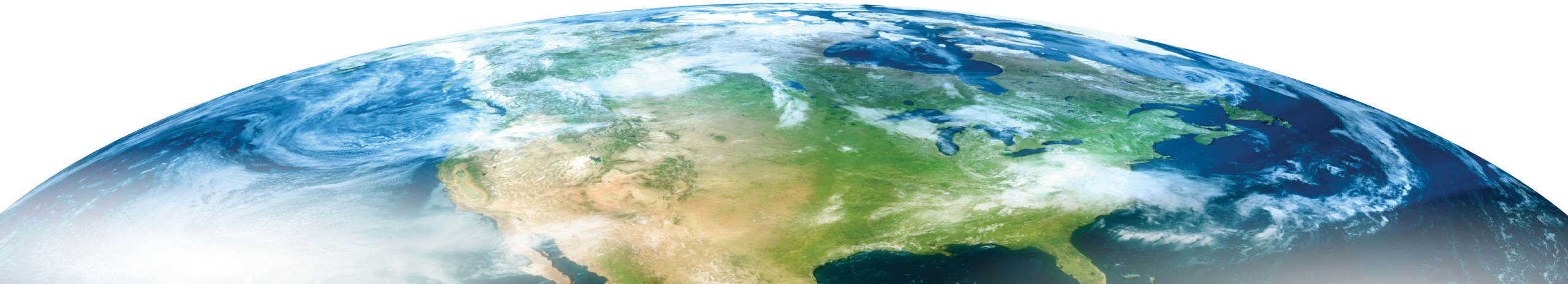
Cloud Estimation Through Image Analytics (CEIA)

Presented to: CEIA Participants
By: Aviation Weather Demonstration and Evaluation (AWDE) Services, ANG-C63
Date: July/August



Introduction

- FAA Aviation Weather Division (ANG-C61) funded the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) to develop the Cloud Estimation through Image Analytics (CEIA) algorithm.
- The CEIA algorithm uses a set of 3 or 4 weather cameras to provide sky cover information every 10 minutes.
- The FAA Aviation Weather Demonstration and Evaluation (AWDE) Services Team has been tasked to conduct a virtual 4-week evaluation focused on determining the usability of CEIA and determine the information needed for decision-making.
- The CEIA assessment will be conducted July-August 2023, during this time participants will be asked provide feedback on CEIA during 30-minute virtual interview sessions.

Approach and Objectives

Assessment Approach

- Each participant will be asked to complete a demographic form.
- Participants will be provided:
  - A training briefing that includes assessment objectives, participant expectations, CEIA product description, and contact information.
  - Three scenarios will provide various sky cover conditions including: Overcast, variable, and clear sky conditions.
- Participants will be asked to participate in a 30-minute virtual meeting to provide feedback on the usability of CEIA and to determine if CEIA provides information needed to support decision-making.
  - AWDE will work with each participant to accommodate schedules.
  - The virtual meetings may be conducted one-on-one or with a group of participants.
  - Personal identifying information, such as names, airlines, or company names, will not be collected during the assessment.

Assessment Approach

- The virtual meeting will consist of:
  - The moderator providing a background of AWDE, introducing AWDE and MIT/LL personnel on the meeting, detailing the assessment objectives, procedures and participant expectations and providing an overview of CEIA.
  - Participants will be shown CEIA via the FAA Weather Cameras User Acceptance Testing (UAT) website on both the Weather Trends and Weather Data tabs to provide a live view of the CEIA sky cover estimate and trendline.
  - Next, participants will be shown the three scenarios to view different sky cover conditions.
  - Participants will then be asked a series of structured interview questions to obtain feedback on the usability of CEIA and if CEIA provides information needed to support decision-making.
  - Participants may ask questions and request to view the FAA Weather Camera UAT website or scenarios, again, at any time during the meeting.

Assessment Approach Continued

- At the end of the assessment, participants will be asked to complete an optional end of assessment questionnaire.
- Additional data collection will occur at the 2023 AirVenture Conference at Wittman Regional Airport in Oshkosh, Wisconsin, attendees will have the capability to:
  - View a narrated presentation of CEIA.
  - Complete a demographic form and questionnaire to provide feedback on the overall usability and suitability of CEIA.

