 km, water 1.8 km
	20:50	23:15	showers and thunderstorm
03/12/95	00:20	05:15	water layer 1-2 km
03/12/95	05:45	08:20	water layer 1-2 km

1995 Operations Continues

MADISON, WI

Date	Start	End	**Satellites**	**Cloud Type**
05/21/95	15:30	16:19	LandSat, GOES-8	clear
				aerosol layer up to 7 km
06/02/95	17:45	19:15	NOAA-14, GOES-8	water cloud~2 km
				and rain
06/06/95	14:30	16:15	LandSat, GOES-8	thin cirrus 10-12.2 km
06/09/95	17:40	19:45	NOAA-14, GOES-8	low water clouds ~1 km
				water and ice 3.4–6 km
06/12/95	17:00	19:40	NOAA-14, GOES-8	cirrus 7.5–10 km
				low cumulus ~2.4 km
06/15/95	15:10	17:25	GOES-8	thin cirrus,
				aerosols 7.4–10 km
06/20/95	18:30	19:26	NOAA-14, GOES-8	clear
06/22/95	14:20	16:00	LandSat, GOES-8	clear,
				aerosol layer 7.7–9 km
06/28/95	02:30	03:22	GOES-8	multi-layer water clouds
				3.3–4.7 km
06/29/95	19:50	19:33	NOAA-14	low cumulus ~ 400 m
				water clouds 1–2 km and
				3.5–4.5 km
07/04/95	02:30	03:47	GOES-8,	cirrus 9.3–11.5 km
07/07/95	18:05	19:40	NOAA-14, GOES-8	thin cirrus 10–12 km
				cumulus ~1 km
*07/08/95	13:55	16:24	LandSat, GOES-8	cirrus 10–12 km
07/10/95	17:50	19:10	NOAA-14, GOES-8	multi-layer water and ice
				thin cirrus 11–12 km
07/14/95	01:36	02:17	GOES-8	clear
07/18/95	18:25	19:28	NOAA-14, GOES-8	clear and cumulus at 2 km
07/21/95			GOES-8	clear
07/24/95	13:57	14:19	GOES-8	multi-layer water clouds
				0.7 - 4.5 km
				with precip. , a thunderstorm
				interrupted the data taking,
	14:56	16:31	LandSat,GOES-8	water and ice 3 - 5 km, clear
07/26/95	01:01	04:09	GOES-8,	a thunderstorm,
				multi layer clouds 0-11 km
07/27/95	17:25	19:48	NOAA-14, GOES-8,	strong boundary layer,
				thin cirrus 10-12.5 km

1995 Operations Continues

MADISON, WI

Date	Start	End	**Satellites**	**Cloud Type**
08/02/95	01:40	02:40	GOES-8	low water clouds at 1 km
08/04/95	18:05	19:50	NOAA-14, GOES-8	cumulus 1-3 km
				thin cirrus 10-12 km
08/08/95	17:35	19:00	NOAA-14, GOES-8	cumulus at 1 km,
				thin cirrus 6-6.8 km, clear
08/09/95	14:10	16:10	LandSat, GOES-8	water cloud deck at 300-500 m
08/10/95				No data, because of a power failure
08/15/95	17:30	19:37	NOAA-14, GOES-8	multi-layer water 3.5 km - 7 km
08/18/95	01:50	02:22	GOES-8	clear
08/23/95	01:10	02:38	GOES-8	high water clouds + virga 5-6.5 km
∗08/24/95	11:29	14:44	GOES-8 + aircraft	water at 500-850 m, (+VIL)
08/25/95	14:00	16:22	LandSat, GOES-8	water at 300 - 500 m
08/30/95	00:00	01:54	GOES-8	multi-layer water up to 7.5 km
09/01/95	18:25	19:58	NOAA-14, GOES-8	clear
09/05/95	18:16	19:40	NOAA-14	thin cirrus at 10-12 km,
				strong boundary layer up to 1.8 km
				(+ VIL)
09/07/95	23:05	→	GOES-8	scattered, thin cirrus 8-12 km
09/08/95	→	00:28		
09/10/95	14:06	16:05	LandSat, GOES-8	clear
∗09/11/95	17:40	→	NOAA-14, GOES-8	thin cirrus 9.5 - 11.7 km,
∗09/12/95	→	00:28		water + ice 4 - 11.5 km (+ VIL)
09/12/95	18:05	19:35	NOAA-14, GOES-8	water at 2.1 km,
				some ice at 3.5 - 6 km
∗09/14/95	18:53	19:44	GOES-8	clear (+ VIL)
	20:01	21:45	GOES-8	clear
	21:49	23:00	GOES-8	scattered thin cirrus 8.3 - 11.0 km
∗09/19/95	12:03	14:02	GOES-8	water and ice 1.7- 5.5 km, rain,
	14:08	15:40	GOES-8, LandSat	rain interrupted
				data taking (+ VIL)
09/21/95	18:00	19:20	NOAA-14, GOES-8	water and ice
				at 400 m - 2.5 km
09/26/95	14:40	16:23	LandSat, GOES-8	water 3 - 4 km (+VIL)
09/26/95	23:39	→	GOES-8	clear (cirrus for VIL)
09/27/95	→	01:06		
09/27/95			GOES-8	no data, operator sick
09/29/95	18:30	19:57	NOAA-14, GOES-8	water 1-3 km
				cirrus 5 - 8 km (+VIL)

