

A High performance I/O Module: the HDF5 WRF I/O module

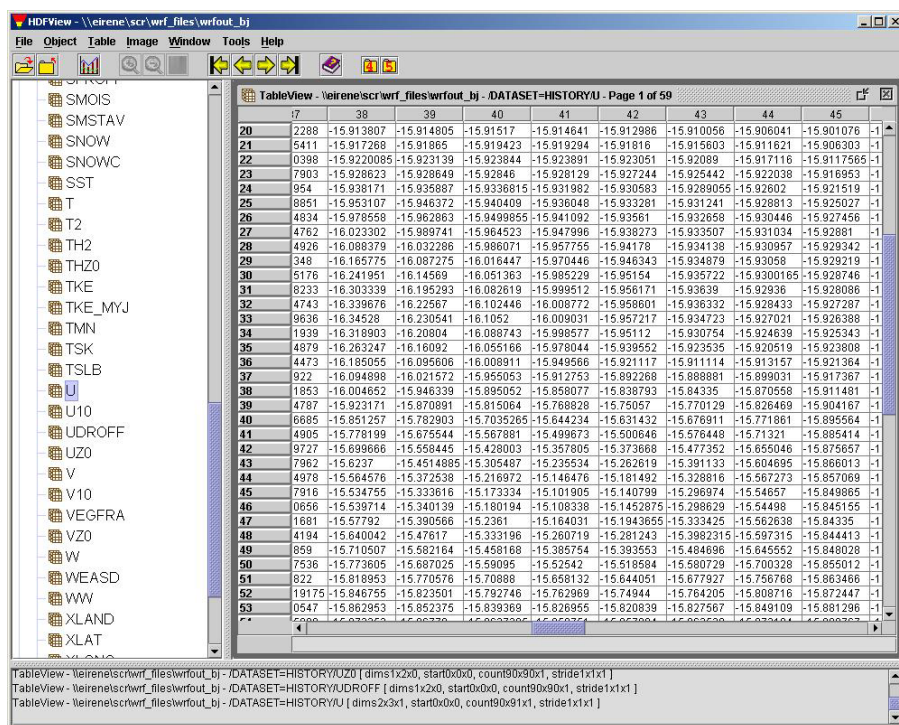
<http://www.ncsa.uiuc.edu/apps/WRF-ROMS>

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NCSA is currently developing an implementation of WRF I/O module that reads and writes HDF5 datasets. The module will be available to anyone using WRF as a new option for I/O. We believe that the high performance features of HDF5 will definitely help the WRF user community.

The WRF-HDF5 module is being developed as part of the NSF funded MEAD project at NCSA. The module implements the standard WRF/IO interface, so it can be used with any WRF application. All the I/O features of the WRF-I/O netCDF module are supported. A serial I/O version is available for evaluation, and a parallel I/O version is being developed now.

Below is the illustration of WRF model output in HDF5. The initial data is provided by Brain F. Jewett and Robert B. Wilhelmson's numerical study of tornado outbreaks in 1996 in the state of Illinois and nearby states. We are using the HDF View Java tool to visualize the data structure and data.



The screenshot displays the HDFView application window. On the left, a tree view shows the dataset hierarchy: SMOIS, SMSTAV, SNOW, SNOWC, SST, T, T2, THZ, THZ0, TKE, TKE_MYJ, TMN, TSK, TSLB, U, U10, UDROFF, UZ0, V, V10, VEGFRA, VZ0, W, WEASD, WW, XLAND, and XLAT. The main window shows a table titled 'TableView - Veirene\scr\wrf_files\wrfout_bj - /DATASET=HISTORY/U - Page 1 of 59'. The table has columns labeled i7, 38, 39, 40, 41, 42, 43, 44, and 45. The data rows show numerical values for each variable. At the bottom, three lines of text provide details about the data dimensions and strides for the selected dataset: 'TableView - Veirene\scr\wrf_files\wrfout_bj - /DATASET=HISTORY/UZ0 [dims:1x2x0, start:0x0, count:90x90x1, stride:1x1x1]', 'TableView - Veirene\scr\wrf_files\wrfout_bj - /DATASET=HISTORY/UDROFF [dims:1x2x0, start:0x0, count:90x90x1, stride:1x1x1]', and 'TableView - Veirene\scr\wrf_files\wrfout_bj - /DATASET=HISTORY/U [dims:2x3x1, start:0x0, count:90x91x1, stride:1x1x1]'.