Assessment Objectives

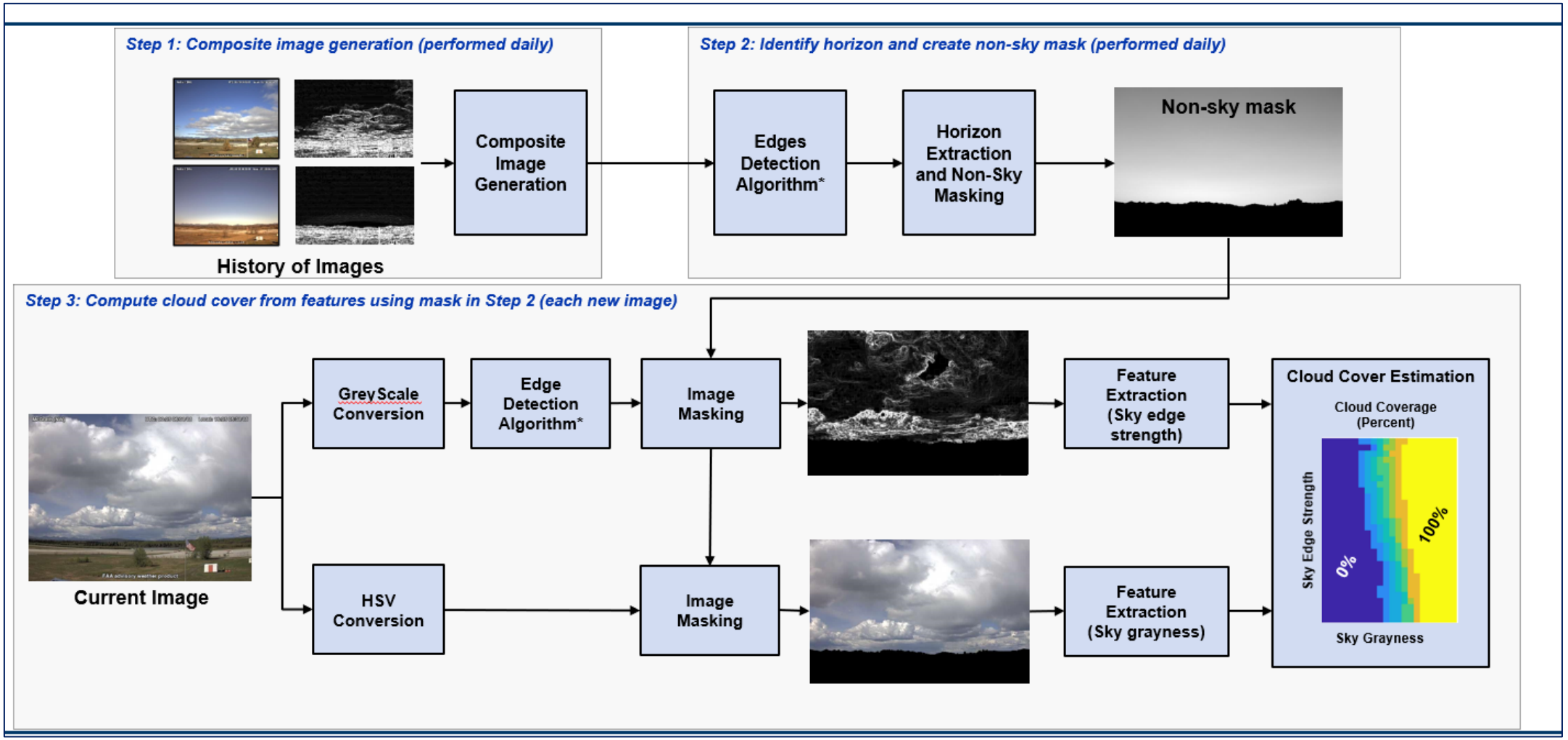
- Determine if CEIA provides information needed to support decision-making.
  - Does CEIA provide adequate cloud information?
  - Is the CEIA information needed to support decision-making?
- Determine the usability of CEIA.
  - Is CEIA easy to use?
  - Is critical information easy to find?

CEIA Overview

CEIA Background Information

- MIT/LL developed an algorithm that uses camera imagery to provide sky coverage conditions every 10 minutes called CEIA.
- The CEIA algorithm:
  - Identifies the horizon to only analyze the sky portion of the scene.
  - Uses edge detection to analyze the texture of the sky (relative edge strength).
  - Analyzes the hue of the pixels to determine sky grayness - lack of color indicates cloudiness.
  - Uses a correlation table to convert edge strength (texture) and sky grayness to a cloud coverage percentage.

