Measuring Environmental Impact on Operations

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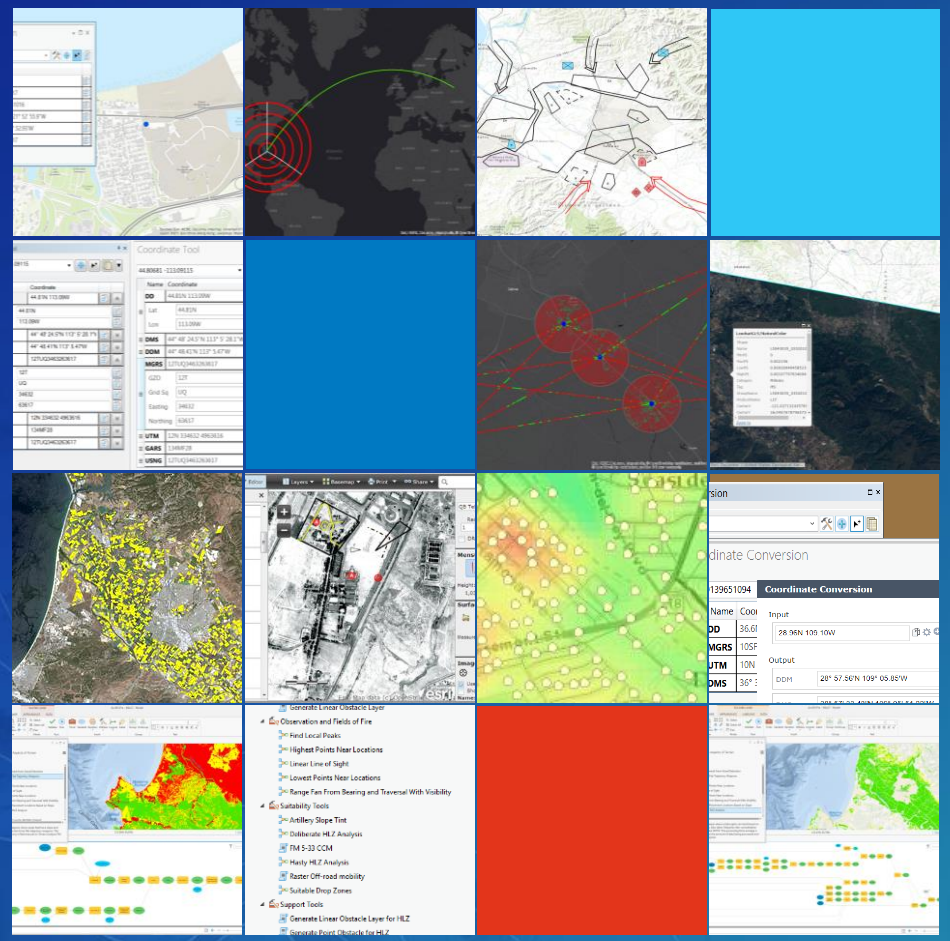
Defense Solutions

We support the Defense, Intelligence , and National Security industry



- Fully documented and maintained
- Fully supported
- Open source

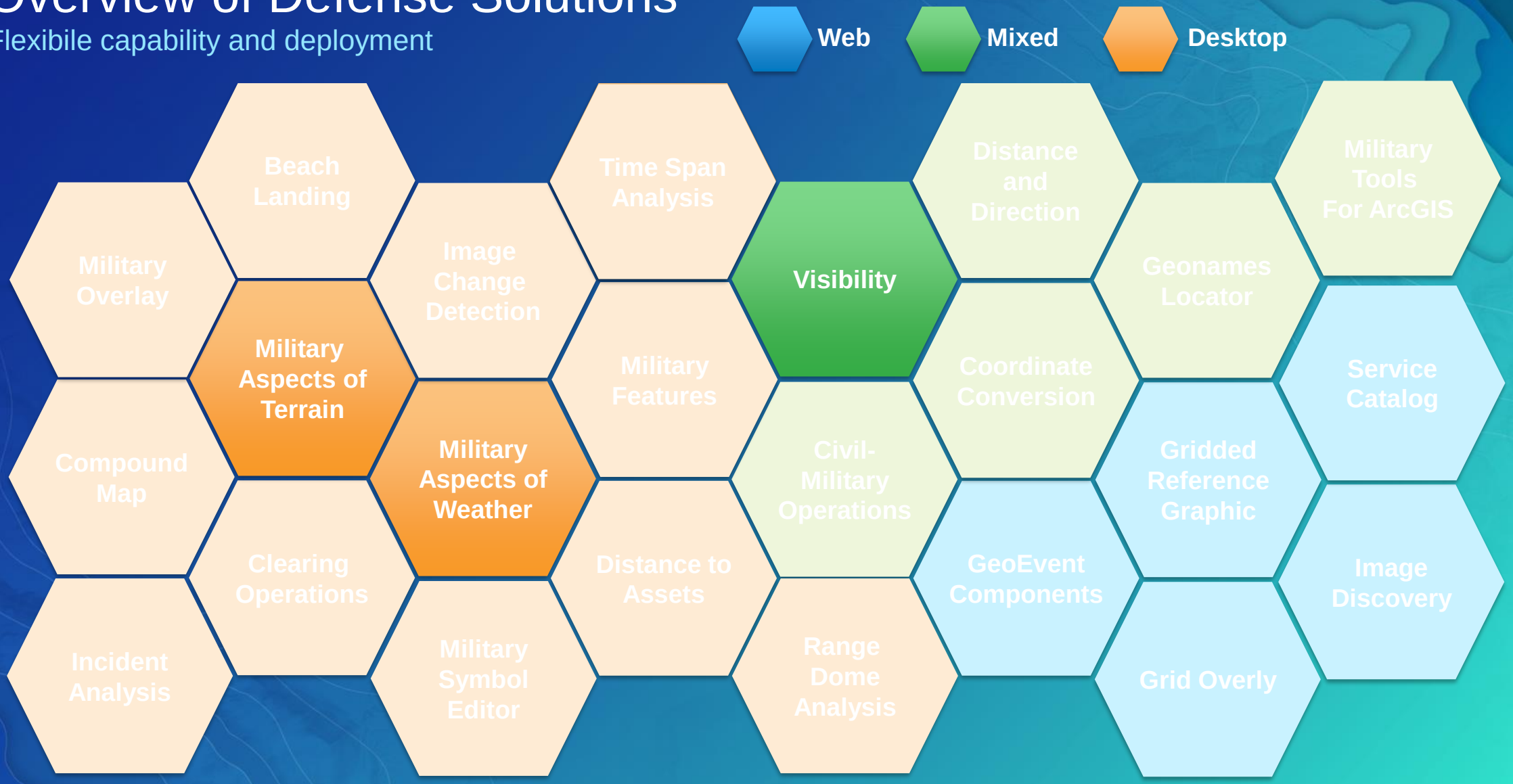
Empowering our users with focused workflows that fit their needs

