



YOUR ASSET, YOUR FORECAST

## H2020 SECLI-FIRM – Webinar

Complementing the U.S. Public Sector's  
Climate Services: The role of Machine  
Learning and Cloud Computing

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## Quick intro – About us:

**Benchmark Labs** provides IoT forecasting solutions by delivering asset-specific forecasts for the agricultural sector and beyond, to optimize management strategies, reduce water consumption and improve operational margins.

**PLUGANDPLAY**





## THE IMPACT ON FORECAST ACCURACY

### TEMPERATURE FORECAST ERROR (Root Mean Squared Error °C)



GRIDDED FORECAST



IN-FIELD FORECAST







# THE PROBLEM: where is the data?

National Weather Service  
NCEP Central Operations

Home News Organization  
DDC NOAA NWS | NCEP Centers: AWC CPC EMC NCO NHC OPC SPC SWPC WPC

NCEP Home > NCO Home > IDSB > NCEP Product Inventory - Global Products

### NCEP Products Inventory

#### Global Products

Global Forecast System (GFS) Model  
Global Data Assimilation System (GDAS) Model

Information about the GFS  
CC is the model cycle routine (i.e. 00, 06, 12, 18)  
FFF is the forecast hour of product from 000 - 384  
YYYYMMDD is the Year, Month and Day

Click on the links under Inventory to see the file's contents.  
Use as a guide when selecting specific parameters from NOMADS. Click to view what is available.

DESCRIPTION	NCEP FTP/HTTP SERVER File Name	NWS FTP SERVER File Name	
<b>GFS</b>			
<b>GFS - Global longitude-latitude grid</b> Most commonly used parameters			
<b>WCSS File Name</b>	<b>Inventory</b>		
0.25 degree resolution	gfs.tccz.pgrib2.0p25.FFFF ANL FH000 FH001-384	Available in GRIB2 via ftp Available in GRIB2 via https gfs.tccz.pgrib2.0p25.FFFF	Not Available
0.5 degree resolution	gfs.tccz.pgrib2.0p50.FFFF ANL FH000 FH003-384	gfs.tccz.pgrib2.0p50.FFFF gfs.tccz.pgrib2.1p00.FFFF	Not Available
1.0 degree resolution	gfs.tccz.pgrib2.1p00.FFFF ANL FH000 FH003-384		Not Available
<b>GFS - Global longitude-latitude grid</b> Least commonly used parameters			
<b>WCSS File Name</b>	<b>Inventory</b>		
0.25 degree resolution	gfs.tccz.pgrib2.0p25.FFFF FH001-384	Available in GRIB2 via ftp Available in GRIB2 via https gfs.tccz.pgrib2.0p25.FFFF	Not Available
0.5 degree resolution	gfs.tccz.pgrib2.0p50.FFFF FH003-384	gfs.tccz.pgrib2.0p50.FFFF gfs.tccz.pgrib2.1p00.FFFF	Not Available
1.0 degree resolution	gfs.tccz.pgrib2.1p00.FFFF ANL FH000 FH003-384		Not Available
<b>GFS - 0.5 deg Combined Global Latitude-Longitude Grid</b> All parameters			
<b>WCSS Filename</b>	<b>Inventory</b>		
gfs.tccz.pgrib2.full.0p50.FFFF Concat of pgrib2.0p50 and pgrib2.0p50	FH000 FH003-384	Available in GRIB2 via ftp Available in GRIB2 via https gfs.tccz.pgrib2.full.0p50.FFFF	Not Available
<b>GFS - T1534 Semi-Lagrangian grid</b>			
<b>WCSS Filename</b>	<b>Inventory</b>		
gfs.tccz.sfluxgrb.FFFF.grb2	FH000 FH001-384	Available in GRIB2 via ftp Available in GRIB2 via https gfs.tccz.sfluxgrb.FFFF.grb2	Not Available
<b>GFS - MOS Aviation Products</b>			
<b>WCSS Filename</b>	<b>Inventory</b>		
Alaska CONUS 40km TSTM & 80km SVR WX Short-Range GFS Air Force Short-Range GFS	mdl_mavgribak.ICCz mdl_mavgribak.ICCz mdl_mavgribak.ICCz mdl_gflamav.ICCz mdl_gflamav.ICCz	Available in GRIB via ftp Available in GRIB via https mdl_mavgribak.ICCz mdl_mavgribak.ICCz mdl_mavgribak.ICCz mdl_gflamav.ICCz mdl_gflamav.ICCz	Not Available

