National Solar Radiation Database (NSRDB) Webinar

October 6, 2020

Questions and Answers

Last Name	First Name	Email Address	Question Asked	Answer Given
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	Is the new 5-min temporal resolultion represent a new frequency update or interpolated data?	The new 5-min data corresponds to the launch of the new GOES satellites in 2018 and 2019 (GOE 16 and 17) that provide 5min and 2km resolution images.
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	Where can we find the spectral data?	The spectral data is available via the developer.nrel.gov API as well as via the NSRDB viewer at https://maps.nrel.gov/nsrdb-viewer
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	What is the elevation of wind speed measured at and reported by NSRDB?	2m. It is downscaled from MERRA2 reanalysis datasets.
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	Please, can you post a reference where we can find the definition of cloud types used/reported in NSRDB?	The cloud types used/reported in the NSRDB are recorded in the dataset "units" attributes which you could access via HSDS. For reference, here are the cloud_type units: 'N/A': -15, 'Clear': 0, 'Probably Clear': 1, 'Fog': 2, 'Water': 3, 'Super-Cooled Water': 4, 'Mixed': 5, 'Opaque Ice': 6, 'Cirrus': 7, 'Overlapping': 8, 'Overshooting': 9, 'Unknown': 10, 'Dust': 11, 'Smoke': 12.
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	Would it be useful to add/report the uncertainty of all included parameters along with the downloadable data at NSRDB view?	It is a good idea. But it requires a lot of effort. We don't have a plan to do this at this time. Having said that there are a lot of published reports on the uncertainty of various parameters. Please check NREL publications or NASA publications on MERRA2.
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	What is the core difference between TMY and TMY-POA in GHI/DHI/DHI data?please.	Please check this publication which discusses the difference between the two. Manajit Sengupta, Aron Habte, Janine M. Freeman. "The Case for Custom TMY's: Examples Using the NSRDB." Proceedings of the 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC), 16-21 June 2019, Chicago, Illinois: pp. 2287-2292. Piscataway, NJ: Institute of Electrical and Electronics Engineers (IEEE). 2020. https://doi.org/10.1109/PVSC40753.2019.8980811 Also check slide 7 of the following presentation… Manajit Sengupta, Aron Habte, Janine Freeman. 2019. The Case for Custom TMYs: Examples Using the NSRDB. NREL/PR-5D00-74201. https://www.nrel.gov/docs/fy19osti/74201.pdf.
ALFULAYYIH	YASIR	alfulayyih@email.arizona.edu	a paper about TMY-POA time series conversion, would you like to cite it please?	Manajit Sengupta, Aron Habte, Janine M. Freeman. "The Case for Custom TMY's: Examples Using the NSRDB." Proceedings of the 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC), 16-21 June 2019, Chicago, Illinois: pp. 2287-2292. Piscataway, NJ: Institute of Electrical and Electronics Engineers (IEEE). 2020. https://doi.org/10.1109/PVSC40753.2019.8980811
Ahmed abdulraheem	Adnan	adnan.alsumeri@gmail.com	This database just until 2015 ?	Currently from 1998 to 2019
Alyami	Faraj	farajhussainf.alyami@wmich.edu	could soiling factor model be defined by satellite ?	Soiling is a combination of precipitation and aerosols. It is a derivative of these two. Additional factors that play are role would be wind speed and surface type. This can be done in collaboration with soiling study experts. If there is interest to many users then we can work with other experts, DOE and NSRDB team to produce this.
Alyami	Faraj	farajhussainf.alyami@wmich.edu	what is the error in the data between 30 min and observaation ?	We validate the NSRDB dataset (V3) using high quality ground observations and we found the hourly dataset has a bias with +/- 5%. Please check the following publications for details.
Alyami	Faraj	farajhussainf.alyami@wmich.edu	Is the database provided for Middle East ?	Solar data for the Middle East is included in the "IODC" (Indian ocean data) for 2017-2019
Anderson	Kevin	kevin.anderson@nrel.gov	How should users provide feedback about what new features would be most useful to them? For example do you do user surveys, or should we just email the NSRDB team?	you can send direct emails to nsrdb@nrel.gov or manajt.sengupta@nrel.gov

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Asarian	Eli	eli@riverbendsci.com	Can you clarify the temporal resolution of the MERRA-2 and MODIS aerosol (AOD) data used by NSRDB. Native resolution of MERRA-2 is hourly and MODIS is 1-2x/day, but the 2018 NSRDB publication says the aerosol data are first averaged to monthly before use. Has that been changed for the previous version? In my arear (northern california), wildfires smoke is a big issue and it changes hourly/daily, so monthly would lose a lot of information.	The NSRDB is simulated by the Physical Solar Model (PSM) with a 4-km elevation-scaled Modern-Era Retrospective Analysis for Research and Applications,Version2(MERRA-2) AOD; however,the4-kmMERRA-2 AOD might not appropriately represent the spatial distribution of aerosol loading, especially over highly polluted areas with large gradients of AOD. However, the AOD from MERRA-2 should capture the wildfires that we see around the western side of the USA as we use hourly temporal resolution data from MERRA-2. The assumption here is that MERRA-2 captures elevated aerosol loading but we need to check this when we process the 2020 data. As a note the MODerate Resolution Imaging Spectroradiometer (MODIS) Multi-Angle Implementation of Atmospheric Correction (MAIAC) AOD is not used to produce the AOD data in the NSRDB dataset. The MODIS information was used to produce Albedo data in the NSRDB and is assimilated in MERRA-2 AOD. Additional information on downscaling method for MERRA-2: MERRA-2 assimilates satellite information and it is about 50 km x 50 km in spatial and hourly resolution, we consider that the average value for that pixel. we use a model to downscale the pixel to NSRDB grid size by considering a 2500 meter scale height and the assumption is an exponential relationship between AOD and elevation. First we bring AOD to sea level elevation (zero meter) then we bring the AOD to the NSRDB grid elevation. Details on this method can be found in
Asarian	Eli	eli@riverbendsci.com	Are aersols averaged to monthly time scale before use in NSRDB, or are they used at their native resolution (hourly/daily)?	Hourly elevation-scaled AOD data from MERRA-2 is used. Previous version of PSM used monthly averages but PSM v3 uses MERRA2 hourly AOD.