Overview of Defense Solutions

Flexibile capability and deployment

Overview of Defense Solutions

Flexibile capability and deployment



Understanding the environment is important to the success of the operation

- Where conditions are suitable to operate?
- Where can/can't we operate?
- What type of asset is most suitable?
- Where does the enemy have the advantage?
- Terrain and Weather Analysis are part of Intelligence Preparation of the Battlefield


Credit : army.mil


Credit : af.mil

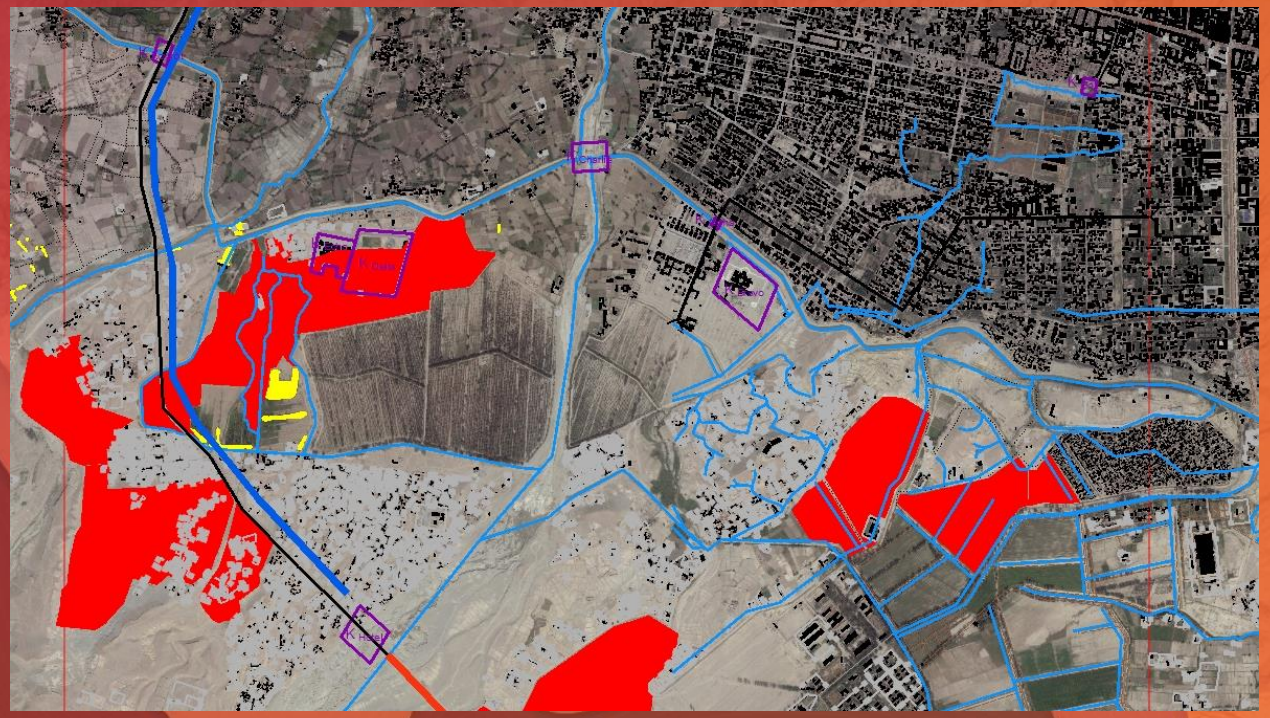

Credit : navy.mil

Terrain’s Effects on Operations

Photo By: Cpl. Julio McGraw

Military Aspects of Terrain Process

- Data preparation
- Publish obstacles and lines of communication
- Create and publish suitability overlays
- Find and publish key terrain
- Create and publish Modified Combined Obstacle Overlay (MCOO)
  - Combining
    - Obstacles and lines of communication
    - Suitability overlays
    - Key terrain
  - Adding
    - Mobility corridors
    - Friendly/hostile avenues of approach



