

# Locust Forecast Web API User Guide

Version 1.2

## Document change history

Date	Document version	Description
10/28/2021	1.0	Initial
12/15/2021	1.1	Add water landing avoidance parameters.
2/10/2022	1.2	Add new sections for matrix runs and downloading result files. Correct required or optional parameter classification in Section 1. API responses include one or more job names.

The Locust forecast web API provides web accessible endpoints for automated programs to run and monitor a forecast run. This document is applicable for the web application version 0.6.2 or later.

Access to the API requires a key issued at the time of user registration. A key is unique to each user and it is used for authentication. There is a daily limit on the number of API calls each user can make. The limit is 250 calls per day (Eastern Time) and it may be changed without a prior notice to avoid system overload.

The base URL for a Locust forecast Web API is <https://locusts.arl.noaa.gov>. All API endpoints described below drop the base URL part for brevity. For example, for the `/rest/v1/batch` endpoint, the full URL is <https://locusts.arl.noaa.gov/rest/v1/batch>.

## 1. Submitting a batch run

Endpoint	POST <code>/rest/v1/batch</code>	
Authentication	required	Available to registered users.
Request format	json or xml	Use the "Content-Type" header with <code>application/json</code> or <code>application/xml</code> .
Request body	required	This is a list of single swarm run inputs. A batch can contain up to 100 runs. When the batch has only one swarm run, a list must be used.
Response format	json or xml	Use the "Accept" header with <code>application/json</code> or <code>application/xml</code> .
Response body		Returns the batch ID value that can be used for checking the run status. The number of API calls and the daily limit are also included in the response. An example in JSON is as follows: <pre>{"batchId":7090,"batchJobName":"batch_7090","dailyCounts":{"limit":250,"calls":1}}</pre>

Input fields for each single swarm run are shown in the table below. Note that latitude and longitude are the only required input fields.

Name	Data Type	Description
name	string	(Optional) Name of the single swarm run. Must consist of alphanumeric characters and/or underscores. The character length must be between 1 and 20. If unspecified, "swarm" will be used.
latitude	number	(Required) Latitude of the starting location. Must be between -90 and 90 degrees.
longitude	number	(Required) Longitude of the starting location. Must be between -180 and 180 degrees.
height	number	(Optional) Starting height in meters. Must be between 0 and 10,000. If unspecified, 500 will be used.
height2	number	(Optional) Additional height of the starting location in meters. Must be between 0 and 10,000. If unspecified, 1000 will be used.
height3	number	(Optional) Additional height of the starting location in meters. Must be between 0 and 10,000. If unspecified, 1500 will be used.
meteorologicalData	string	(Optional) Name of the meteorological data set. Must be GFS (which has one-degree spatial resolution) or GFS0p25 (for ¼-degree spatial resolution with shorter temporal range). If unspecified, "GFS0p25" will be used.
startDate	date	(Optional) Start year, month, and day. Must use the YYYY-MM-DD format. If unspecified, today's date (in Eastern Time) will be used.
firstDayStartHour	integer	(Optional) Must be between 0 and 23 if used.
firstDayStartMinute	integer	(Optional) Must be between 0 and 59 if used.
firstDayEndingHour	integer	(Optional) Must be between 0 and 23 if used.
firstDayEndingMinute	integer	(Optional) Must be between 0 and 59 if used.
durationOfSimulation	integer	(Optional) Number of days. Must be between 1 and 15. Note that the duration may be additionally limited by the meteorological data in use. If unspecified, 3 will be used.
simulationDirection	integer	(Optional) 0: forward in time, 1: backward in time. If unspecified, 0 will be used.
nonstopFlight	boolean	(Optional) If set to true, overnight stops are disabled. Note if this parameter is set to true, the landUseBasedFlight parameter below must be set to false. If unspecified, false will be used.
takeoffTimeAfterSunrise	number	(Optional) Takeoff time in hours after sunrise. For example, 2.5 means two and half hours later. Sunrise time is computed each day using the starting location. Must be between 0 and 4.0. If unspecified, 2.0 will be used.
landingTimeBeforeSunset	number	(Optional) Landing time in hours before sunset. For example, 2.5