Bell	Charlie	charlie.bell@i-emsat.co.uk	Does all data correspond to ground level?	Yes. Wind speed is at 2m height.
Bell	Charlie	charlie.bell@i-emsat.co.uk	Are there any (near) future plans to cover Europe? Many thanks :)	if/when funding is available, the NSRDB infrastructure can produce solar resource and meteorological dataset for any non-water body location around the globe. There are some sources of public European data including CMSAF and PVGIS which we encourage you to check if you haven't already.
Berlinsky	Alex	alex.berlinsky@icf.com	Will data validation efforts continue regularly or were they only performed to validate the changes for the 5 min data? My understanding is that data validation has not been regularly performed over the last 3 or so years. If this understanding is correct, will this be changing going forward?	We validate our dataset on a yearly basis. Please check the following links that show some of the publications on NSRDB validation. Manajit Sengupta, Aron Habte, Yu Xie, Grant Buster. 2020. Improving the Accuracy of the National Solar Radiation Database (NSRDB) Using High-Resolution Data. NREL/PR-5D00-75814. https://www.nrel.gov/docs/fy20osti/75814.pdf. Manajit Sengupta, Aron Habte, Yu Xie, Galen Maclaurin. 2019. Spectral and Broadband Data Sets from the National Solar Radiation Database (NSRDB). NREL/PR-5D00-74218. https://www.nrel.gov/docs/fy19osti/74218.pdf. Aron Habte, Manajit Sengupta, Anthony Lopez, Yu Xie, Galen Maclaurin. "Assessment of the National Solar Radiation Database (NSRDB 1998-2016): Preprint.": 6 pp. 2018. https://www.nrel.gov/docs/fy18osti/71607.pdf. Aron Habte, Manajit Sengupta, Anthony Lopez, Yu Xie, Galen Maclaurin. "Assessment of the National Solar Radiation Database (NSRDB 1998-2016)." Proceedings of the 2018 IEEE 7th World Conference on Photovoltaic Energy Conversion (WCPEC), 10-15 June 2018, Waikoloa Village, Hawaii: pp. 2305-2308. Piscataway, NJ: Institute of Electrical and Electronics Engineers (IEEE). 2018. https://doi.org/10.1109/PVSC.2018.8547589.
Berlinsky	Alex	alex.berlinsky@icf.com	How regularly are the modeling algorithms changed in response to data validation efforts?	Data validation does not necessarily lead directly to changing the model unless there are clear bugs in the program. Most substantial changes in algorithm are in response to either new science which we believe can improve accuracy or change substantial change in inputs (eg. MERRA to MERRA2). So large model changes are not very frequent. We are actively working on PSM v4 which would represent significant modelling algorithm improvement. One thing to note is that changes in model requires reprocess all years of data as per our paradigm. This means that we are conservative about deploying new model versions.
Berlinsky	Alex	alex.berlinsky@icf.com	Are there plans to make available the TMY3 Class 1 datasets from 1961-2005	No, we recommend users to migrate to gridded TMY dataset which is more accurate compared to the TMY3 dataset.

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Briceno	Nicolas	NBriceno@innergex.com	In your PSM workflow, where does the actual irradiance data come from? GOES, MODIS, MERRA, …?	We donot fully understand your question about the source of "actual" irradiance? We calculate irradiance using the PSM with data from GOES/MODIS/MERRA as input. PSM contains the FARMS radiative transfer model which use the inputs (that contain information about clouds, water vapor, aerosols) and output GHI, DNI and DHI. We validate against ground measurement data from the SURFRAD ground measurement network.
Brockmeyer	Sam	sam.brockmeyer@heliolytics.com	Is there any current and future planned initiatives to expand geographical coverage beyond current areas (Europe, Middle East, etc)?	Solar data for the Middle East and parts of Europe is included in the "IODC" (Indian ocean data) for 2017-2019. Also data for the India subcontinent is available for 2000-2014. All data in the NSRDB is based on funding from agencies. Production from the GOES satellites (covering Americas) is regularly funded while the other data we make available has been intermittently funded to date.
Brockmeyer	Sam	sam.brockmeyer@heliolytics.com	Will there be any future database for continental Europe?	Currently no, apologies but please check out CMSAF and PVGIS.
Busireddy	Susruthreddy	susruth@u-renew.com	Is the 5 min data more acurate compared to the other data? Or they use the same satelite?	The 5min data from 2018 is derived using the same algorithms as the 30min data prior to 2018. The input is just higher resolution from the new GOES satellites. It should be noted that the 5 minute data is expected to be of higher accuracy as it is more capable of capturing variability in variable sky conditions. Also the newer GOES satellites have 16 channels (compared to 4 for the previous series) and therefore has better capability to provide cloud properties more accurately.
CHAN	VALERIE	VALERIE.CHAN@STELLAVISE.COM	Is there a dataset that is most helpful to model/represent snow losses?	We do not provide new snow data, but we are exploring the addition of new precipitation data to work with SAM PVwattsv7 which has a snow loss model.
Cakan	Deniz	dcakan@eng.ucsd.edu	Thank you for the webinar: I would like to run optical simulations on photovoltaic devices using your available databases as my spectrum inputs. I have had trouble locating a database that provides irradiance that is spectrally resolved (W/m^2 * nm-1). I am only finding spectrally averaged data. Could you recommend a database for me? I believe I heard that there is a new database „ÄúFarm„Äù? that may have this spectrally resolved data?	The spectral data is available via the developer.nrel.gov API as well as via the NSRDB viewer at https://maps.nrel.gov/nsrdb-viewer. Please check out the spectral on demand tab.