GDAS  
GFDL-CM2p1-iso04  
GFDL-CM2p5-FLOR-A06  
GFDL-CM2p5-FLOR-B01  
GFDL-SPEAR  
GHCM CAMS  
IRI-ECHAM4p5-AnomalyCoupled  
IRI-ECHAM4p5-DirectCoupled  
LSMASK  
NASA-GEOS2S  
NASA-GMAO  
NASA-GMAO-062012  
NCAR-CESM1  
NCDC-OISST  
NCEP-CFSv1  
NCEP-CFSv2  
Ov2 SST

Models NMME GFDL-CM2p1  
Models NMME GFDL-CM2p5  
Models NMME GFDL-CM2p5  
Models NMME GFDL-CM2p5  
Models NMME GFDL-SPEAR[HINDCAST FORECAST]  
Models NMME GHCM\_CAMS[updated temp]  
Models NMME IRI-ECHAM4p5-AnomalyCoupled[MONTHLY]  
Models NMME IRI-ECHAM4p5-DirectCoupled[MONTHLY]  
Models NMME LSMASK[land]  
Models NMME NASA-GEOS2S[HINDCAST FORECAST]  
Models NMME NASA-GMAO[MONTHLY]  
Models NMME NASA-GMAO-062012[sc8110 mc8110 MONTHLY]  
Models NMME NCAR-CESM1[HINDCAST FORECAST]  
Models NMME NCDC-OISST[est]  
Models NMME NCEP-CFSv1[MONTHLY]  
Models NMME NCEP-CFSv2[HINDCAST FORECAST]  
Models NMME Ov2\_SST[est]

fluid  
oratory  
Reference: GFDL Only

## data portal

Overview  
a  
side

nm.GFDL.FSGF node

nd Supporting Information (SI) for documentation papers  
gfs/ST  
gfs/ST  
gfs/ST

colon) for native ocean model (tripolar) output (gn grid label)  
A4/ESM4/OM4p5B datasets (uo,v0,tauu0,tauv0) on the native ocean model grid.  
for the complete list of affected datasets and instructions for fixing.

GFDL-ESM4, GFDL-OM4p5B  
ocean\_stats\_0p5\_tracer.nc  
ocean\_stats\_0p5\_uvgrd.nc  
ocean\_stats\_0p5\_vvgrd.nc

ts (ODA)

change Assessment Program (NARCCAP)

## NMME Forecasts of Monthly Climate Anomalies

### Preliminary forecast verification

NMME Forecasts of Monthly Climate Anomalies Home

Seasonal real-time verification page

One-month real-time verification page

Updated July 2019

AMJ 2019 T2m

AMJ 2019 prate

Jun 2019 T2m

Jun 2019 prate

led in Borovikov et al., 2017 to one that uses the LETKF (Local Ensemble Transform Kalman Filter; Penny, 2014), and  
ates along-track alimetry, and does a nudging to MERRA-2 SST and sea ice boundary conditions. The atmospheric  
on field used to drive the GDA2 have been upgraded from MERRA to a MERRA-2 like system. The system is  
MERRA-2 atmospheric reanalysis (Gelaro et al. 2017) and the GMAO S2S Ocean Analysis. Ensemble members are  
initial states at 5-day intervals, with additional members at the end of the month based on perturbations of the  
of ocean states.

nal and seasonal forecasts are submitted to the National MultiModel Ensemble (NMME) project, and are part of the  
J6-model seasonal forecasts. As part of our participation in NMME, a large suite of retrospective forecasts ("hindcasts")  
repleted, and contribute to the calculation of the model's baseline climatology and drift, anomalies from which are the  
seasonal forecasts. All data collections from GMAO S2S-2, 1 are provided on the same horizontal grid. This grid has 720  
ngitudinal direction and 361 points in the latitudinal and are on the regular 0.5°x0.5° longitude-by-latitude grid.

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# THE SOLUTION

Public – private partnerships between the federal government and leading cloud providers (e.g., Microsoft, Amazon, Google)

The image displays three web browser screenshots illustrating public-private partnerships in environmental data and AI.