		means two and half hours prior to sunset. Sunset time is computed each day using the starting location. Must be between 0 and 4.0. If unspecified, 1.0 will be used.
landUseBasedFlight	boolean	(Optional) If set to true, the application uses the following three parameters for the swarm to avoid landing over a body of water. Note if this parameter is set to true, the nonstopFlight parameter in the above must be set to false. If unspecified, false will be used.
waterFractionThreshold	number	(Optional) Threshold water fill fraction of a given landuse / landcover grid cell above which landing in the cell will be avoided. The idea here is that cells on the coast or which contain islands may have some water, but also some land, and the user can specify how much "water" must fill the cell before it is avoided. The application currently uses a 0.05 degree grid size (~5 km) for an extended northern Africa domain and a 0.5 degree grid (~50 km) elsewhere in the world. For example, with the value of 0.8, the cell is avoided if more than 80% of the 5 km x 5 km cell in northern Africa or 80% of the 50 km x 50 km cell elsewhere is water-filled. Must be between 0 and 1. If unspecified, 0.8 will be used.
maxFlightDurationInHours	number	(Optional) Number of hours that a swarm can fly without landing. If this flight time is reached, and the swarm has not encountered a cell with land, it will land in the water. The application tracks this water landing, but then does not allow the swarm to continue. It is as if the swarm ended when it landed on the water. Must be greater than 0 and less than/equal to 240. If unspecified, 72.0 will be used.
minRestInHours	number	(Optional) Minimum resting period in hours that a swarm must be allowed, once it lands on a non-water surface, before it is allowed to take off again. Must be between 0 and 72. If unspecified, 8.0 will be used.
verticalMotion	integer	(Optional) Must be between 0 and 4. For details, see Hysplit documentation for the vertical motion. If unspecified, 4 will be used.
mapBackground	string	(Optional) Map background. Supported values are terrain, toner, and arlmap. If unspecified, "terrain" will be used.
spatialPlotRadius	number	(Optional) Spatial radius of plots in km from the starting location. Must be 100.0 and 5000.0. If unspecified, 1000.0 will be used.
gisFileByDay	boolean	(Optional) Create shapefiles by day. If unspecified, true will be used.
gisFileByHeight	boolean	(Optional) Create shapefiles by height. If unspecified, false will be used.
gisFileByDayHeight	boolean	(Optional) Create shapefiles by height and then by each day. If unspecified, false will be used.
gisFileAllTrajectoriesInOne	boolean	(Optional) Create shapefiles containing all trajectories. If unspecified, false will be used.
useLineShapefile	boolean	(Optional) Use lines instead of points when creating shapefiles. Points will be used if not specified. If unspecified, false will be used.
colorOpacity	number	(Optional) Opacity (in %) of trajectories on plots. Must be between 0 and 100. If unspecified, 50 will be used.
includeHysplitFile	boolean	(Optional) Include Hysplit files when creating the redistributable zip

		file. SETUP, CONTROL, Trajectory dump files, and others are in this category. If unspecified, true will be used.
includeImage	boolean	(Optional) Include image files in the redistributable zip file. If unspecified, true will be used.
includePostscript	boolean	(Optional) Include Postscript files in the redistributable zip file. If unspecified, true will be used.
includePDF	boolean	(Optional) Include PDF files in the redistributable zip file. If unspecified, true will be used.
includeShapefile	boolean	(Optional) Include GIS shapefiles in the redistributable zip file. If unspecified, true will be used.
includeKMZ	boolean	(Optional) Include Google Earth file in the redistributable zip file. If unspecified, true will be used.