Carchedi	Anthony	acarchedi@huntelec.com	For someone just starting out in solar design, Does NSRDB offer resources and recommendations on modeling? Do you have coordination with Pvsyst?	I would recommend looking into the System Advisor Model (SAM): sam.nrel.gov (https://sam.nrel.gov/weather-data.html), as well as the Renewable Energy Potential Model (reV): github.com/nrel/reV. We do not coordinate with PVSYST but there is instruction about how to use the NSRDB data through Pvsyst https://www.pvsyst.com/help/meteo_import_nrel_nsrdb_viewer.htm
Chohfi	Reinaldo	rec@geodesign.com.br	I found difficult to naviagate and place a point on the map because the viewer does not update the coords as you move oveer the map. Could this be implemented? Thanks.	There is a way to put exact location information in the NSRDB viewer. You might use the icons on the top right corner of the map viewer which allow you to input specific latitude and longitude. Please check our recent webinar presentation for details on how to access the data. Also check the YouTube link for the recorded version of the NSRDB webinar....https://youtu.be/8Gv_3iW_A8A
Chohfi	Reinaldo	rec@geodesign.com.br	What's the convention used for the azimuth orientation?	Assuming that you are referring to the fixed-tilt settings for the spectral on-demand the azimuth is degree measured clockwise from the North.
Chohfi	Reinaldo	rec@geodesign.com.br	What about site adaptation?	There is no site adaptation implemented in the NSRDB dataset. We provide the satellite-based solar radiation datasets and expect our users to use their own methods and ground measurements for site adaptation. This provides for cleaner datasets of known source.
Chohfi	Reinaldo	rec@geodesign.com.br	Could you please explain further about the different years for TMY? Thanks.	We generate a new TMY file every year that covers the entire PSM v3 extent. For example, TMY-2016 uses data from 1998-2016, while TMY-2019 uses data from 1998-2019. Note that inclusion of larger number of years in generating the TMY provides better representation.

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Chrkavy	Daniel	daniel.chrkavy@solargis.com	Is there a paper talking about the uncertainty of NSRDB PSMvs model?	We validate our dataset on yearly basis. Please check the following link that show some of the publications on NSRDB validation Manajit Sengupta, Aron Habte, Yu Xie, Grant Buster. 2020. Improving the Accuracy of the National Solar Radiation Database (NSRDB) Using High-Resolution Data. NREL/PR-5D00-75814. https://www.nrel.gov/docs/fy20osti/75814.pdf. Manajit Sengupta, Aron Habte, Yu Xie, Galen Maclaurin. 2019. Spectral and Broadband Data Sets from the National Solar Radiation Database (NSRDB). NREL/PR-5D00-74218. https://www.nrel.gov/docs/fy19osti/74218.pdf. Aron Habte, Manajit Sengupta, Anthony Lopez, Yu Xie, Galen Maclaurin. "Assessment of the National Solar Radiation Database (NSRDB 1998-2016): Preprint.": 6 pp. 2018. https://www.nrel.gov/docs/fy18osti/71607.pdf. Aron Habte, Manajit Sengupta, Anthony Lopez, Yu Xie, Galen Maclaurin. "Assessment of the National Solar Radiation Database (NSRDB 1998-2016)." Proceedings of the 2018 IEEE 7th World Conference on Photovoltaic Energy Conversion (WCPEC), 10-15 June 2018, Waikoloa Village, Hawaii: pp. 2305-2308. Piscataway, NJ: Institute of Electrical and Electronics Engineers (IEEE). 2018. https://doi.org/10.1109/PVSC.2018.8547589.
Cochran	Hannah	hannah.cochran@dsdrenewables.com	What is the difference between PSM and solar anywhere data?	The dataset are developed using two different model approaches and subsequently the data will have some differences. Solar Anywhere model is based on an empirical approach where the model relates satellite measurements and ground observations.(cloud index and clearness index) and use those models to obtain GHI at the surface from satellite measurements. The GHI is then partitioned to DNI and DHI using a decomposition model. On the other hand, PSM is a physical model that follows a two step process. Cloud (mask, type, optical depth and effective particle radius) and aerosol information from satellites are calculated in the first step. This information is used in a radiative transfer model (FARMS) in the second step to calculate GHI, DNI and DHI.
Cochran	Hannah	hannah.cochran@dsdrenewables.com	I don't see the TMY file when selecting all years and PSM v3 TMY	For all years time series data of the PSM v3, select PSM v3 and for TMY dataset based on PSM v3 select PSM v3 TMY
Cochran	Hannah	hannah.cochran@dsdrenewables.com	How do you download PSM TMY data to to import in PVsyst?	See instruction: https://www.pvsyst.com/help/meteo_import_nrel_nsrdb_viewer.htm
Crawley	Dru	dru.crawley@bentley.com	How quickly do you respond to queries? Was not able to use Download Wizard	Response to technical queries sent to our email address may take a while due to limited bandwidth. We generally do notice if there is an outage and try to respond immediately based on the cause of outage. We donot respond to outage messages after we have fixed the issue. We also rarely if ever send out blanket NSRDB emails unless we are announcing something of critical importance. Also a note addressing server latency while delivering data: Small queries are responded to in less than a minute. For spectral data, the response takes about 2 minutes. In some cases reponse is delayed due to have server issues. However, during this time, we have a feature to reduce load that will return a cached file if the same request is submitted multiple times. These files are automatically deleted between 24 and 48 hours after creation. In order to bypass the cache you can alter your request in some subtle way. Perhaps adding some meaningless precision to the end of one of the coordinates, or even adding or removing an attribute to the list of variables.