CEIA Algorithm

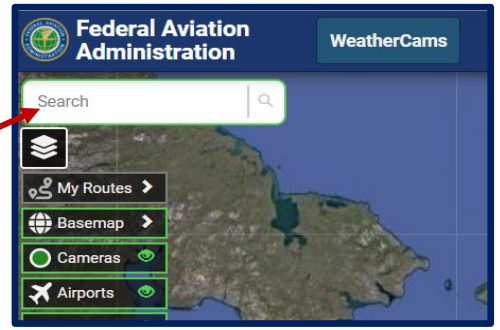


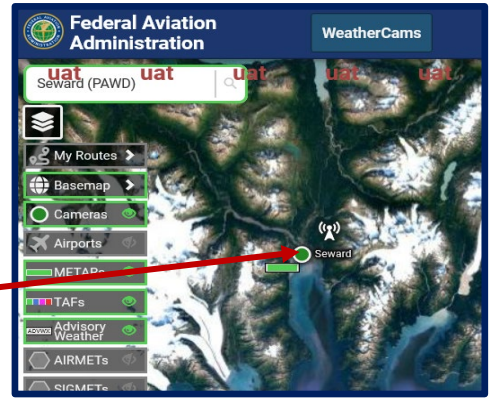
Accessing CEIA

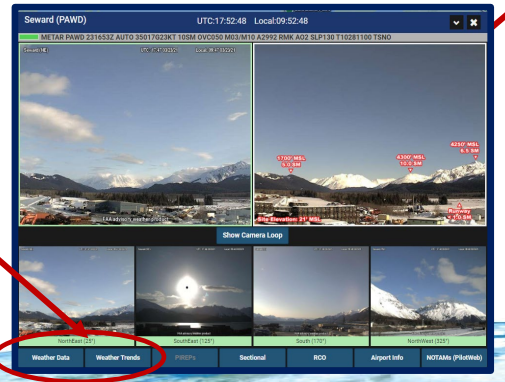
NOTE: CEIA is available on a password protected website located at https://weathercamstest.faa.gov.

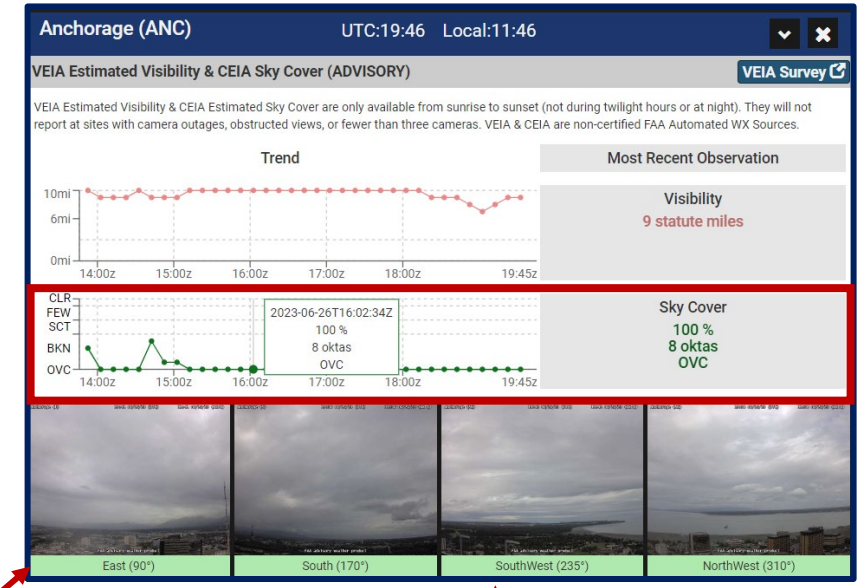
Search capability:

1. Type the name of the location or weather camera identifier.
2. Press Enter on your keyboard or the search symbol.
3. Click on the camera.
4. Select the **Weather Data** or **Weather Trends** tab to display CEIA information .