A sample request body in the JSON format is shown below. The sample contains two single swarm runs. A separate document describing user authentication when calling the web API also illustrates how to submit a JSON request in Python. This document is provided to authorized users when they receive an API key.

```
[{
  "name" : "swarm1",
  "latitude" : 4.0,
  "longitude" : 36.0,
  "height" : 500.0,
  "height2" : 1000.0,
  "height3" : 1500.0,
  "meteorologicalData" : "GFS",
  "startDate" : "2020-04-20",
  "durationOfSimulation" : 3,
  "simulationDirection" : 0,
  "nonstopFlight" : false,
  "takeoffTimeAfterSunrise" : 2.0,
  "landingTimeBeforeSunset" : 1.0,
  "verticalMotion" : 4,
  "landUseBasedFlight" : true,
  "waterFractionThreshold" : 0.8,
  "maxFlightDurationInHours" : 72.0,
  "minRestInHours" : 8.0,
  "mapBackground" : "terrain",
  "spatialPlotRadius" : 500.0,
  "gisFileByDay" : true,
  "gisFileByHeight" : false,
  "gisFileByDayHeight" : false,
  "gisFileAllTrajectoriesInOne" : true,
```

```
"useLineShapefile" : true,
"colorOpacity" : 100,
"includeHysplitFile" : true,
"includeImage" : true,
"includePostscript" : true,
"includePDF" : true,
"includeShapefile" : true,
"includeKMZ" : true
}, {
  "name" : "swarm2",
  "latitude" : 4.5,
  "longitude" : 33.0,
  "height" : 500.0,
  "height2" : 1000.0,
  "height3" : 1500.0,
  "meteorologicalData" : "GFS",
  "startDate" : "2020-04-20",
  "firstDayStartHour" : 8,
  "firstDayStartMinute" : 15,
  "firstDayEndingHour" : 17,
  "firstDayEndingMinute" : 30,
  "durationOfSimulation" : 3,
  "simulationDirection" : 0,
  "nonstopFlight" : false,
  "takeoffTimeAfterSunrise" : 2.0,
  "landingTimeBeforeSunset" : 1.0,
  "landUseBasedFlight" : true,
  "waterFractionThreshold" : 0.8,
  "maxFlightDurationInHours" : 72.0,
  "minRestInHours" : 8.0,
  "verticalMotion" : 4,
  "mapBackground" : "terrain",
  "spatialPlotRadius" : 500.0,
  "gisFileByDay" : true,
  "gisFileByHeight" : false,
  "gisFileByDayHeight" : false,
  "gisFileAllTrajectoriesInOne" : true,
  "useLineShapefile" : true,
  "colorOpacity" : 100,
  "includeHysplitFile" : true,
  "includeImage" : true,
  "includePostscript" : true,
  "includePDF" : true,
  "includeShapefile" : true,
  "includeKMZ" : true
```

```
}]
```

## 2. Checking batch run status

Endpoint	GET /rest/v1/batch/{ <b>BATCH_ID</b> }	
Authentication	required	Available to registered users.
Request		Replace { <b>BATCH_ID</b> } with an actual batch ID.
Request body	not used	
Response format	json or xml	Use the "Accept" header with application/json or application/xml.
Response body		Returns the statuses of the batch run and all of its individual runs. The statuses may be QUEUED, RUNNING, CRASHED, GRAPHICS_RUNNING, GRAPHICS_FAILED, COMPLETED, and EXPIRED. The number of API calls and the daily limit are also included in the response.

An example output after submitting a batch is shown below. It contains one single swarm run. The run is in the RUNNING state. Note that, in the example, the run ID for the single swarm run is 7091 which is different from the batch run ID, 7090. Job names for the batch and all single swarm runs are included in the response. A job name will be required when downloading a run file via a Web API described in Section 3.

```
{
  "batchId":7090,
  "batchJobName":"batch_7090",
  "status":"RUNNING",
  "dailyCounts":{
    "limit":250,
    "calls":2
  },
  "runs":[
    {
      "id":7091,
      "name":"swarm1",
      "jobName":"swarm1_7091",
      "status":"RUNNING"
    }
  ]
}
```

Another example output after the run is completed. The state is COMPLETED.

```
{
```

```

"batchId":7090,
"batchJobName":"batch_7090",
"status":"COMPLETED",
"dailyCounts":{
  "limit":250,
  "calls":3
},
"runs":[
  {
    "id":7091,
    "name":"swarm1",
    "jobName":"swarm1_7091",
    "status":"COMPLETED"
  }
]
}

```

### 3. Downloading batch run output files

Endpoint	GET /pub/{ <b>JOB_NAME</b> }/{ <b>FILE_NAME</b> }	
Authentication	not required	
Request		Replace { <b>JOB_NAME</b> } and { <b>FILE_NAME</b> } with an actual job name and a file name, respectively.
Request body	not used	
Response format	see the note on the right.	Automatically determined by the content of the requested file.
Response body		Returns the file content.

#### 3.1. Downloading zipped file of all graphic and diagnostics of a batch

After a batch run completes, a zip file is created that contains all graphics and diagnostics of the batch. The API endpoint for downloading the zip file is always

`/pub/{BATCH_JOB_NAME}/{BATCH_JOB_NAME}.zip`

where {**BATCH\_JOB\_NAME**} is to be replaced with a batch job name which is found in a batch API response.