De Seve	Danielle	deseve.danielle@hydroquebec.com	Is there any literature that explains how you determined your sky classes?	Reference: https://cimss.ssec.wisc.edu/clavrx/clavr_page_files/clavrx_users_guide_v5.4.1.pdf
De Seve	Danielle	deseve.danielle@hydroquebec.com	How do you determine your sky classes for the validation? (clear, cloudy ..)	As we use a physical model we have cloud properties available in our dataset. This means that we can separate our satellite data into clear and cloud points using the cloud type variable. Cloud type of 0 and 1 are treated as clear while the rest are treated as cloudy. Just to clarify further this raises an interesting validation question when comparing with ground date. We use an average of the ground data and often the ground data contains a mix of cloudy and clear point although the satellite data is either clear or cloud in a binary fashion. Nevertheless the satellite identification is used to determine clear or cloudy.

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De Seve	Danielle	deseve.danielle@hydroquebec.com	the thresholds (GHI station/GHIclear) (for sky classification) are documented in the literature?	yes one can use clear sky index for classification and these are documented well in literature. However, in our analysis we use the satellite cloud classification flag for our comparison (0 and 1 represent clear conditions and other flags greater than 1 are treated as cloudy). We could add an additional classification (e.g. broken cloudy) using the ground datasets where fractional cloudiness over say a 30 minute period could be used to determine those scenes.
Durˇ°n-Castillo	Gloria	durancas@ualberta.ca	Hi, thank you for the presentation. I would like to ask about the accuracy of the albedo data. do you have experience using the albedo data to calculate PV output of bifacial systems?	We don't have any experience using the albedo data for bifacial systems. In our opinion the snow free albedo is state of the art. The high-albedo times are snow but that albedo may not be accurate depending on the actual snow condition (old and dirty snow vs pristine). More effort is needed here but historically we have not had the funding or opportunity to improve on this data.
Fisher	Kate	kathryn.fisher@asu.edu	How can we access the 5 min data? I don't see it on the website	It is available from the NSRDB API, on AWS, via HSDS, and via the Viewer, but only for 2018 and 2019. Select PSM v3 5 Minute
Fitzgerald	Donald	don@sun.ac.za	Is there any data available in Southern Africa on the NSRDB data viewer?	We just released data for 2017-2019 derived from the Meteosat Indian Ocean coverage satellite that covers South Africa.
Fitzgerald	Donald	don@sun.ac.za	Is there any data available in Southern Africa on the NSRDB data viewer?	We just released data for 2017-2019 derived from the Meteosat Indian Ocean coverage satellite that covers South Africa.
Forbess	Jessica	jf@sunshineanalytics.com	I pulled 5 minute data for HI, and was able to get 2019, but 2018 was just clear sky. Is that a known limit? Is 2018 going to be available for HI, or is this a specific grid issue?	Unfortunately the newer generation western GOES satellite (GOES 17) was not launched until late 2018 so we only have 5min data from the Eastern satellite for 2018 which does not cover HI. 5min data for HI is only available from 2019 .
Gross	David	david@heliogen.com	How do you recommend users make sense of P50 DNI differences between commercial models (e.g. Solargis) and your/other federal models (e.g Australian Bureau of Meteorology) that are all looking at data from the last 20 years? We need to give our customers performance estimates and for what it's worth we don't have a good global understanding of differences in these models.	Our model and possible the BOM data use a physical approach and detemine clear and cloud pixels and calculate DNI accordingly. Solargis etc. use a different approach where they can only compute GHI using the cloud index. The DNI is then calculated using a decomposition model. This by itself leads to significant differences especially where DNI is concerned. We cannot offer you a solution but we will be open to discussion of what you observe in order to make efforts to improve the accuracy of our datasets to serve user needs. Please send us an email if you desire to engage in a discussion.
Gu	Xiaohong	xiaohong.gu@nist.gov	Thanks for the great presentations. Have you compared the NSRDB data with those translated from the global horizontal Irradiance to other angles, which can be done in RdTools?	We are not sure about what you are recommending here so please send us an email and we can discuss. Selecting accurate transposition model is important when converting from GHI to POA. The following links have some recommendations - https://www.sciencedirect.com/science/article/pii/S0038092X08002983 https://www.osti.gov/pages/servlets/purl/1429602 https://www.nrel.gov/pv/assets/pdfs/2015_pvmrw_169_gueymard.pdf
Gu	Xiaohong	xiaohong.gu@nist.gov	What's the time zone used in NSRDB?	UTC but there is an option to download data in local time
Guo	Ya	guo.ya1@northeastern.edu	For the 'cloudy type' of NSRDB Data downloaded, which are filled by numbers 0 to8, what does these number indicated acuurately? Is there any notations for these numbers? Thanks!	The cloud type "units" attribute records these values but I guess it doesn't get shipped with the data download wizard. You could explore this using HSDS. For reference, the cloud type units are: 'N/A': -15, 'Clear': 0, 'Probably Clear': 1, 'Fog': 2, 'Water': 3, 'Super-Cooled Water': 4, 'Mixed': 5, 'Opaque Ice': 6, 'Cirrus': 7, 'Overlapping': 8, 'Overshooting': 9, 'Unknown': 10, 'Dust': 11, 'Smoke': 12
Guo	Ya	guo.ya1@northeastern.edu	For the 'cloudy type' of NSRDB Data downloaded, which are filled by numbers 0 to8, what does these number indicate acuurately? Is there any notations for these numbers? Thanks!	This should be in the cloud_type "units" attribute . Here are the units: 'N/A': -15, 'Clear': 0, 'Probably Clear': 1, 'Fog': 2, 'Water': 3, 'Super-Cooled Water': 4, 'Mixed': 5, 'Opaque Ice': 6, 'Cirrus': 7, 'Overlapping': 8, 'Overshooting': 9, 'Unknown': 10, 'Dust': 11, 'Smoke': 12
Guwaeder	Abdulmunim	guwaede@okstate.edu	What sort of software that you use to make statistical analysis for the data you get?	We use our own software that are either Python or Matlab based for our analysis.