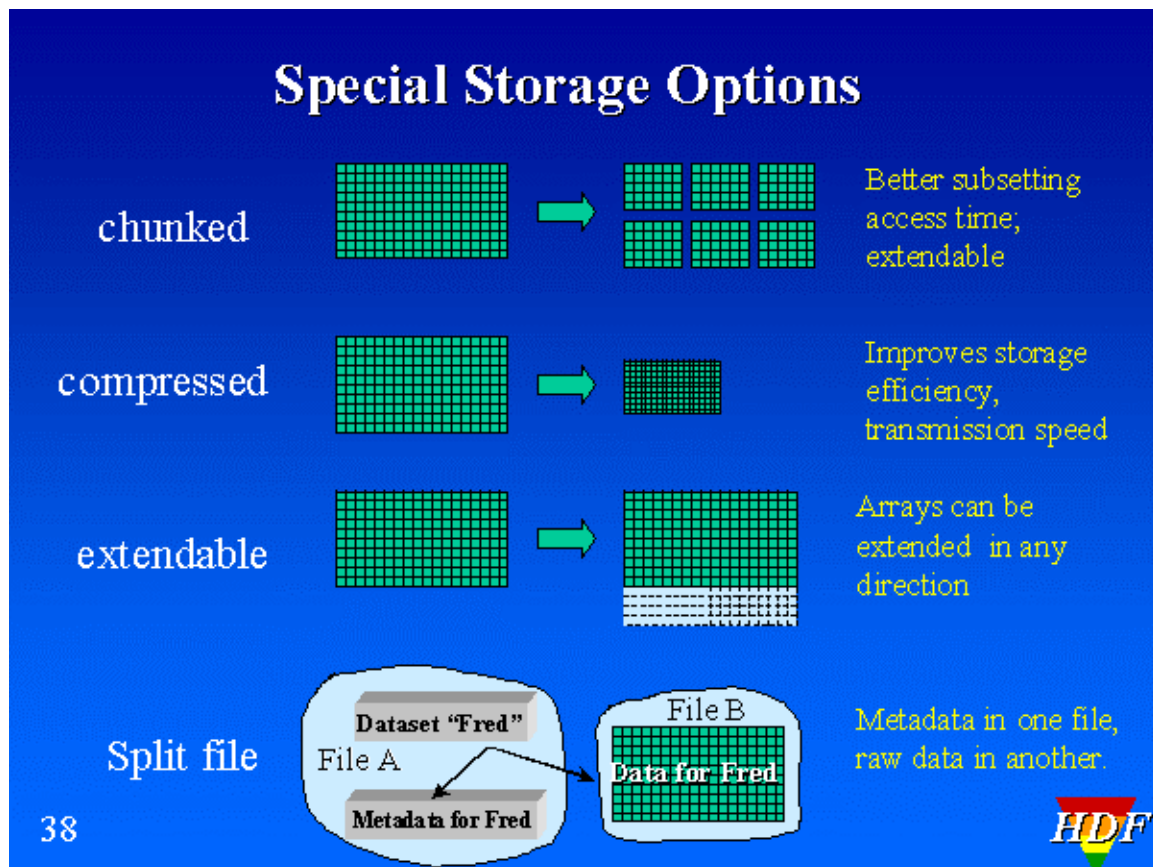
	i7	38	39	40	41	42	43	44	45
20	2288	-15.913807	-15.914805	-15.91517	-15.914641	-15.912986	-15.910056	-15.906041	-15.901076
21	5411	-15.917268	-15.91865	-15.919423	-15.919294	-15.91816	-15.915603	-15.911621	-15.906303
22	0398	-15.9220085	-15.923139	-15.923844	-15.923891	-15.923051	-15.92089	-15.917116	-15.9117565
23	7903	-15.928623	-15.928849	-15.92846	-15.928129	-15.927244	-15.925442	-15.922038	-15.916953
24	954	-15.938171	-15.935887	-15.9338815	-15.931862	-15.930583	-15.9289055	-15.92602	-15.921519
25	8851	-15.953107	-15.946372	-15.940409	-15.936048	-15.933281	-15.931241	-15.928813	-15.925027
26	4834	-15.978558	-15.962863	-15.9498955	-15.941092	-15.93561	-15.932658	-15.930446	-15.927456
27	4762	-16.023302	-15.989741	-15.964523	-15.947996	-15.938273	-15.933507	-15.931034	-15.92881
28	4926	-16.088379	-16.032286	-15.986071	-15.957755	-15.94178	-15.934138	-15.930957	-15.929342
29	348	-16.165775	-16.087275	-16.016447	-15.970446	-15.946343	-15.934879	-15.93058	-15.929219
30	5176	-16.241951	-16.14569	-16.051363	-15.985229	-15.95154	-15.935722	-15.9300165	-15.928746
31	8233	-16.303339	-16.195293	-16.082619	-15.999512	-15.956171	-15.93639	-15.92936	-15.928086
32	4743	-16.339676	-16.22567	-16.102446	-16.008772	-15.958601	-15.936332	-15.928433	-15.927287
33	9636	-16.34528	-16.230541	-16.1052	-16.009031	-15.957217	-15.934723	-15.927021	-15.926388
34	1939	-16.318903	-16.20804	-16.088743	-15.998577	-15.95112	-15.930754	-15.924639	-15.925343
35	4879	-16.263247	-16.16092	-16.055166	-15.978044	-15.939552	-15.923535	-15.920519	-15.923808
36	4473	-16.185055	-16.095606	-16.008911	-15.949568	-15.921117	-15.911114	-15.913157	-15.921384
37	922	-16.094898	-16.021572	-15.955053	-15.912753	-15.892268	-15.888881	-15.899031	-15.917367
38	1853	-16.004652	-15.948339	-15.895052	-15.858077	-15.838793	-15.84335	-15.870558	-15.911481
39	4787	-15.923171	-15.870891	-15.815064	-15.768828	-15.75057	-15.770129	-15.826469	-15.904167
40	6685	-15.951257	-15.782903	-15.7035265	-15.644234	-15.631432	-15.676911	-15.771861	-15.895564
41	4905	-15.778199	-15.675544	-15.567881	-15.499673	-15.500646	-15.576448	-15.71321	-15.885414