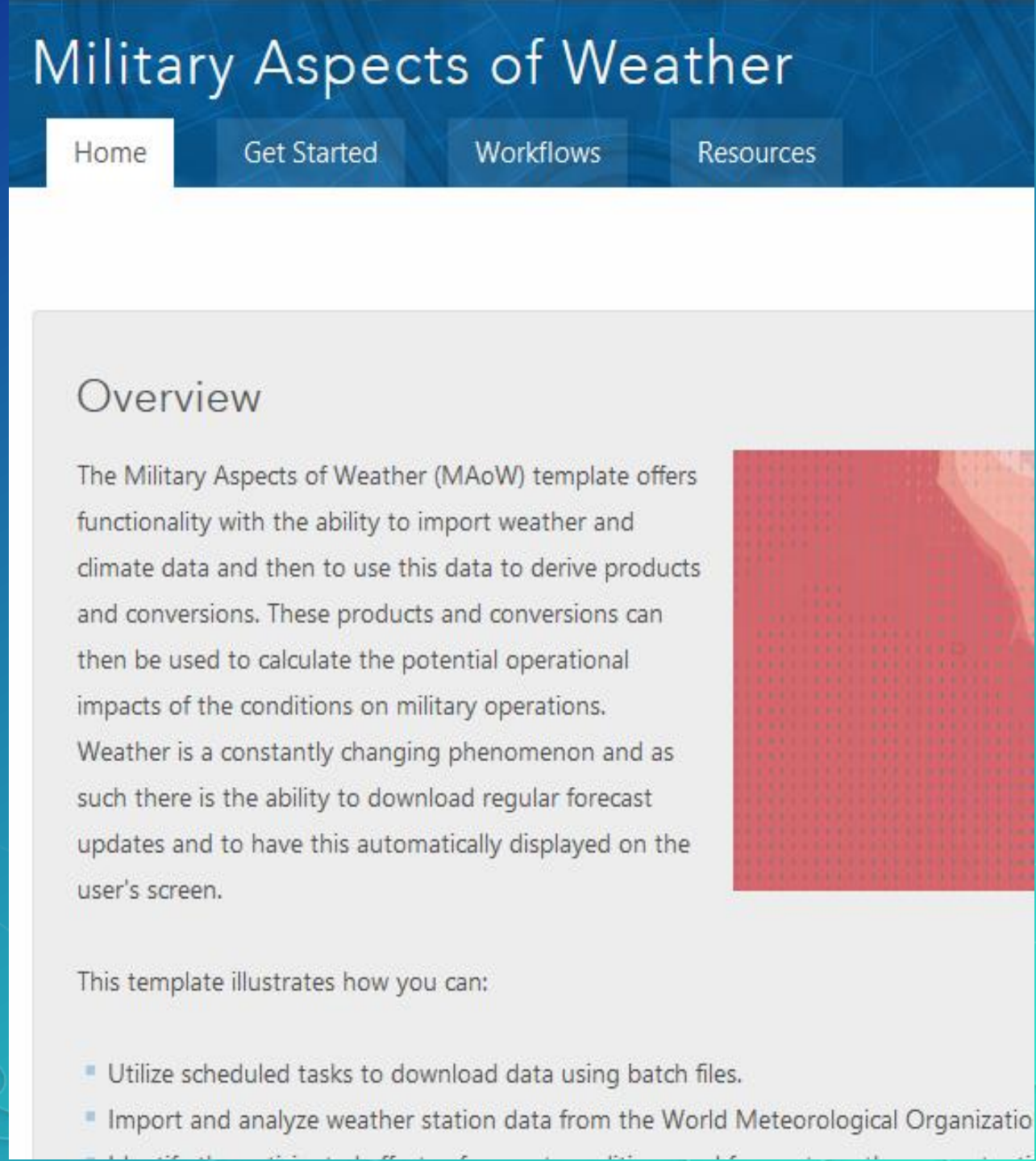
Military Aspects of Terrain Demo

Weather’s Effect on Operations

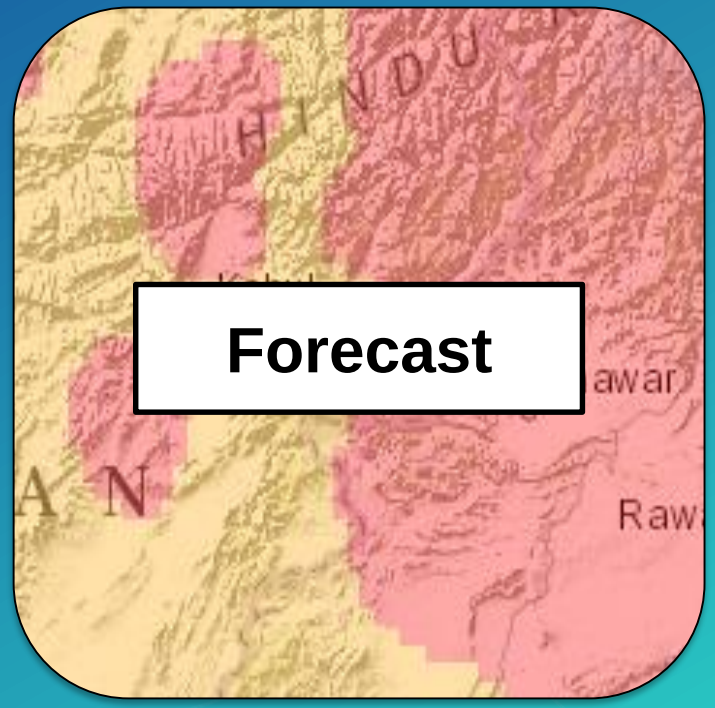
Military Aspects of Weather

- Utilize scheduled tasks to download data using batch files.
- Identify the anticipated effects of forecast weather on potential operational activities.
- ArcGIS 10.1 – 10.4.x