Guwaeder	Abdulmunim	guwaede@okstate.edu	Is it possible to get the recent data in any country in the world ?	We only update our datasets once a year and donot have a mandate to update more frequently on the public servers. If users do require more frequent update please communicate your needs to DOE so that they are aware. This might result in changes in the future. Also we currently only have data from the GOES and Meteosat Indian Ocean satellites. So we do not have data that is not covered by these satellites.

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Hanna	Liam	lhanna@advancedsolarproducts.com	I work for a solar EPC company and we use NSRDB data to model all of our array productions for financers and customers. We have found that the irradiance is too optimistic compared to ground pyranometers we have historically installed in solar arrays. Is this something that you anticipate the 5 minute data will help with? Additionally will NREL be including support for 5 minute data in PVWatts anytime soon?	We do not adapt our 30 minute data to sites and there is the possibility of a bias in our datasets. 5 minute data should improve accuracy as we have more information during variable periods. If you do feel strongly about seeing the 5 minute data in PVWatts please email the SAM team with this request.
Hansen	Clifford	cwhanse@sandia.gov	One suggestion for the web interface: it would be invaluable to be able to type in a lat/long, rather than having to click a point and hope you get it right where you wanted it.	This is already an option in the NSRDB viewer. Check the tutorial in the NSRDB viewer by clicking the top far right icon in the viewer
Hardy	Trevor	trevor.hardy@pnnl.gov	Thanks for the updates today. When might we expect to see the work regarding AI based derivation for missing cloud data?	We have preliminary results now that are very promising. It is likely that we will include this in the next version of the PSM in 2021 with a paper describing the methodology around the same time.
Hardy	Trevor	trevor.hardy@pnnl.gov	We have seen several shifts in the data formatting from API returns in the last 18 months. Are you stabilizing the API or are these types of formating changes expected going forward?	As you might have noticed we have made so many new changes in the last 18 months. This is a result of (a) new satellites with higher res data (b) adding new downstream datasets (c) moving towards AWS and hsds based data delivery. Our goal has been to standardize both the storage and the delivery so we hopefully expect that things will not change as rapidly going forward.
Hashemi	Behzad	hasb01@uqo.ca	Are the records for the cloud cover (in %) available for different locations on the website? If not, do you have any plan to add them?	We assume that you question is about percent cloudiness over a year. This can easily be calculated using the cloud type parameter. We donot have cloud fraction for individual times - at this time a pixel is either clear or cloudy. This might change in the future if we can develop a practical way to use 500m visible data from the satellite.
Hiza	Nicholas	nhiza@orionrenewables.com	Can you model and make available net capacity factor for your map? Can you model and make available net capacity factor for your map, based on panels currently contained in SAM?	You can compute net capacity factor at a large scale using the Renewable Energy Potential Model (reV): github.com/nrel/reV
Holgado	Sydney	sydneyholgado@postroadfoundation.org	Is there more information beyond hsds-examples on how to extract multiple years of DNI at a time using the HSDS method? I could only get one year at a time using guidance from the examples.	You can use our Resource Extraction Tool (rex) along with HSDS to extract multiple years at a time: https://nrel.github.io/rex/rex/rex.resource_extraction.multi_year_resource_cli.html#multiyearx,
Holgado	Sydney	sydneyholgado@postroadfoundation.org	Is it possible to generate a simulation with multiple locations at once using SAM?	No, but you can use the Renewable Energy Potential Model (reV) to do so: https://nrel.github.io/reV
Kankiewicz	Adam	kankiewiczja@bv.com	Will PSM irradiance data be available in a realtime or near-realtime basis soon?	At this time we do not have a DOE mandate to make more frequent data available although technical capabilities do exist. Feedback to DOE about user needs might change this going forward.
Ladd	Charles	cladd@ecoplexus.com	Can the satellite data be used to predict the light reflected off of the surface? That information could be used to predict performance of bifacial PV modules.	There is surface albedo data in the NSRDB which is derived from MODIS (for snow free ground) and IMS (for snow). Please be careful about using the high-albedo (snow) data as in those cases the albedo is probably lower due to dirt and old snow.
Ladson	JACK	Jack.Ladson@Gmail.com	I am surprised that the Beer-Lambert law Is being used in this application. There are known limitations that include scattering of light and non-monochromatic radiation. Wavelenght sensitive. Have these properties been examined to understand limitations and influence of limitations? Is this the correct model? Were other models examined?	The Beer-Lambert law is not being used in this application. We used REST2 for clear sky which accounts for circumsolar radiation. We use a decomposition model for cloud situations but will be moving to a more physical model for calculating DNI in cloudy situation that integrates radiance around the solar disk. Please drop us an email if you would like to discuss this in more details.
Lopez Lorente	Javier	jlopezlorente01@qub.ac.uk	Is it possible to download the raster data at 4km or 2km resolution in order to be used in GIS tools? Thanks	No, we do not retain the raster data as we do not report data over the ocean. The data is produced on a regular grid so it should be relatively easy to rasterize it.
Macklin	Joe	joe.macklin@igs.com	with increasing climate change effects, are you seeing any trends in measured irradiance over the last 10¬†years compared to historical measurements?	We have been investigating trends in data but the signal are weak at best and may be below the threshold of uncertainty when considering such short time periods of time.
Merriam	Scot	smerriam@srmprojects.ca	This data seems to be a robust hindcast. Is NREL working to provide solar radiation forecasting ability to take into account climate change effects, such as increased atmospheric smoke from forest fires?	This project is specifically to provide historical data. Forecasting work is part of other projects although providing climate projection has not been an active area of our work.

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Merriam	Scot	smerriam@srmprojects.ca	This data seems to be a robust hindcast. Is NREL working to provide solar radiation forecasting ability to take into account climate change effects, such as increased atmospheric smoke from forest fires?	