The following Python code shows how to download a batch zip file:

```

import requests

job_name = "batch_7090"
file_name = "{}.zip".format(job_name)
base_url = "https://locusts.arl.noaa.gov"
url = "{}pub/{}/{}".format(base_url, job_name, file_name)
r = requests.get(url)
with open(file_name, "wb") as f:
    f.write(r.content)

```

## 3.2. Downloading an output file of a single swarm run

When a single swarm run finishes, a number of files are available for downloading. The API endpoint for downloading a file is

`/pub/{JOB_NAME}/{FILE_NAME}`

where `{JOB_NAME}` and `{FILE_NAME}` are to be replaced with a job name and a file name, respectively. Job names can be looked up from a batch status response. The following table shows file names that are available for downloading. Note file names are case-sensitive.

File name	Description
<code>{JOB_NAME}.zip</code>	Zipped file of all graphic and diagnostics of a single swarm run. Parameters includeHysplitFile, includeImage, includePostscript, includePDF, includeShapefile, and includeKMZ can be individually set to include or exclude a certain category of files in the zip file. See the description of these include parameters in Section 1 for details.
<code>{JOB_NAME}_trj_001.png</code>	Trajectory plot in the PNG image format.
<code>{JOB_NAME}_trajplot.ps</code>	Trajectory plot in the Postscript format.
<code>{JOB_NAME}_trajplot.pdf</code>	Trajectory plot in the PDF format.
<code>{JOB_NAME}_HYSPLITtraj.kmz</code>	Trajectory plot for the Google Earth program.
<code>{JOB_NAME}_gis.zip</code>	Zipped Geographical Information System (GIS) Shapefiles.
<code>{JOB_NAME}_tdump.#</code>	HYSPLIT trajectory file per day. Note # = 1, 2, ... denotes first day, second day, and so on, respectively.
<code>{JOB_NAME}_SETUP.#.txt</code>	HYSPLIT SETUP file per day. Note # = 1, 2, ... denotes first day, second day, and so on, respectively.
<code>{JOB_NAME}_CONTROL.#.txt</code>	HYSPLIT CONTROL file per day. Note # = 1, 2, ... denotes first day, second day, and so on, respectively.
<code>{JOB_NAME}_MESSAGE.#.txt</code>	HYSPLIT MESSAGE file per day. Note # = 1, 2, ... denotes first day, second day, and so on, respectively. A message file contains HYSPLIT diagnostics output.

The following Python code shows how to download a redistribution zip file:

```
import requests

job_name = "swarm1_7091"
file_name = "{}.zip".format(job_name)
base_url = "https://locusts.arl.noaa.gov"
url = "{}pub/{}/{}".format(base_url, job_name, file_name)
r = requests.get(url)
with open(file_name, "wb") as f:
    f.write(r.content)
```

## 4. Submitting a matrix run

Endpoint	POST /rest/v1/matrix	
Authentication	required	Available to registered users.
Request format	json or xml	Use the "Content-Type" header with application/json or application/xml.
Request body	required	This is a list of max run inputs. See below for a complete list of the inputs.
Response format	json or xml	Use the "Accept" header with application/json or application/xml.
Response body		Returns the matrix run ID value that can be used for checking the run status. The number of API calls and the daily limit are also included in the response. An example in JSON is as follows:  {"matrixRunId":803,"jobName":"matrix_803","dailyCounts":{"limit":250,"calls":9}}.

Input fields for a matrix run are shown below. Almost all input fields are identical to those described in Section 1. The "latitude" and "longitude" input fields have a different meaning. Input fields only available to a matrix run are "latitudeSpacing", "longitudeSpacing", "latitudeCount", "longitudeCount" and "trajectoryFrequencyGridSize". Also note that the default values for "name", "meteorologicalData", and "durationOfSimulation" are different from those for batch runs.

