Webinar: NOAA's 3km Rapid Refresh Weather Forecasting Models and Renewable Energy Forecasts	
Question	**Answer**
Would it be possible for NOAA to provide some guidance around which weather situations are most challenging for NWP, esp. those that impact energy?	Accurately forecasting clouds is continuing to be a challenge, and in particular the timing associated with cloud formation / dissipation, which greatly impacts solar radiation prediction and even winds. Forecasting hub-height winds in complex terrain continues to be a challenge, both because we don't resolve all of the important features even with a 3-km grid, but also getting the contributions of the various sources of drag on the model correct -- we need more observations at hub height in different regions of the country.
HRRR data via grib or netcdf is really challenging when you need time series data at a point. Are there any official tools or data hosts that make it simpler?	The NOAA Open Data Dissemination (NODD) is continuing to improve tools to allow users to download NOAA model output (as well as NOAA observations) from the cloud. They have already incorporated new data formats (e.g. ZARR) which allows users to download a single variable (albeit from the entire domain) easily from the cloud without needing to download the entire file.
Will forecast error estimates/statistics be available with RRFS forecasts?	NOAA's Model Analysis Tool Suite (MATS) is an online tool used regularly by NOAA's model developers to evaluate both operational and experimental models against "traditional" observations. You can learn more about it via this paper: doi:10.15191/nwajom.2020.0803
The retirement of NAM was mentioned a few minutes ago. I know this is all about HRRR, but is there a planned replacement for NAM?	Yes, the NAM (as well as the HiRes Window) will be retired when RRFS version 1 becomes operational. There are three primary reasons: (1) the NAM hasn't been actively developed/improved since 2018, (2) we need to port the model to a new operational computer and the expertise needed to do this no longer exists because of the previous point, and (3) we want to simplify the production suite. So the replacement for the NAM is the RRFS.
When will HRRR-chem (smoke) be available via NODD? Am I just missing it in https://www.nco.ncep.noaa.gov/pmb/products/hrrr/ ? (edited)	HRRR-chem is an experimental model, and while it is run in a quasi-realtime way to aid in its development, it is not run operationally by the NWS and thus not on the NODD. However, the operational HRRR includes smoke forecasts (as will the RRFS), and those are available on the NODD. The primary difference is that the smoke is treated as a static tracer and does not evolve chemically in the HRRR/RRFS, but chemical processes are performed in HRRR-chem (which makes that model MUCH more computationally expensive)
Are there any plans for reanalysis data sets with the latest HRRR/Rap model? Similar to last 30+ years of data available with ERA5 etc.	We are in discussions to make a long 20-y retrospective HRRR (or perhaps RRFS) dataset that can be used to train a 3-km machine-learning (data-driven) prediction model. But there are no concrete plans yet.

Can you say more about the need of using cumulus parameterization on the 3-km grid resolution?	In the HRRR, we do not have a cumulus parameterization. However, while developing the RRFS, it was discovered that the FV3 dynamic core produces excessive vertical motions which greatly (and negatively) impacts the structure of the storms. By including a tuned-down convective parameterization in RRFS, we were able to partially mitigate the RRFS/FV3 issues and improve the forecasts.
Are there some sample GRIB files for the RRFS available, so we can start comparing against HRRR?	The RRFS model is still in active development. After the code is frozen, controlled retrospective runs for a spring, summer, and winter season will be conducted. At that stage, we will be able to share those GRIB files.
What language will RRFS be written in & will the RRFS have the ability to directly integrate any nascent machine learning schemes into its parameterizations?	RRFS is written in Fortran. We are exploring using ML techniques to replace some of the more computationally expensive parameterization schemes. The effort that is the most advanced is a replacement for the radiative transfer parameterization; this paper provides the details (10.1175/JTECH-D-23-0012.1). We are currently implementing this in the Global Forecast System; if successful, then we will immediately implement it in RRFS (but it will be RRFS v2).
You might have mentioned it, but is the temporal resolution of the outputs the same for HRRR and the other NWP models shown in the slide about ramp events?	The HRRR (and the RRFS) will provide 15-min output of many fields (including downwelling solar radiation and wind speeds at the surface and hub-height), and hourly output for all of the other 3-d fields. I am not familiar with the other models used in the ramp event slide (I don't even know their name), so I can say for sure.
How well can you predict light wind/zero wind speeds as a function of time?	Predicting calm conditions is tough, especially at longer forecast hours. We have only recently really started looking at statistics for this particular phenomenon. We can capture some events, but there is work to be done.
Dave, What AI / ML tools will help you the most (soon) with ReE at Utility Scale and Grid Edge?	That is a tough question, primarily because the ML field is moving so FAST. I was part of a team that wrote a strategy document about AI/ML research in NOAA two years ago, just before the release of the first data-driven ML weather prediction model. Generative AI has totally transformed the field for sure. That said, I would like to develop some AI/ML approaches that are applied in a post-processing to both bias correct and sharpen the forecasts we get from physics-based models like the HRRR and RRFS