Mikofski	Mark	Mark.Mikofski@dnvgl.com	Hi Manajit, will the slides be available online after the talk?	Yes on the nsrdb website and the recorded presentation is also available in https://sam.nrel.gov/weather-data/weather-data-videos.html.
Mikofski	Mark	Mark.Mikofski@dnvgl.com	RE: API - is there a newsletter or bulletin to know if the API is going to change in advance? Or to know if there are going to be downtime? And to know if the API is online and healthy?	Yes all changes and anticipated changes will be documented in the NSRDB website. If you have any suggestions from the user viewpoint we will be happy to take it anytime so please drop us an email.
Mikofski	Mark	Mark.Mikofski@dnvgl.com	Manajit, Hi, any explanation on why DNI mean bias error is so high in northeast USA? nearly 15%	The main challenge when estimating DNI MBE is accounting for variability in cloudy skies as captured in 1 minute ground data. We average ground data for 1 hour and compare with DNI from the satellite (which is instantaneous measurement) on an hourly basis. In effect the comparison methodology leads to this quantification of error when in actuality both the ground and satellite data are capturing the atmospheric state accurately from their viewpoint.
Moore	Kathleen	moore@iedat.com	How about smoke-affected boundary layers, and the GHI-DNI relationship ?	The aerosol optical depth should capture the smoke in the boundary layer. We compute GHI and DNI separately from our radiative transfer model taking the aerosols into account.
Newmiller	Jeff	jeff.newmiller@dnvgl.com	When requests are sent via the API is the returned data also delivered via the email/link/zip mechanism?	There are 2 types of API request. One directly returns a CSV file but is limited to small requests. The second uses the email notification system and supports the full scope of requests supported. https://developer.nrel.gov/docs/solar/nsrdb
Newmiller	Jeff	jeff.newmiller@dnvgl.com	I observe that one response indicates that you "do not report data over the ocean"… is this a technical limitation or a management decision? Do you have recommendations for estimating resource for offshore marine applications?	We provide data near the coast line, but have removed data over the ocean to reduce the size of data being disseminated which is already exceeding 100TB. We have the raw data over oceans and can produce the data if needed. Please contact us if you think this is or will become an important dataset.
Omotola	Sunday Kunle	sunday.omotola@wemabank.com	Special thanks to the facililatator, please can I have the slide after the meeting?	Yes, all attendees will receive an email in the next 24-48 hours with a link to access the webinar recording.
Omotola	Sunday Kunle	sunday.omotola@wemabank.com	Is there any data available for West Africa,Nigeria precisely?	The new Meteosat data for 2017-2019 should cover West Africa
Orozco	Iveth	iveth_11oansa@hotmail.com	How can I dowload the data per month, because When I downloaded they were in minutes, it's too much data, please.	You can download hourly data and then sum to a month if needed. As solar applications don't generally use data at such a coarse temporal resolution we do not produce such data. If you have any specific need please contact us.
Pelland	Sophie	sophie.pelland@canada.ca	Regarding your downscaling tool (to go from 4 km 30 minutes to 2 km 5 minutes): can you comment on how realistic the variability is? And: is there any limit in principle on the level of spatial and temporal downscaling (e.g. could you potentially generate say 1 second data)?	It will difficult to capture the the spatial and temporal variability using our model to downscale to one second. As you realize the available information content is used to produce data at the native resolution. Higher temporal and spatial data is simply some form of interpolation. Another thing to realize is that temporal and spatial resolution go hand in hand and both need to be specified. The variability we see when we generate the 2km 5 minute data capture variability quite well as per our evaluation. There is no limit to the principle of spatial and temporal downscaling. But as the variability signature changes non-linearly with space and time there will have to be some effort to develop the necessary variability parameters that will enable donwscaling across all spatial and temporal scales.
Reid	Harlan	hreid@q-lab.com	I have a few questions. First, is all of the data available as models, only, or is there measurement data, as well?	We do not publish the raw satellite measurement data as part of the NSRDB. Also we do not distribute the surface measurements but you can go download NREL, SURFRAD or ARM data which is publicly available.
Reid	Harlan	hreid@q-lab.com	Second, I've used the SAM tool, in the past, to determine relative energy at various angles at a specific location. This is with a solar array setup, but I actually would want to have daily radiation data as W/m⁻≤ TUV and W/m⁻≤ Global Irradiance at various angles. Would the FARMS model be what I need, or is there something else that would help me? I'm not in Solar Energy, but I study degradation of outdoor materials, so radiation values are preferred.	I would suggest that you use either our spectral dataset which is available at various tilts. Otherwise you could use a transposition model (available from pvlib or other such public repositories) to convert the horizontal data (GHI and DNI) available from the NSRDB to specific tilts. Note that we now distribute UV data too now. Please contact us if you have additional questions.
Reid	Harlan	hreid@q-lab.com	Is all of this model data? Would any of it be direct measurement with total solar and TUV radiometers?	All NSRDB data is computed using PSM. The model data has been comprehensively validated using UV data from various locations. Please contact us and we can provide you with the links to the validation studies.

Last Name	First Name	Email Address	Question Asked	Answer Given
Reusser	Mark	mark.reusser@icf.com	A slide was provided showing rersults of validation vs SURFRAD data. In all cases, the clear sky data is biased positive (MBE). This is also the case for the All Sky for all sites except one. Doesn't this imply an overall positive bias for the model (appears to be about 2.5% - 3.0% on average for all sky). The average MBE for the DNI All Sky appears to be about 6%	The validation is done using the seven stations. The result shows +/- 5% and +/- 10% bias (more in to the positive bias) for GHI and DNI, respectively. We have to be careful about interpreting the biases. Satellite data is instantaneous and we use hourly data. On the other hand the ground data is averaged for an hour but the data is 1 minute resolution. We use the satellite to interpret whether a scene is clear or cloudy. This method of evaluation will by itself produce some level of bias but I would say that both datasets are correct from their own viewpoint of spatial and temporal representation. We have evaluate clear sky radiation from satellite where ther ground data is also 90% + clear and found that the GHI and DNI match up within 1%.