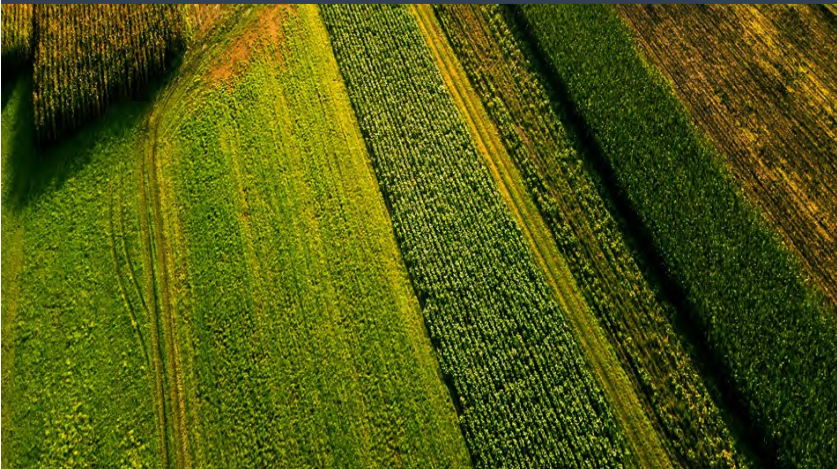
**Registry of Open Data on AWS:** This screenshot shows the AWS Open Data Registry. It features a search bar with the text "Search datasets" and a button "Search datasets". Below the search bar, it states "You are currently viewing a subset of data tagged with climate." The "About" section explains that the registry exists to help people discover and share datasets available via AWS resources. It also includes a section "Add to this registry" with instructions on how to add a dataset or example of how to use a dataset to this registry.

**Earth Engine Data Catalog:** This screenshot shows the Earth Engine Data Catalog. It features a search bar and a "Language" dropdown menu. The main content area displays a grid of dataset thumbnails, including "Canada AAFIC Annual Crop Inventory", "AHN Netherlands 0.5m DEM, Interpolated", "AHN Netherlands 0.5m DEM, Non-Interpolated", and "AHN Netherlands 0.5m DEM, Raw Samples". Each thumbnail includes a description of the dataset and a "Filter list of datasets" button.

**Microsoft AI for Earth:** This screenshot shows the Microsoft AI for Earth website. It features a large image of a forest and a video player. The text "Take part in AI for Earth" is prominently displayed, along with the tagline "Be a part of our initiative for environmental innovation." Below the main image, there are two smaller images: one showing a person holding a green balloon and another showing a blue frog on a log.



## USE CASE: AGRICULTURE - CGDD



### Problem statement:

Can we obtain actionable information from seasonal forecasts about potential harvest dates based on cGDD?



### Data:

Maximum and Minimum temperatures from NMME

Weather Station data



### Constraints:

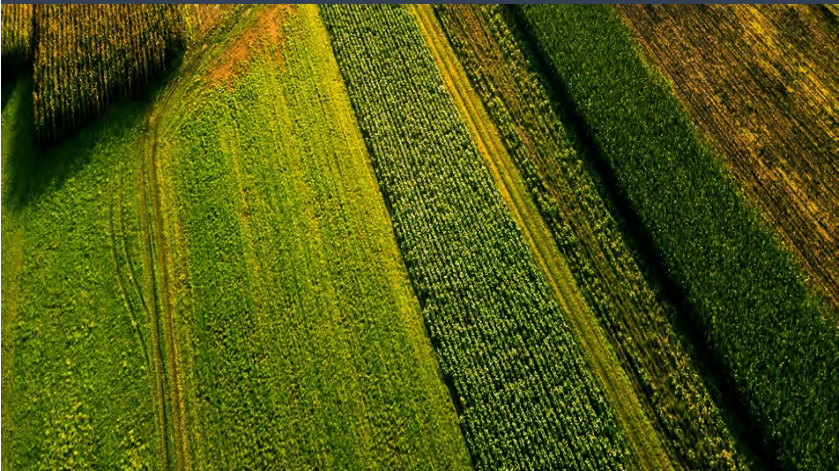
Average cGDD needed for a given crop (e.g., wine grapes)