http://solutions.arcgis.com/defense/templates/maow/



Military Aspects of Weather

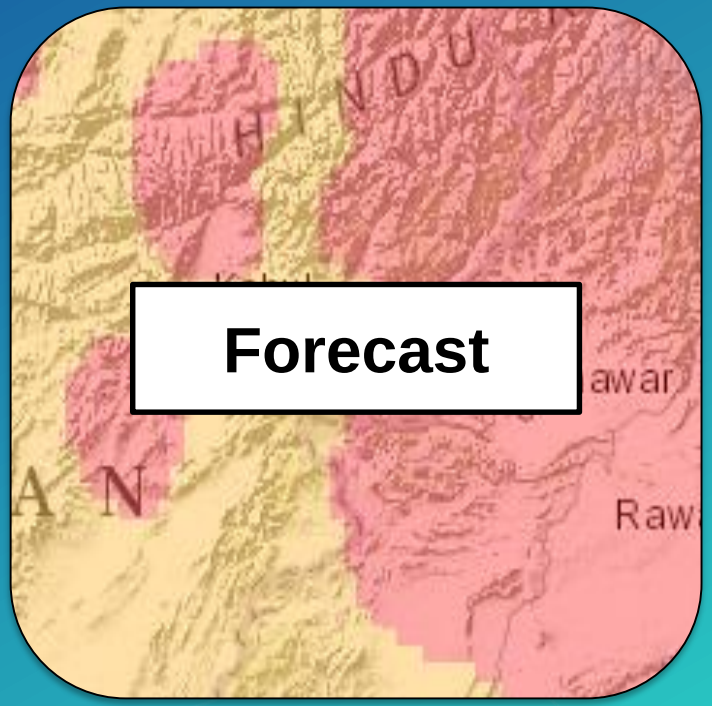


- Weather averages over long period of time.
- What are ‘normal’ conditions?

- What are the conditions now?
- Weather variables at locations

- What will weather be like in the next few hours?
- Forecast weather variables and impacts