Name	Data Type	Description
name	string	(Optional) Name of the single swarm run. Must consist of alphanumeric characters and/or underscores. The character length must be between 1 and 20. If unspecified, "matrix" will be used.
latitude	number	(Required) Latitude of the southwest corner of the source matrix. It is a starting location for the first day of the simulation (decimal degrees). Must be between -90 and 90 degrees.

longitude	number	(Required) The longitude of the southwest corner of the source matrix. It is a starting location for the first day of the simulation (decimal degrees). Must be between -180 and 180 degrees.
latitudeSpacing	number	(Optional) Spacing in latitude between two vertically adjacent starting locations. The value must be in the range (0, 10] degrees excluding zero. If unspecified, 1.0 will be used.
longitudeSpacing	number	(Optional) Spacing in longitude between two horizontally adjacent starting locations. The value must be in the range (0, 10] degrees excluding zero. If unspecified, 1.0 will be used.
latitudeCount	number	(Optional) Number of starting locations in the latitude direction, at a fixed longitude. This number times the corresponding number in the longitude direction cannot exceed 125. If unspecified, 3 will be used.
longitudeCount	number	(Optional) Number of starting locations in the longitude direction, at a fixed latitude. This number times the corresponding number in the latitude direction cannot exceed 125. If unspecified, 5 will be used.
height	number	(Optional) Starting height in meters. Must be between 0 and 10,000. If unspecified, 500 will be used.
height2	number	(Optional) Additional height of the starting location in meters. Must be between 0 and 10,000. If unspecified, 1000 will be used.
height3	number	(Optional) Additional height of the starting location in meters. Must be between 0 and 10,000. If unspecified, 1500 will be used.
meteorologicalData	string	(Optional) Name of the meteorological data set. Must be GFS (which has one-degree spatial resolution) or GFS0p25 (for ¼-degree spatial resolution with shorter temporal range). If unspecified, "GFS0p25" will be used.
startDate	date	(Optional) Start year, month, and day. Must use the YYYY-MM-DD format. If unspecified, today's date (in Eastern Time) will be used.
firstDayStartHour	integer	(Optional) Must be between 0 and 23 if used.
firstDayStartMinute	integer	(Optional) Must be between 0 and 59 if used.
firstDayEndingHour	integer	(Optional) Must be between 0 and 23 if used.
firstDayEndingMinute	integer	(Optional) Must be between 0 and 59 if used.
durationOfSimulation	integer	(Optional) Number of days. Must be between 1 and 15. Note that the duration may be additionally limited by the meteorological data in use. If unspecified, 15 will be used.
simulationDirection	integer	(Optional) 0: forward in time, 1: backward in time. If unspecified, 0 will be used.
nonstopFlight	boolean	(Optional) If set to true, overnight stops are disabled. Note if this parameter is set to true, the landUseBasedFlight parameter below must be set to false. If unspecified, false will be used.
takeoffTimeAfterSunrise	number	(Optional) Takeoff time in hours after sunrise. For example, 2.5 means two and half hours later. Sunrise time is computed each day using the starting location. Must be between 0 and 4.0. If unspecified, 2.0 will be

		used.
landingTimeBeforeSunset	number	(Optional) Landing time in hours before sunset. For example, 2.5 means two and half hours prior to sunset. Sunset time is computed each day using the starting location. Must be between 0 and 4.0. If unspecified, 1.0 will be used.
landUseBasedFlight	boolean	(Optional) If set to true, the application uses the following three parameters for the swarm to avoid landing over a body of water. Note if this parameter is set to true, the nonstopFlight parameter in the above must be set to false. If unspecified, false will be used.
waterFractionThreshold	number	(Optional) Threshold water fill fraction of a given landuse / landcover grid cell above which landing in the cell will be avoided. The idea here is that cells on the coast or which contain islands may have some water, but also some land, and the user can specify how much "water" must fill the cell before it is avoided. The application currently uses a 0.05 degree grid size (~5 km) for an extended northern Africa domain and a 0.5 degree grid (~50 km) elsewhere in the world. For example, with the value of 0.8, the cell is avoided if more than 80% of the 5 km x 5 km cell in northern Africa or 80% of the 50 km x 50 km cell elsewhere is water-filled. Must be between 0 and 1. If unspecified, 0.8 will be used.
maxFlightDurationInHours	number	(Optional) Number of hours that a swarm can fly without landing. If this flight time is reached, and the swarm has not encountered a cell with land, it will land in the water. The application tracks this water landing, but then does not allow the swarm to continue. It is as if the swarm ended when it landed on the water. Must be greater than 0 and less than/equal to 240. If unspecified, 72.0 will be used.
minRestInHours	number	(Optional) Minimum resting period in hours that a swarm must be allowed, once it lands on a non-water surface, before it is allowed to take off again. Must be between 0 and 72. If unspecified, 8.0 will be used.
verticalMotion	integer	(Optional) Must be between 0 and 4. For details, see Hysplit documentation for the vertical motion. If unspecified, 4 will be used.
trajectoryFrequencyGridSize	number	(Optional) Grid size in degrees for counting trajectory frequency. Must be greater than 0 and less than/equal to 2.0. If unspecified, 0.25 will be used.
mapBackground	string	(Optional) Map background. Supported values are terrain, toner, and arlmap. If unspecified, "terrain" will be used.
spatialPlotRadius	number	(Optional) Spatial radius of plots in km from the starting location. Must be 100.0 and 5000.0. If unspecified, 1000.0 will be used.
gisFileByDay	boolean	(Optional) Create shapefiles by day. If unspecified, true will be used.
gisFileByHeight	boolean	(Optional) Create shapefiles by height. If unspecified, false will be used.
gisFileByDayHeight	boolean	(Optional) Create shapefiles by height and then by each day. If unspecified, false will be used.
gisFileAllTrajectoriesInOne	boolean	(Optional) Create shapefiles containing all trajectories. If unspecified, false will be used.