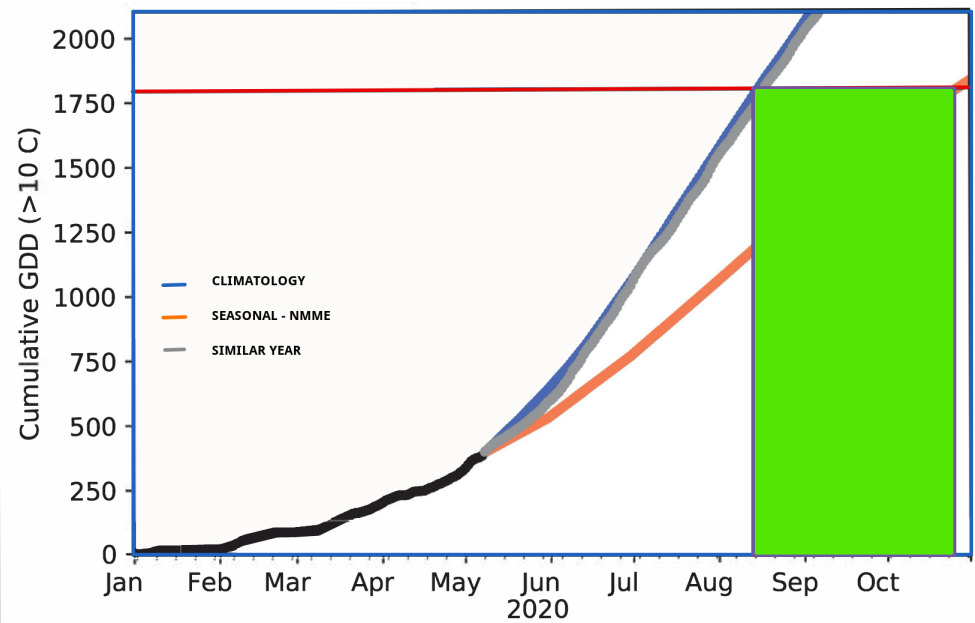




## USE CASE: AGRICULTURE - CGDD



**Example:** Seasonal forecast versus climatology and analog year – Wine grapes  
May forecast



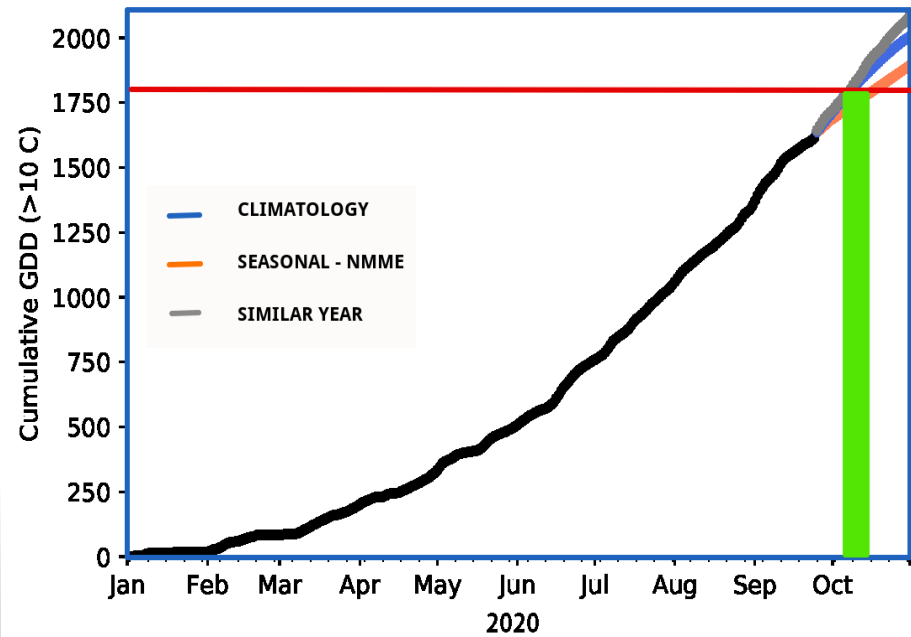




## USE CASE: AGRICULTURE - CGDD



**Example:** Seasonal forecast versus climatology and analog year – Wine grapes  
September forecast





## USE CASE: FOREST FIRE INDEX FORECASTS



### Problem statement:

Can we calculate KBDI (drought index) from NASA's GOES-S2S model output?

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### Idea:



- Get daily outputs of precipitation and maximum temperature
- Statistically downscale the output
- Calculate KBDI
- Compare output with historical fires



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### Infrastructure:

- **Saturn Cloud Server**
  - 2 cores, 16 GB RAM, 40 GB disk
- **Dask Cluster**
  - 2 cores
  - 64 workers