Military Aspects of Weather

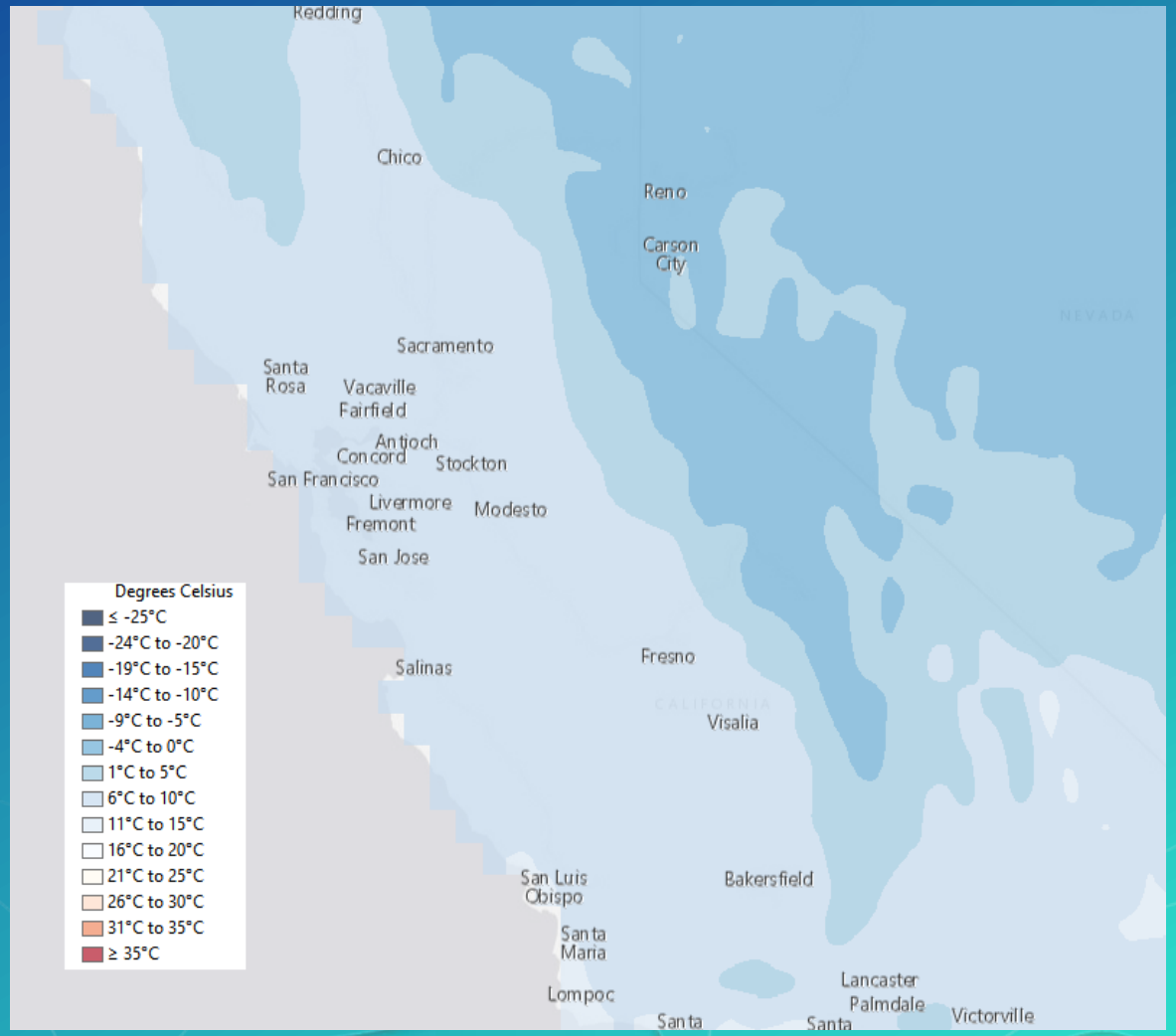


Expected Conditions with Climate

Long term planning

Expected conditions based on monthly averages

Global coverage



Climatic Research Unit – 10 Minute Global

http://www.cru.uea.ac.uk/

CRU CL 2.0

- Precipitation
- Wet days
- Mean temperature
- Mean diurnal temp range
- Relative humidity
- Sunshine
- Ground frost
- 10m windspeed

- https://crudata.uea.ac.uk/cru/data/hrg/tmc/

Climatic Research Unit: *Data*

Ten Minute Climatology

File	Gzipped	Uncompressed	Description
readme.txt	-	-	Documentation
grid_10min_problems.txt	-	-	Problem log (none)
new_et_al_10minute_climate_CR.pdf	-	3 MB	*Climate Research* paper describing dataset
grid_10min_pre.dat.gz	28 MB	101 MB	Precipitation
grid_10min_rd0.dat.gz	10 MB	56 MB	Wet-days
grid_10min_tmp.dat.gz	11 MB	56 MB	Mean temperature
grid_10min_dtr.dat.gz	9 MB	56 MB	Mean diurnal temperature range
grid_10min_reh.dat.gz	12 MB	56 MB	Relative humidity
grid_10min_sunp.dat.gz	12 MB	56 MB	Sunshine
grid_10min_frs.dat.gz	7 MB	56 MB	Ground-frost
grid_10min_wnd.dat.gz	6 MB	56 MB	10m windspeed
grid_10min_elv.dat.gz	3 MB	15 MB	Elevation
tmc.iso.gz	96 MB	509 MB	CD-ROM image of all files Use *Nero*, *Adaptec-CD* etc to cut to disc