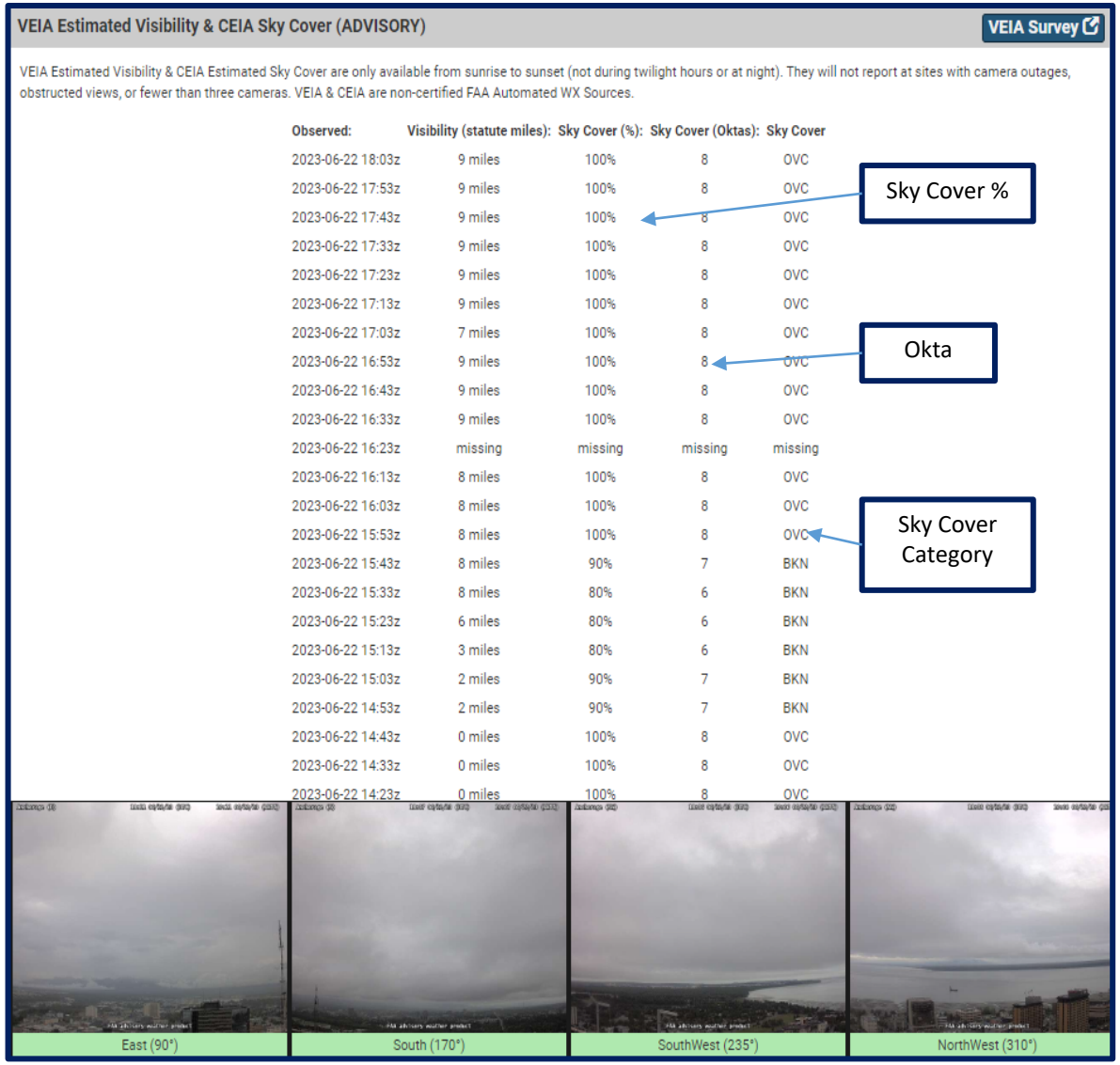






CEIA is displayed under the VEIA, METAR or Advisory Weather information on both the Weather Data and Weather Trends tab.