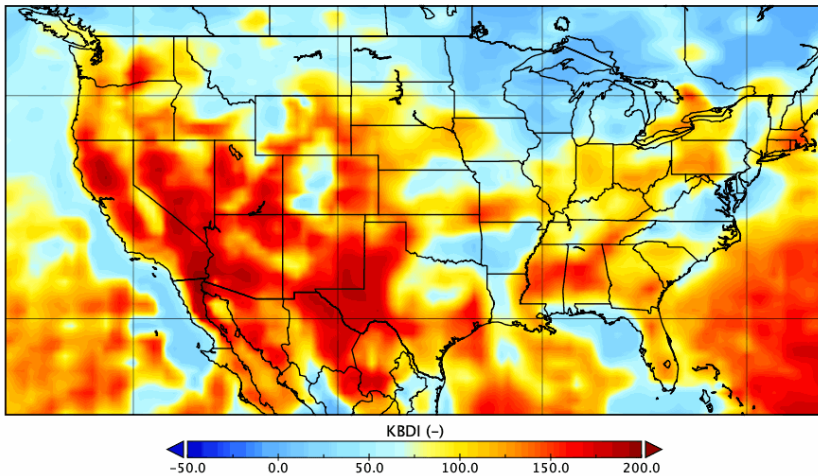




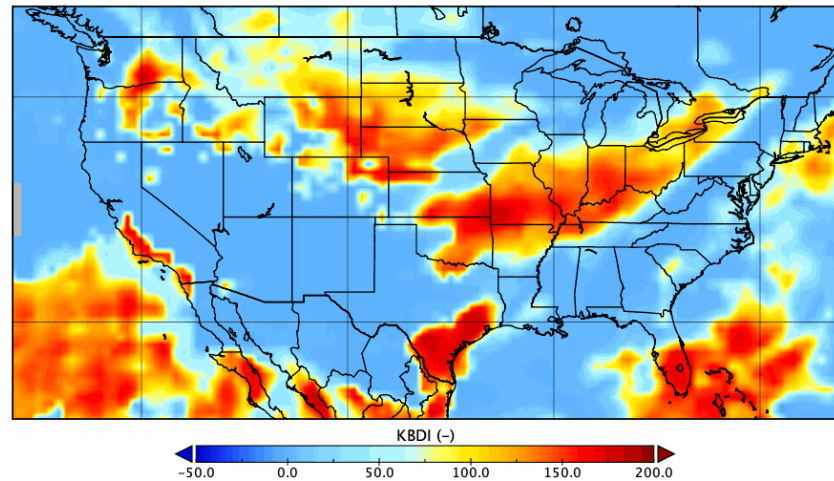
# FOREST FIRE INDEX FORECASTS

July 13 model run –  
September 2020 (left) & December 2020 (right)

Fire Danger Index (KBDI)  
Based on NASA GMAO MERRA2 + S2S



Fire Danger Index (KBDI)  
Based on NASA GMAO MERRA2 + S2S







# NEXT STEPS: SEASONAL INFORMATION IN THE CLOUD

Registry of Open Data on AWS



## NOAA Unified Forecast System Subseasonal to Seasonal Prototype 5

[agriculture](#) [climate](#) [disaster response](#) [environmental](#) [meteorological](#) [oceans](#) [sustainability](#) [weather](#)

### Description

The Unified Forecast System Subseasonal to Seasonal prototype 5 (UFS S2Sp5) dataset is reforecast data from the UFS atmosphere-ocean coupled model experimental prototype version 5 produced by the Medium Range and Subseasonal to Seasonal Application team of the UFS-R2O project. The UFS S2Sp5 is the first dataset released to the broader weather community for analysis and feedback as part of the development of the next generation operational numerical weather prediction system from NWS. The dataset includes all the major weather variables for atmosphere, land, ocean, sea ice, and ocean waves.

Acknowledgment - The Unified Forecast System (UFS) atmosphere-ocean coupled model experimental version 5 (UFS S2Sp5) data used in this study are made available through the UFS Research to Operations (UFS-R2O) project sponsored by the National Weather Service (NWS) Office of Science and Technology Integration (OSTI) Modeling Program Division and the National Oceanic and Atmospheric Administration (NOAA) Oceanic and Atmospheric Research (OAR) Weather Program Office (WPO).

### Update Frequency

Prototype 5 is a retrospective run for the period from 2011 to 2018. The runs are initialized twice per month (1st and 15th) and the length of the forecast is 35 days with an output frequency of 6 hours.

### Resources on AWS

**Description**  
UFS prototype files

**Resource type**  
S3 Bucket

**Amazon Resource Name (ARN)**  
`arn:aws:s3:::noaa-ufs-prototype5-pds`

**AWS Region**  
`us-east-1`

**AWS CLI Access (No AWS account required)**  
`aws s3 ls s3://noaa-ufs-prototype5-pds/ --no-sign-request`

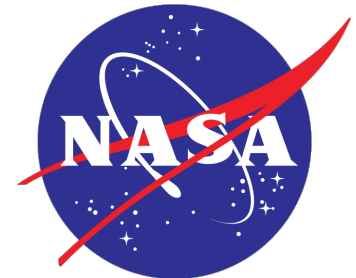
**Explore**  
[Browse Bucket](#)

PLUGANDPLAY





## SPECIAL THANKS TO:





<https://www.benchmarklabs.com>

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