1995 Operations Continues

MADISON, WI

Date	Start	End	Satellites	Cloud Type
10/02/95	17:55	19:28	NOAA-14, GOES-8	water 3.5 - 4.7 km
				cirrus 8.5 - 10.5 km (+VIL),
				some HSRL data missing
10/04/95	00:21	01:22	GOES-8	clear
10/05/95	13:55	16:07	LandSat	water 0.3 - 1.25 km
10/09/95	18:03	19:54	NOAA-14, GOES-8	broken cumulus at 1.2 km
				otherwise clear
10/10/95	13:58	15:37		cirrus for the VIL,
				clear for the HSRL
10/11/95	00:10	01:14	GOES-8	clear
10/12/95	14:08	16:11	LandSat, GOES-8	clear + very thin
				(200 m thick) cirrus layer at 9.5 km
10/13/95	15:45	17:15	GOES-8	thin cirrus 9-11.2 km
	17:27	19:16		(+VIL)
10/18/95	00:04	01:55	GOES-8	cirrus 8.8 - 11.3 km,
				thin water at 7.8 km
10/19/95	18:14	19:28	NOAA-14, GOES-8	water at 1.2-5 km,
				rain interrupted data taking
10/21/95			LandSat (VIL)	No data, low clouds, rain, snow
10/22/95	16:58	18:37	GOES-8	Multi-layer water and
	18:41	19:26		ice, ice 3.5 - 11 km, water 4.5 - 7 km
10/25/95	00:24	01:26	GOES-8	Clear
10/25/95	22:58	→	GOES-8	Thin scattered cirrus
10/26/95	→	01:42		8.5 - 11.3 km (+AERI)
	14:18	15:17		Ice at different layers from 2 km to
	15:33	16:33		10.5 km, water layers, and cumulus
	16:37	17:54		(+AERI)
	18:23	19:48		
	19:53	21:50		
10/27/95	18:52	19:52	NOAA-14, GOES-8	low water + light rain,
				cirrus at 7 km
10/28/95	14:43	15:53	LandSat, GOES-8	water 0.3-2.2 km with
				ice, light drizzle
10/30/95			NOAA-14, GOES-8	No data because of a datasystem
				problem

1995 Operations Continues

MADISON, WI

Date	Start	End	**Satellites**	**Cloud Type**
11/03/95	00:35	01:40	GOES-8	low water at 1-2km, some clear between
11/06/95	15:13	16:25	LandSat	water at 500 m and 6 km, ice 6-8 km
11/07/95	18:25	19:30	NOAA-14, GOES-8	overcast, water at 1 km
11/09/95	23:40	→	GOES-8	cirrus 4-10.5 km
11/10/95	→	02:50		
11/13/95	14:43	16:01	LandSat, GOES-8	clear
11/15/95	18:32	19:45	NOAA-14, GOES-8	scattered water at 1-4 km,
				light virga
11/16/95	21:56	→	GOES-8	clear, cirrus 4-10.5 km,
11/17/95	→	02:23		thin water 5-5.7 km and 2.3 km
				(+VIL, AERI)
11/21/95	23:22	00:25	GOES-8	clear
11/22/95	14:38	16:05	LandSat, GOES-8	water and ice 1.5 - 3.2 km (+VIL)
11/24/95			NOAA-14	No data. Operators day off.
11/27/95			NOAA-14	No data. Snowstorm.
11/29/95			LandSat	No data. Lost the I2-reference cell.
11/30/95	22:35	→	GOES-8	ice and water 0 - 5 km,
12/01/95	→	00:49		light drizzle
12/02/95	18:14	19:26		high water 4-7.5 km,
				cirrus 9.5-11 km (VIL)
12/04/95	15:19	17:21		ice 4.5 - 10.6 km,
				water 5-5.5 km (VIL)
	17:25	20:02	NOAA-14,GOES-8	ice 2.7 - 11 km,
				water 5.5 km (VIL)
12/06/95	15:33	17:04		thin cirrus with
	17:09	18:22		lot of structure
	18:35	19:54		5.8-9.5 km (VIL)
	19:58	21:11		
	21:48	23:00	GOES-8	clear
12/08/95	14:52	16:02	LandSat,GOES-8	data before a snowstorm,
				ice 0.9 - 4 km (VIL)