CEIA Information on Weather Data Tab



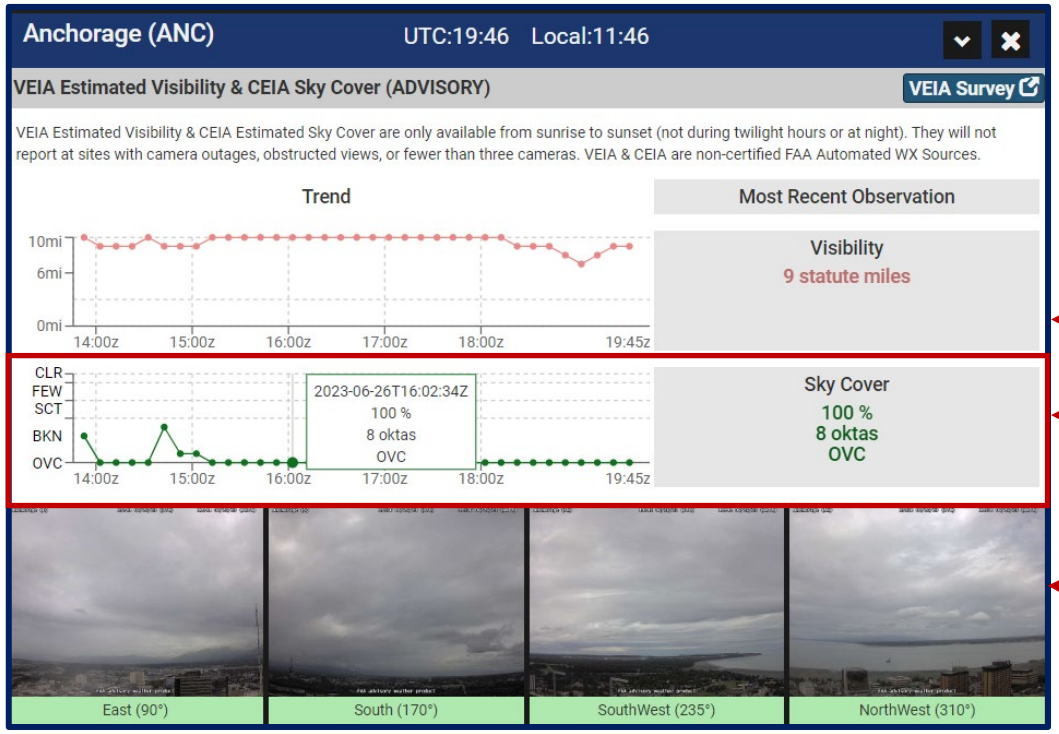
Sky Cover % identifies the percentage of sky obscured by clouds when observed from a particular location.

Okta is the unit of measurement used to describe the amount of sky cover at any given location. Ranges from 0 oktas (completely clear) to 8 oktas (completely overcast).

Sky Cover Category (clear, few, scattered, broken and overcast) is the classification of sky cover based on the amount of sky completely hidden by clouds.