Rupp	David	david.rupp@oregonstate.edu	Can we access the ground-truthing data from NREL?	Not directly from the NSRDB website but the ground truth data can be accessed from….. Measurement and Instrumentation Data Center https://midcdmz.nrel.gov/ offers near real-time solar irradiance and meteorological data for several U.S. locations. NOAA Surface Radiation Research Branch http://www.srrb.noaa.gov/surfrad/index.html https://www.esrl.noaa.gov/gmd/grad/solrad/index.html Surface Radiation (SURFRAD) Network University of Oregon Solar Radiation Monitoring Laboratory http://solardat.uoregon.edu/ Operates solar radiation monitoring stations throughout the Pacific Northwest
S	Karthikeyan	karthi21c@pec.edu	Many researchers are working in laboratory conditions under high radiation energy intensive lights. How far it is reliable over actual solar conditions?	There are many publications and standards that discuss the mismatch between the solar simulators and natural solar radiation.
S	Karthikeyan	karthi21c@pec.edu	Is it significant to study other climatic parameters along with solar irradiation when we deal with solar thermal systems?	Yes, those parameters are important as they influence the actual energy produced.
S	Karthikeyan	karthi21c@pec.edu	Are there any provisions available for us to share the local solar irradiation data online?	I assume that you would like to share data you collect. We do work with partners to share high quality measurements. Please check out https://www.nrel.gov/midc. If you are interested in sharing your data please contact us and we can discuss this option.
S	Karthikeyan	karthi21c@pec.edu	How to arrive at the over all radiation input received by a solar thermal system? Are there any time guidelines available for making such observations?	Please check out the System Advisor Model that is freely available from NREL. It is connected to the NSRDB and can help you do those calculations.
S	Karthikeyan	karthi21c@pec.edu	What are the limitations of recording solar irradiation data by using hand held a solar power meter over radiation pyranometers?	Pyranometers evolved through time. Secondary standard pyranometers now provide lower uncertainty. Also, pyranometers are classified under ISO 9060 standard. Hand held radiometers can give rough estimation of irradiance for various reasons including orientation, technology used and calibration.
S	Karthikeyan	karthi21c@pec.edu	Is it necessary to have bell shaped plot / curve of solar data for accessing the performance of solar appliances?	We do not fully understand your question. Please feel free to email us with more details and we will try to answer your question.
Saber	Ahmed	ahmed.saber@etap.com	Can I get future forecast data? Secondly, can I get near historical data, like 2019, 2020 etc.?	This project is primarily to provide historical data. The data is updated every year so yes you can get historical data from 1998-2019 right now. We update this once a year so 2020 data will be available in 2021.
Saber	Ahmed	ahmed.saber@etap.com	What are the applciaitons of 10 years back data?	Timeseries data is used to estimate long-term PV and CSP production (P50, P90 etc.) given long term interannual variability. The longer the time series the more the confidence in the estimates.
Saber	Ahmed	ahmed.saber@etap.com	Can I get future forecast data?	Future forecasts are available from various weather forecast source. This project provides a long-term time series dataset for use in models such as SAM and PVSyst.
Sallam	Khaled	khaled.sallam@okstate.edu	The 1-axis tracking does not requier the tilt angle, is this correct? Is it assumed latitude tilt?	When analyzing a 1-axis tracker you should set tilt=0. When analyzing a fixed panel, tilt=latitude is a fair assumption.
Sauer	Kenneth	kenneth.sauer@pvel.com	Do you have an example Python script on GitHub in your Getting Started/Help Docs on how to download multiple weather files at multiple locations for multiple years at once via API? Thanks.	You can see examples of using our HSDS service here: github.com/nrel/hsds-examples

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Sauer	Kenneth	kenneth.sauer@pvel.com	Is there a reason why you cannot look up a physical (e.g., mailing) address or set of coordinates in NSRDB viewer?	This feature is available on the website based download. Please click on the circular icon at the top right of the page. The download API can accept coordinates. There is also a dataset discovery endpoint that can accept an address at https://developer.nrel.gov/docs/solar/nsrdb/nsrdb_data_query/
Sauer	Kenneth	kenneth.sauer@pvel.com	Can we download snow albedo via NSRDB Viewer? API? I have not seen it on the Viewer. Why is this different from surface albedo? Which monthly albedos to put into SAM? Surface and/or snow?	Surface albedo dataset is included in the NSRDB dissemination options including the NSRDB viewer. The surface albedo includes snow albedo information when there is snow at a location. The snow albedo is currently fixed at 0.86 (fresh snow). So that number can be an overestimate if the snow is old and dirty snow. Estimating the actual albedo of snow is an active area of research for us.
Sauer	Kenneth	kenneth.sauer@pvel.com	Sorry, did you say wind speed is at 2 m or 10 m height?	Windspeed is at 2m as produced by MERRA2
Sauer	Kenneth	kenneth.sauer@pvel.com	Wasn't the historical wind speed data at 10 m? Can old data be mixed w/ new given the change to 2 m? If we download all the individual years of data, is the wind speed always at 10 m or 2 m or is there some mixture of heights?	As of PSM v3 the windspeed data is at 2m. PSM v2 used MERRA derived windspeed which was computed at 10m. We need feedback from users about whether the 2m or 10m data is more useful for PV and CSP modeling.
Sauer	Kenneth	kenneth.sauer@pvel.com	What do you recommend importing into SAM or PVsyst? GHI only? GHI + DHI? DNI + DHI? Should we avoid DNI given the bad bias?	I suggest that you use the DNI and DHI. The bias is basically due to the comparison methodology. Please see question 80 for some additional details about the bias.