Last updated: July 2002, Mike Salmon

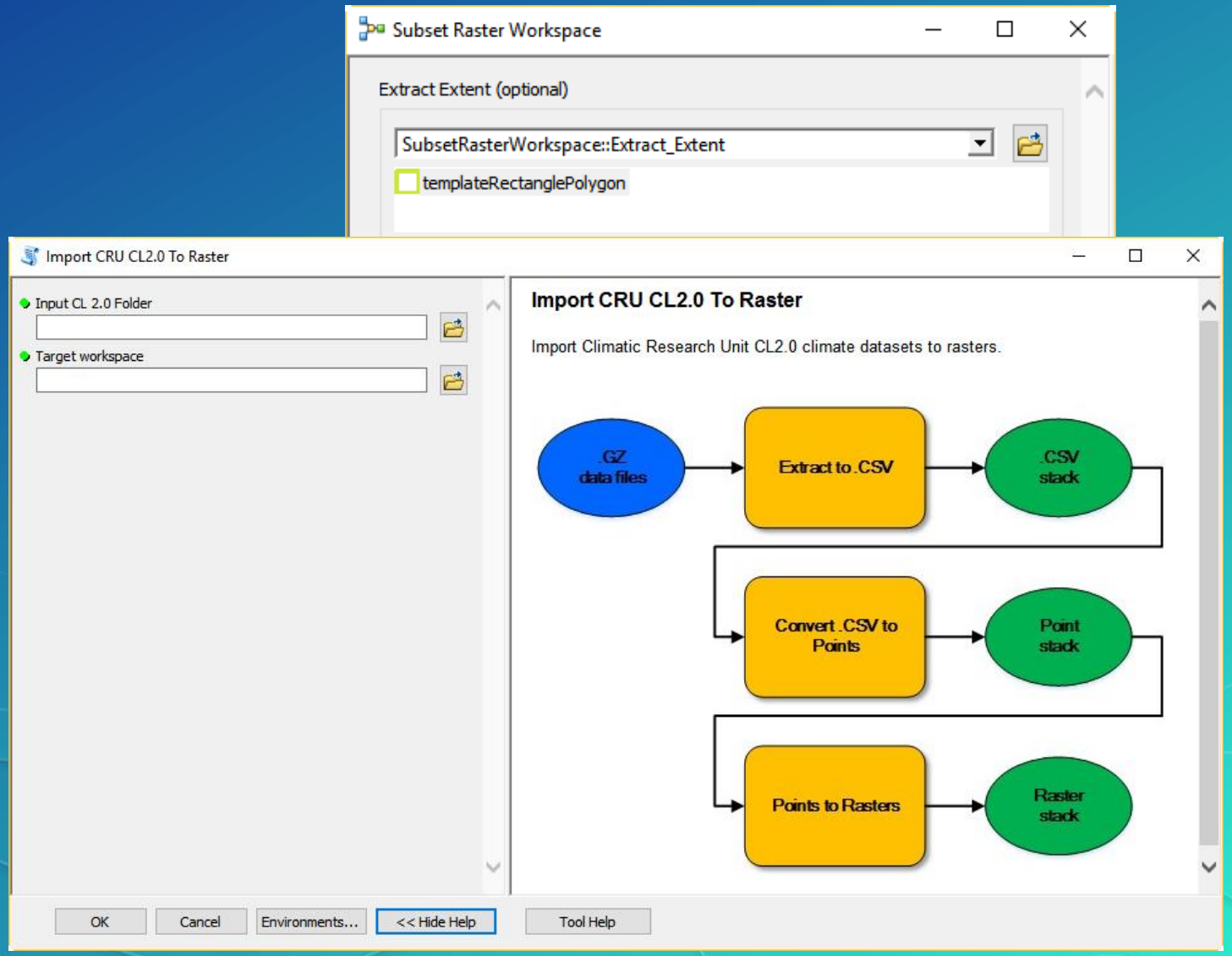
Processing CRU data

- Download raw data

https://crudata.uea.ac.uk/cru/data/hrg/tmc/

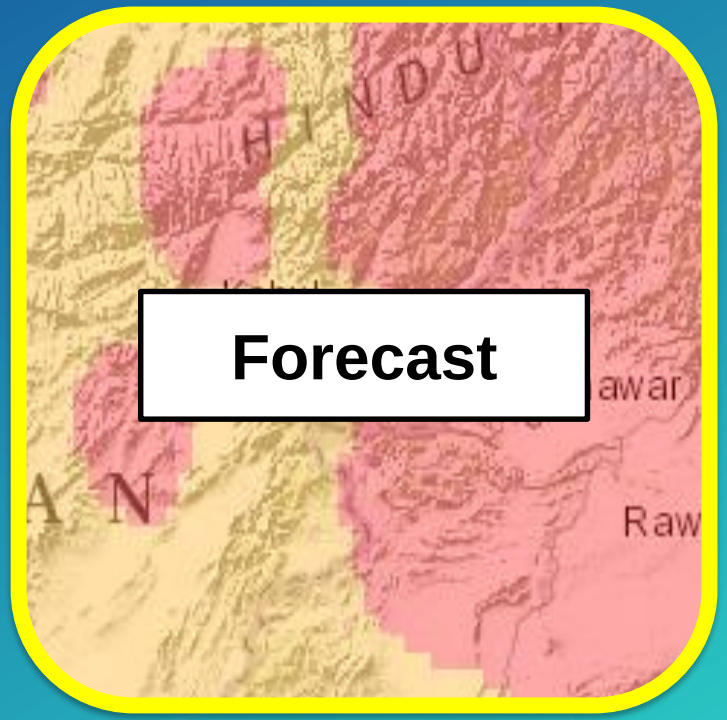
- Import raw CRU data to raster datasets

- Optionally: Subset to smaller region



Expected conditions with Climate

Military Aspects of Weather



Forecasted conditions and impacts

What conditions will be like in the next few hours?

- Temperature
- Cloud coverage
- Etc.

What will be their impact on operations?

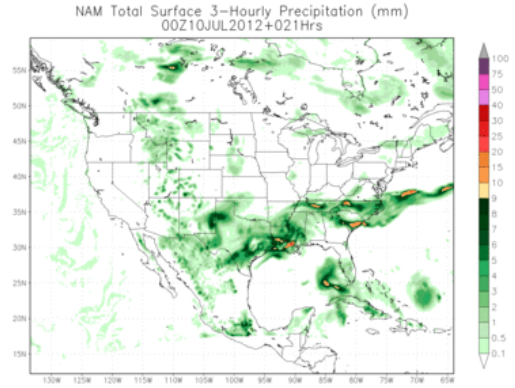
- UAV operations
- Personnel
- Etc.

Forecast data

- NOAA North American Mesoscale Forecast System (NAM)
- NAM Hourly Forecast product
  - 1 hour interval
  - Next 36 hours
- 141 weather variables
  - Only using 12
- OPeNDAP (Open-source Project for a Network Data Access Protocol)

North American Mesoscale Forecast System (NAM)