https://skyteamaviation.com/fog-and-cloud-cover/
https://glossary.ametsoc.org

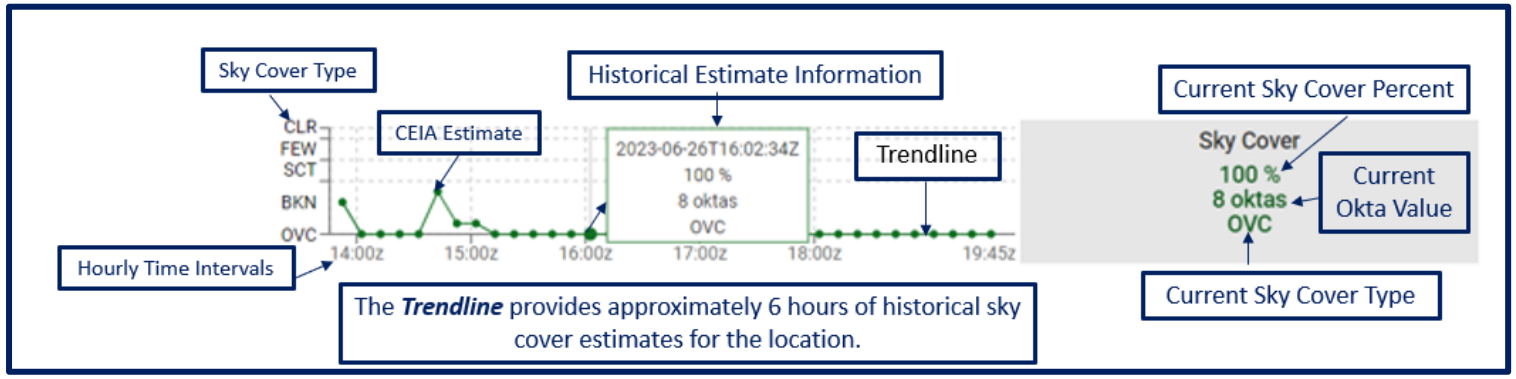
CEIA Information on Weather Trends Tab



VEIA

CEIA

Weather Camera Images



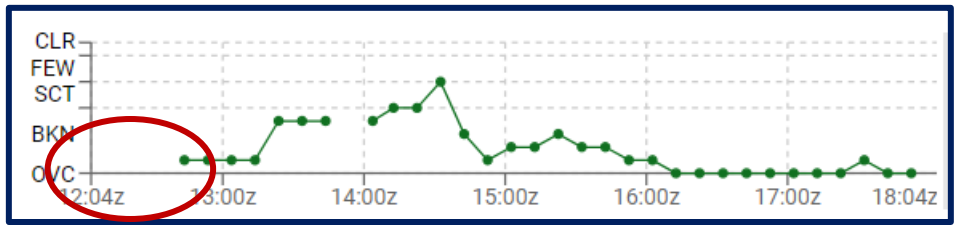
CEIA Camera Sites

- CEIA is available through the FAA Weather Cameras UAT website for Alaska locations only, when CEIA becomes operational, CEIA will be available at all weather camera sites including: Alaska, Colorado, Hawaii and Maine).
- CEIA is not available after dark and will display a message.

> VEIA Estimated Visibility & CEIA Estimated Sky Cover are only available from sunrise to sunset (not during twilight hours or at night). They will not report at sites with camera outages, obstructed views, or fewer than three cameras. VEIA & CEIA are non-certified FAA Automated WX Sources.

- Missing data due to a problem with the cameras or until six hours of data is collected will be shown as “missing” on the Weather Data tab and blank on the Weather Trends Tab.

2023-06-23 14:03z	9 miles	60%	5	BKN
2023-06-23 13:53z	missing	missing	missing	missing
2023-06-23 13:43z	9 miles	60%	5	BKN
2023-06-23 13:33z	9 miles	60%	5	BKN
2023-06-23 13:23z	9 miles	60%	5	BKN
2023-06-23 13:13z	9 miles	90%	7	BKN
2023-06-23 13:03z	9 miles	90%	7	BKN
2023-06-23 12:53z	10 miles	90%	7	BKN
2023-06-23 12:43z	9 miles	90%	7	BKN
2023-06-23 12:33z	missing	missing	missing	missing
2023-06-23 12:23z	missing	missing	missing	missing
2023-06-23 12:13z	missing	missing	missing	missing