42	9727	-15.699666	-15.558445	-15.428003	-15.357805	-15.373668	-15.477352	-15.655046	-15.875657
43	7962	-15.6237	-15.4514885	-15.305487	-15.235534	-15.262619	-15.391133	-15.604895	-15.866031
44	4978	-15.564576	-15.372538	-15.216972	-15.146476	-15.181492	-15.328816	-15.567273	-15.857069
45	7916	-15.534755	-15.333616	-15.173334	-15.101905	-15.140789	-15.286974	-15.546657	-15.849865
46	0656	-15.538714	-15.340139	-15.180194	-15.108338	-15.1452875	-15.288629	-15.544489	-15.845156
47	1681	-15.57792	-15.390586	-15.2381	-15.164031	-15.1943655	-15.333425	-15.562638	-15.84335
48	4194	-15.640042	-15.47817	-15.333196	-15.260719	-15.281243	-15.3982315	-15.597315	-15.844413
49	859	-15.710507	-15.582164	-15.458168	-15.385754	-15.393553	-15.484696	-15.645552	-15.848028
50	7536	-15.773605	-15.687025	-15.59095	-15.52542	-15.518584	-15.580729	-15.700328	-15.855012
51	822	-15.818953	-15.770576	-15.70888	-15.658132	-15.644051	-15.677927	-15.756768	-15.863466
52	19175	-15.846755	-15.823501	-15.792746	-15.762969	-15.749444	-15.764205	-15.808716	-15.872447
53	0547	-15.862953	-15.852375	-15.839369	-15.826955	-15.820839	-15.827567	-15.849109	-15.881296

Hierarchical Data Format (HDF) 5

<http://hdf.ncsa.uiuc.edu>

HDF5 was developed to support contemporary high performance computing environments, including datasets larger than 2 Gigabytes, very large numbers of objects in a file, and alternative storage layouts, such as chunking and compression [1]. HDF5 was designed to use MPI-I/O, which is capable of performing I/O efficiently in parallel computing environments. HDF5 can also handle complex data structures and complex subsetting.

The following schematic illustrates the special storage options of HDF5.



HDF5 is used by many scientific communities, including those that manage important Earth Science data, including the NASA EOS 'Aura' satellite [2] and the NPOESS system [3].

1. <http://hdf.ncsa.uiuc.edu/HDF5>
2. http://lennier.gsfc.nasa.gov/seeds/W3pr_Craig.pdf
3. http://lennier.gsfc.nasa.gov/hdfeos/workshops/WSsix/presentations/Goldberg/HDF5_for_NPOESS.pdf