useLineShapefile	boolean	(Optional) Use lines instead of points when creating shapefiles. Points will be used if unspecified.
colorOpacity	number	(Optional) Opacity (in %) of trajectories on plots. Must be between 0 and 100. If unspecified, 50 will be used.
includeHysplitFile	boolean	(Optional) Include Hysplit files when creating the redistributable zip file. SETUP, CONTROL, Trajectory dump files, and others are in this category. If unspecified, true will be used.
includeImage	boolean	(Optional) Include image files in the redistributable zip file. If unspecified, true will be used.
includePostscript	boolean	(Optional) Include Postscript files in the redistributable zip file. If unspecified, true will be used.
includePDF	boolean	(Optional) Include PDF files in the redistributable zip file. If unspecified, true will be used.
includeShapefile	boolean	(Optional) Include GIS shapefiles in the redistributable zip file. If unspecified, true will be used.
includeKMZ	boolean	(Optional) Include Google Earth file in the redistributable zip file. If unspecified, true will be used.

A sample request body in the JSON format is shown below. The sample sets up 3 x 5 hypothetical starting locations using 0.5 degree spacings in latitude and in longitude. The lower left (or the southwest) corner is placed at latitude = -0.6822 deg and longitude = 35.1958 deg. A separate document describing user authentication when calling the web API also illustrates how to submit a JSON request in Python. This document is provided to authorized users when they receive an API key.

```
{
  "name" : "matrix1",
  "latitude" : -0.6822,
  "longitude" : 35.1958,
  "latitudeSpacing" : 0.5,
  "longitudeSpacing" : 0.5,
  "latitudeCount" : 3,
  "longitudeCount" : 5,
  "height" : 500.0,
  "height2" : 1000.0,
  "height3" : 1500.0,
  "meteorologicalData" : "GFS",
  "startDate" : "2022-02-01",
  "durationOfSimulation" : 10,
  "simulationDirection" : 0,
  "nonstopFlight" : false,
  "takeoffTimeAfterSunrise" : 2.0,
  "landingTimeBeforeSunset" : 1.0,
```

```

"landUseBasedFlight" : true,
"waterFractionThreshold" : 0.8,
"maxFlightDurationInHours" : 72.0,
"minRestInHours" : 8.0,
"verticalMotion" : 4,
"trajectoryFrequencyGridSize" : 0.25,
"mapBackground" : "terrain",
"spatialPlotRadius" : 500.0,
"gisFileByDay" : true,
"gisFileByHeight" : false,
"gisFileByDayHeight" : false,
"gisFileAllTrajectoriesInOne" : true,
"useLineStylefile" : true,
"colorOpacity" : 100,
"includeHysplitFile" : true,
"includeImage" : true,
"includePostscript" : true,
"includePDF" : true,
"includeShapefile" : true,
"includeKMZ" : true
}

```

## 5. Checking matrix run status

Endpoint	GET /rest/v1/matrix/{ <b>MATRIX_RUN_ID</b> }	
Authentication	required	Available to registered users.
Request		Replace { <b>MATRIX_RUN_ID</b> } with an actual matrix run ID.
Request body	not used	
Response format	json or xml	Use the "Accept" header with application/json or application/xml.
Response body		Returns the statuses of the matrix run. The status may be QUEUED, RUNNING, CRASHED, GRAPHICS_RUNNING, GRAPHICS_FAILED, COMPLETED, and EXPIRED. The number of API calls and the daily limit are also included in the response.