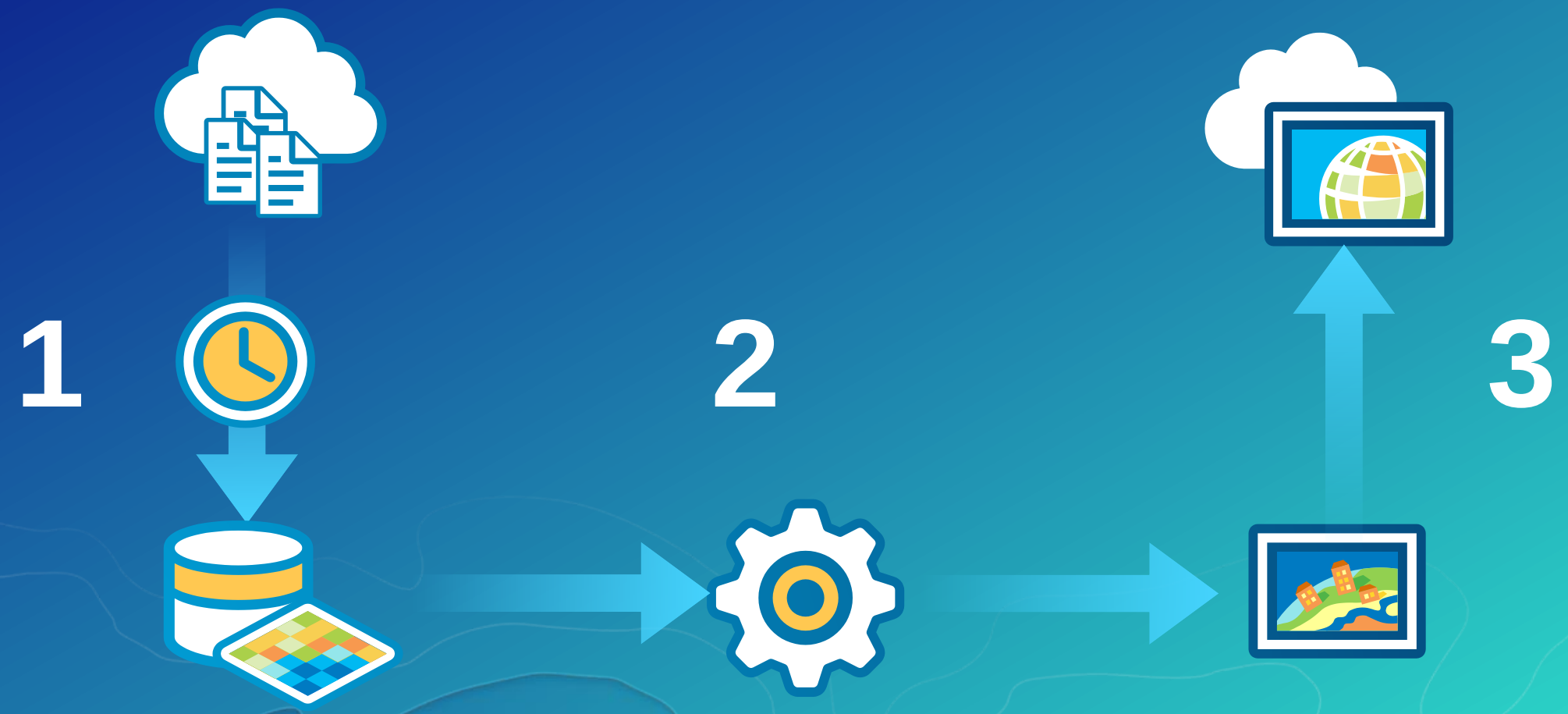
The North American Mesoscale Forecast System (NAM) is one of the major weather models run by the National Centers for Environmental Prediction (NCEP) for producing weather forecasts. Dozens of weather parameters are available from the NAM grids, from temperature and precipitation to lightning and turbulent kinetic energy. The NAM generates multiple grids (or domains) of weather forecasts over the North American continent at various horizontal resolutions. High-resolution forecasts are generated within the NAM using additional numerical weather models. These high-resolution forecast windows are generated over fixed regions and are occasionally run to follow significant weather events like hurricanes. The NAM home page is an excellent source of information for how the model is configured and run and an excellent source of forecast products.



An animated image of NAM total surface 3-hourly precipitation, forecast from 03 UTC on July 10, 2012, to July 13, 2012, at 12 UTC. In the initial few frames, hurricane Emilia can be seen in the bottom left corner spinning off to the west. This image was produced with the Grid Analysis and Display System (GrADS) and ImageMagick.

https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/north-american-mesoscale-forecast-system-nam

Forecast data process



Raster Function

- Geometric or Radiometric function applied pixel-by-pixel
- Hyper-efficient “on-the-fly” processing
- Chained together to create “processing chains”

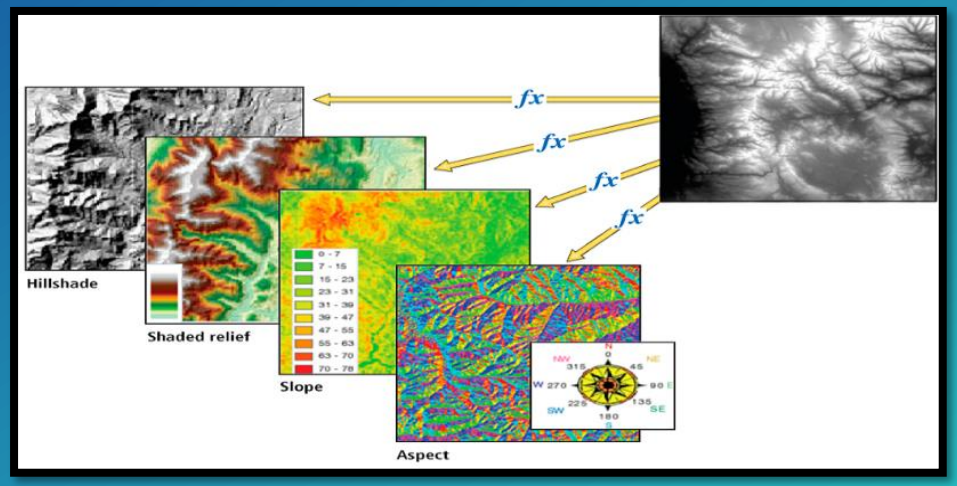
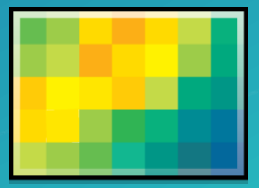
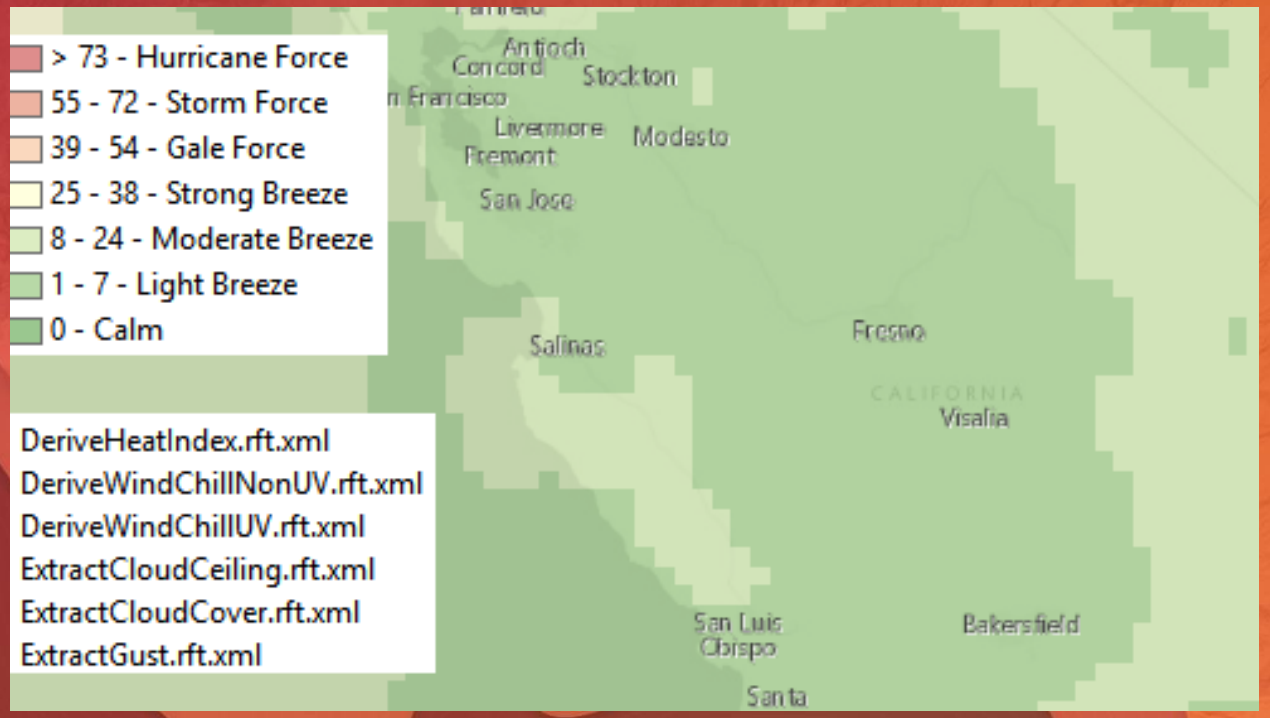