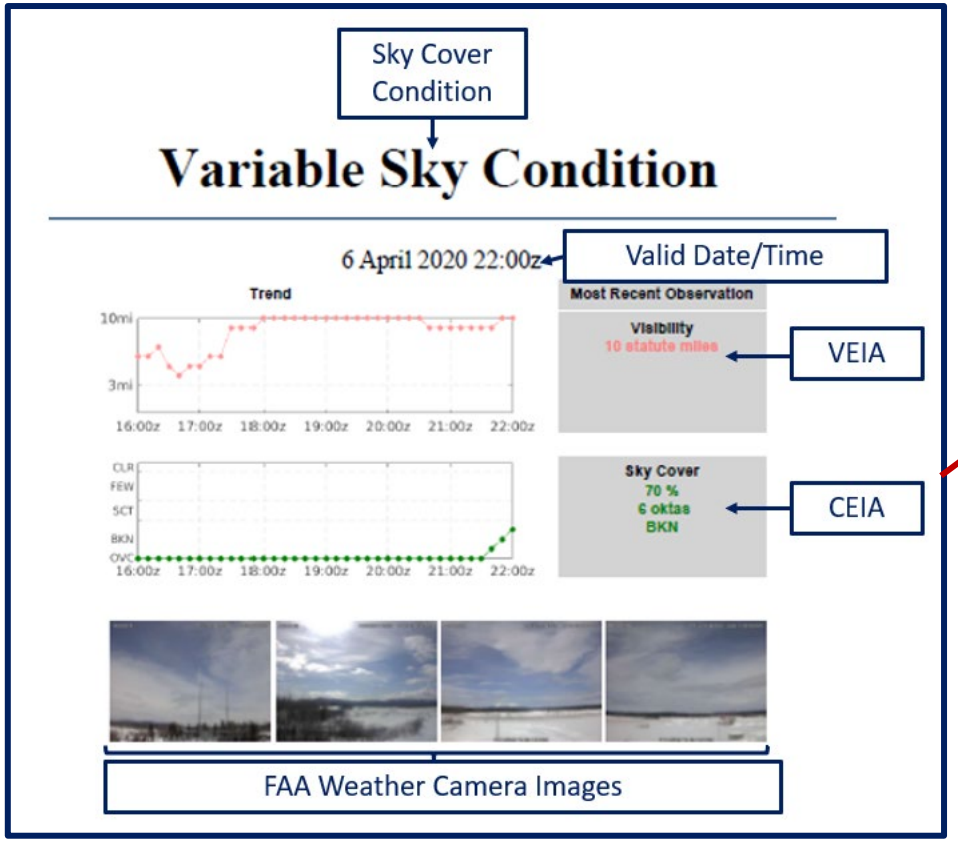
CEIA Scenario

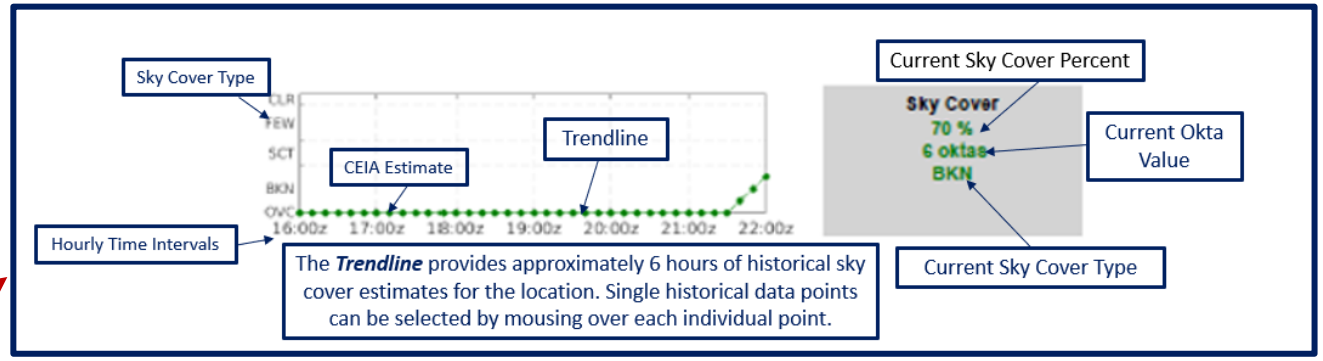
- MIT/LL developed three scenarios containing seven images of the following sky cover conditions:
  - Overcast.
  - Variable conditions with the sky cover transitioning from overcast to broken, scattered, few, and clear.
  - Clear to overcast.

Scenario	Date(s)	Time	Cloud Cover Condition	7 Hourly Intervals (z)
1	3 April 2020	16:00z	Overcast Sky Condition	16:00, 17:00, 18:00, 19:00, 20:00, 21:00, 22:00
2	6 April 2020- 7 April 2020	21:00z	Variable Sky Condition	21:00, 22:00, 23:00, 00:00, 01:00, 02:00, 03:00
3	13 April 2020	16:00z	Clear to Overcast Sky Condition	16:00, 17:00, 18:00, 19:00, 20:00, 21:00, 22:00

Scenario Information

Each image in the scenario contains the following information:





Note: In the scenarios, historical data can not be accessed by selecting an individual data point which is available in the on-line version.

Recruiting Participants

AWDE is recruiting the following user groups to participate in the CEIA User Assessment:

- GA Pilots
- Part 121/135 Pilots
- Part 121/135 Dispatchers
- AAWU Meteorologists

To register to participate, you can complete the demographic form by scanning the Quick Response code below or following this link: https://www.surveymonkey.com/r/RFRGSFG.

If you have any questions or can't access the demographic form, please contact:

Jill Miller at jill.f-ctr.miller@faa.gov or call 609-412-9080.

Contact Information

If you have any questions, please contact Sonia or Jill.

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Human Factors Engineer

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