An example output after submitting a matrix run is shown below. The run is in the RUNNING state.

```

{
  "matrixRunId":803,
  "jobName":"matrix_803",
  "status":"RUNNING",
  "dailyCounts":{

```

```

    "limit":250,
    "calls":7
  }
}

```

Another example output after the run is completed. The status is COMPLETED.

```

{
  "matrixRunId":803,
  "jobName":"matrix_803",
  "status":"COMPLETED",
  "dailyCounts":{
    "limit":250,
    "calls":9
  }
}

```

## 6. Downloading matrix run files

Endpoint	GET /pub/{ <b>JOB_NAME</b> }/{ <b>FILE_NAME</b> }	
Authentication	not required	
Request		Replace { <b>JOB_NAME</b> } and { <b>FILE_NAME</b> } with an actual job name and a file name, respectively. See below for determining a job name.
Request body	not used	
Response format	see the note on the right.	Automatically determined by the content of the requested file.
Response body		Returns the file content.

### 6.1. Downloading zipped file of all graphic and diagnostics of a matrix run

After a matrix run completes, a zip file is created that contains all graphics and diagnostics of the run. The API endpoint for downloading the zip file is

```
/pub/{JOB_NAME}/{JOB_NAME}.zip
```

where {**JOB\_NAME**} is to be replaced with a job name which is found in an API response.

The following Python code shows how to download a matrix run zip file:

```

import requests

job_name = "matrix_803"
file_name = "{}.zip".format(job_name)
base_url = "https://locusts.arl.noaa.gov"
url = "{}pub/{}/{}".format(base_url, job_name, file_name)
r = requests.get(url)
with open(file_name, "wb") as f:
    f.write(r.content)

```

## 6.2. Downloading an output file of a matrix run

When a matrix run finishes, a number of files are available for downloading. The API endpoint for downloading a file is

`/pub/{JOB_NAME}/{FILE_NAME}`

where `{JOB_NAME}` and `{FILE_NAME}` are to be replaced with a job name which is found in an API response.

The following table shows file names that are available for downloading. Note file names are case-sensitive.

File name	Description
<code>{JOB_NAME}_trj_001.png</code>	Trajectory plot in the PNG image format.
<code>{JOB_NAME}_trajplot.pdf</code>	Trajectory plot in the PDF format.
<code>{JOB_NAME}_HYSPLITtraj.kmz</code>	Trajectory plot for the Google Earth program.
<code>{JOB_NAME}_gis.zip</code>	Trajectory plot. Zipped Geographical Information System (GIS) Shapefiles.
<code>{JOB_NAME}_freq.png</code>	Frequency plot in the PNG image format.
<code>{JOB_NAME}_freq.pdf</code>	Frequency plot in the PDF format.
<code>{JOB_NAME}_shapefiles_traj_freq.zip</code>	Frequency plot. Zipped GIS Shapefiles.
<code>{JOB_NAME}_gridplot.jpg</code>	Grid plot in the JPG image format.
<code>{JOB_NAME}_gridplot.ps</code>	Grid plot in the Postscript format.
<code>{JOB_NAME}_toa.png</code>	Time-of-arrival plot in the PNG format.
<code>{JOB_NAME}_toa.pdf</code>	Time-of-arrival plot in the PDF format.
<code>{JOB_NAME}_toa_gis.zip</code>	Time-of-arrival plot. Zipped GIS Shapefiles.

The following Python code shows how to download a KMZ file containing a trajectory plot:

```
import requests

job_name = "matrix_803"
file_name = "{}_HYSPLITtraj.kmz".format(job_name)
base_url = "https://locusts.arl.noaa.gov"
url = "{}pub/{}/{}".format(base_url, job_name, file_name)
r = requests.get(url)
with open(file_name, "wb") as f:
    f.write(r.content)
```