Image File,
native form

Raster Function

Screen request





Forecasted weather and impacts

Road Ahead – Fall/Winter 2017

Terrain:

- Raster function based suitability
- Decouple from TDS schema
- Support for ArcGIS Pro

Weather:

- More updated sources for climate data
- Support for ArcGIS Pro

Questions?

… and answers

- Find our solutions at:
  solutions.arcgis.com/#Defense

- Join our community:
  geonet.esri.com/groups/defense-and-intelligence

- Survey for our workshop:

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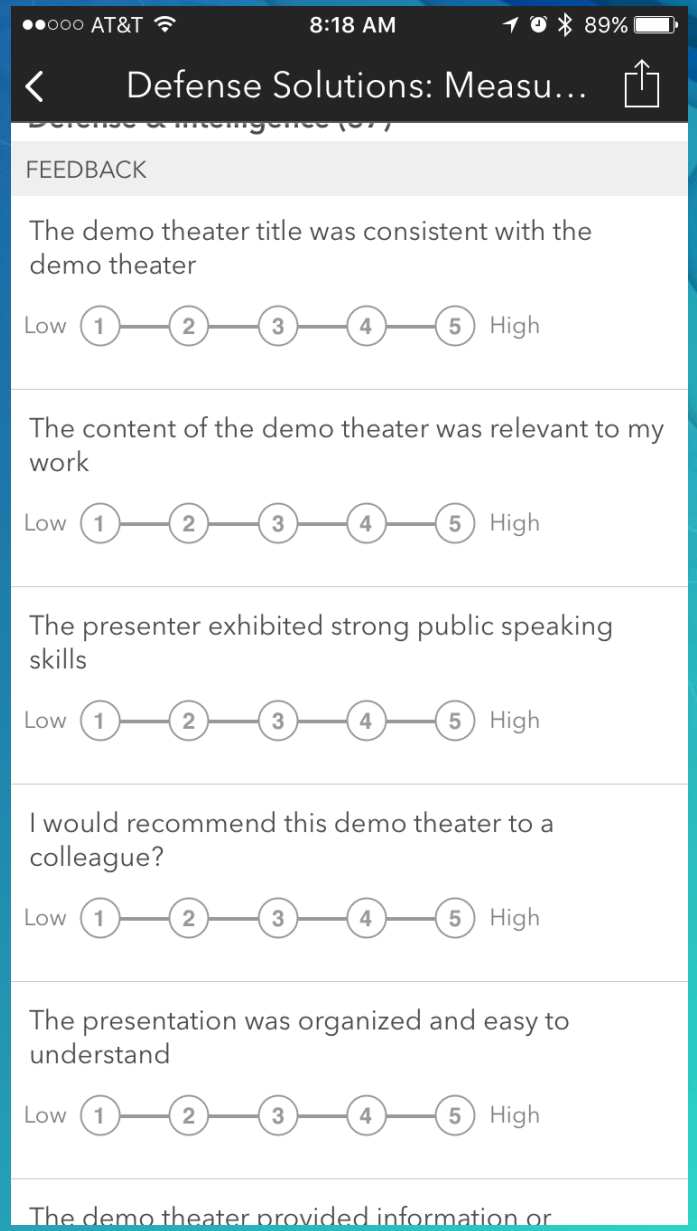

esri

THE SCIENCE OF WHERE