Sauer	Kenneth	kenneth.sauer@pvel.com	When will the new POA TGY data sets be available?	This will take some effort to deploy and we will require funding to make this happen. We know that this may become extremely useful to our users but this has to be an on demand service as cannot store data for all possible configuration. We are in discussions with DOE about this implementation.
Seel	Joachim	jseel@lbl.gov	can you explain how one can download TMY2019 GHI and DNI shapefiles for the entire US? When drawing a rough box in the download wizzard one gets the "download limit indicator" error.	I would recommend you explore accessing the data on the cloud via AWS and HSDS where you can access the complete dataset without limitations.
Sukunta	Manussawee	manussawee.sukunta@eia.gov	Do you know if wind resource data was completed as a part of DOE's request (international)?	The wind speed and direction data in the NSRDB is downscaled from MERRA2 data. This data is not for use in wind modeling and was not developed as part of any DOE international request. If we are getting your question wrong please contact us and we will be happy to discuss.
SV°nchez PV©rez	Pedro AndrV©s	psanchez30@ucmerced.edu	Can we request to the hdsd api a subset of a particular region of conus or we need to download the full data?	Yes, please see our resource extraction tool (rex): https://nrel.github.io/rex
TUNA	Hf∞LAL	htuna@enerji.gov.tr	we want to update our national map of solar energy potential. so how do we combine models ?	This will require more detailed discussion. Please contact us via email if you would like to discuss.
Taylor	Ben	benjamin.taylor@signalenergy.com	How is the 30 minute data averaged from the 5 minute data? What is the labelling convention? Is the 11:30 average an average of data from 11:30 to 12:00 i.e. "left-labelled"?	the 30 minute data is only averaged for 2018 and 2019. For all prior years 30min data was the native satellite resolution (instantaneous). The 5min to 30min averaging is done by averaging 7 5min timesteps in a window centered on the 30min timestep. Data is also aggregated from the nearest 4 spatial pixels to go from 2km to 4km (squared).
Van De Bogart	Aaron	avandebogart@blattnercompany.com	What did was sent to SAM? Has the convention or column format and scaling been fixed between NSRDB direct website vs SAM?	Please contact us if you are facing any technical issues that were not there previously. Feedback on such issue will help us resolve any problems we might not have detected ourselves.
Vega	Rolando	RVega-Avila@cpsenergy.com	What are the error metrics of the NSRDB when comparing grid resolution with actual measurements?	The validation is done using the seven stations. The result shows +/- 5% and +/- 10% bias (more in to the positive bias) for GHI and DNI, respectively. Please check slide 19 of the webinar presentation for the MBE and RMSE statistics. Your question may be related to comparison of satellite measurements (with some spatial extent) and ground measurements (point). We average the ground data to represent the spatial coverage of satellites. This is not a perfect solution though.
WOLTER	NIELS	madison.solar@me.com	Just a couple of comments. I am most interested in 15 minute data - as that is the same interval at which demand charges and power to the grid are determined. So I do more and more 15-minute analysis.	For 2018 and 2019 you could use the available 5min data either at 15 minute intervals, or by averaging to 15min resolution. For other years we have a downscaling model but that is not publicly deployed. Please contact us and we can send you the link to our publications.
WOLTER	NIELS	madison.solar@me.com	Also I like to track the annual solar resource in Madison WI. Typically the previous year's data shows up in about November of the next year. It would be great of that lag were shorter.	We release the data once the entire year has been processed, but due to the complexity of the PSM pipeline and amount of computation needed (particularly with the new satellites) this takes quite a while. We continue to work to release the data as early as possible. But we expect it to be normally summer/early fall of the next year. We will take your suggestion and see if we can get annual estimates earlier.

Last Name	First Name	Email Address	Question Asked	Answer Given
Wang	Weijia	weijia.wang@etap.com	Is there any country or region on the earth that the dataset does not cover? Thank you.	Yes, we do not cover northern Europe or East Asia at the moment.
Weiss	Tom	tom.weiss@trinitysolarsystems.com	I had to step away for a bit, so if it was covered I apologize. I work in Residential Solar in the North East and snow loading is very important. Are there plans to more easily integrate snow loading data into this data? Or maybe it's more a question for the SAM team	We have had various proposals to provide precipitation data but those have not been funded yet. We hope that we can actively work in this in the near future as we do have some ideas about how to do this.
Wilber	Michelle	mmwilber@alaska.edu	Sorry if someone already asked - but any joy for Alaska?	Unfortunately the GOES satellites only cover the southern portion of Alaska. We report as much data as we can get from the Satellites. To cover Alaska we will need to include polar orbiters and this is where we need to work with NASA. We keep trying to find avenues and funding to make this happen.
Wilson	Daniel	DWilson@OCISolarPower.com	Will the presentation be available after the presentation?	Yes, at https://nsrdb.nrel.gov/about/announcements.html
Wilson	Daniel	DWilson@OCISolarPower.com	Is it possible to get data for the current year? Presently it appears the data is only available through 2019.	We do not release data until we have processed an entire years worth of data. Due to the amount of time/computation needed we currently release data in the late summer/early fall of the next year. We do have the ability to process data sooner but this is not a DOE priority for this project.
Zea Alzate	Nicolas	nzea_ext@xm.com.co	Hi, there is no present data available on the your data bases?	Our data is distributed annually with one year lag. We don't provide current datasets. We have the ability to produce recent datasets but DOE SETO decides on how often we distribute datasets based on DOE priorities.
Zea Alzate	Nicolas	nzea_ext@xm.com.co	Do you have any particular github recomendation for forecasting PV output with GHI and temperature data from the present month? I'm thriving to define an accurate model to do this	You would need to look at various weather forecasting models such as HRRR, GFS or GEOS.