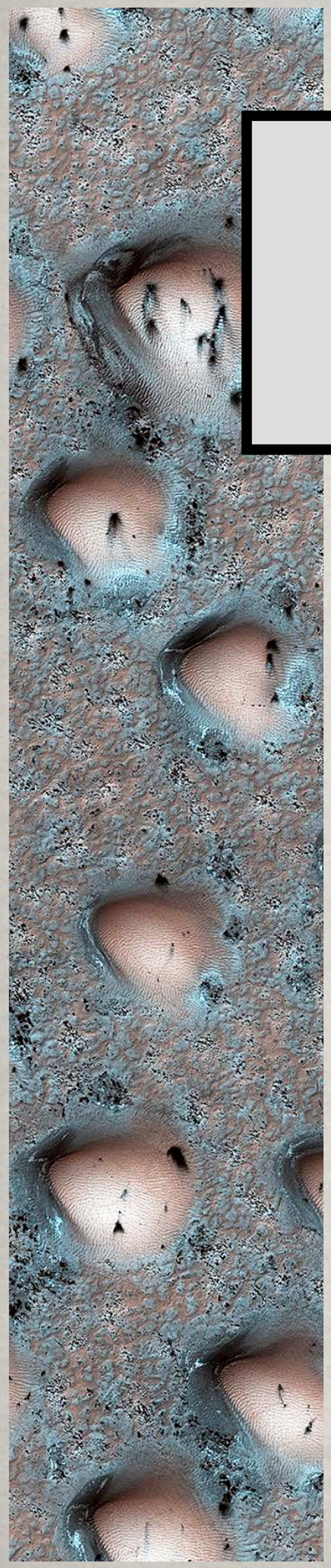


HiWISH: THE HIGH RESOLUTION IMAGING SCIENCE EXPERIMENT (HiRISE) SUGGESTION TOOL

HiRISE

uahirise.org

https://www.uahirise.org/hiwish/

M. Chojnacki[1], A. S. McEwen[1], S. Byrne[1], C. Hansen[2], I. J. Daubar[3], R. Beyer[4], G. McArthur[1], and the HiRISE science and operations team.

[1-2]LPL, University of Arizona (chojan1@pirl.lpl.arizona.edu); [2]Planetary Science Institute, Tucson, AZ; [3]Brown University, Providence, RI; [4]Carl Sagan Center, SETI Institute, Mountain View, CA.

LPSC 51 - Abstract #2095
March 2020

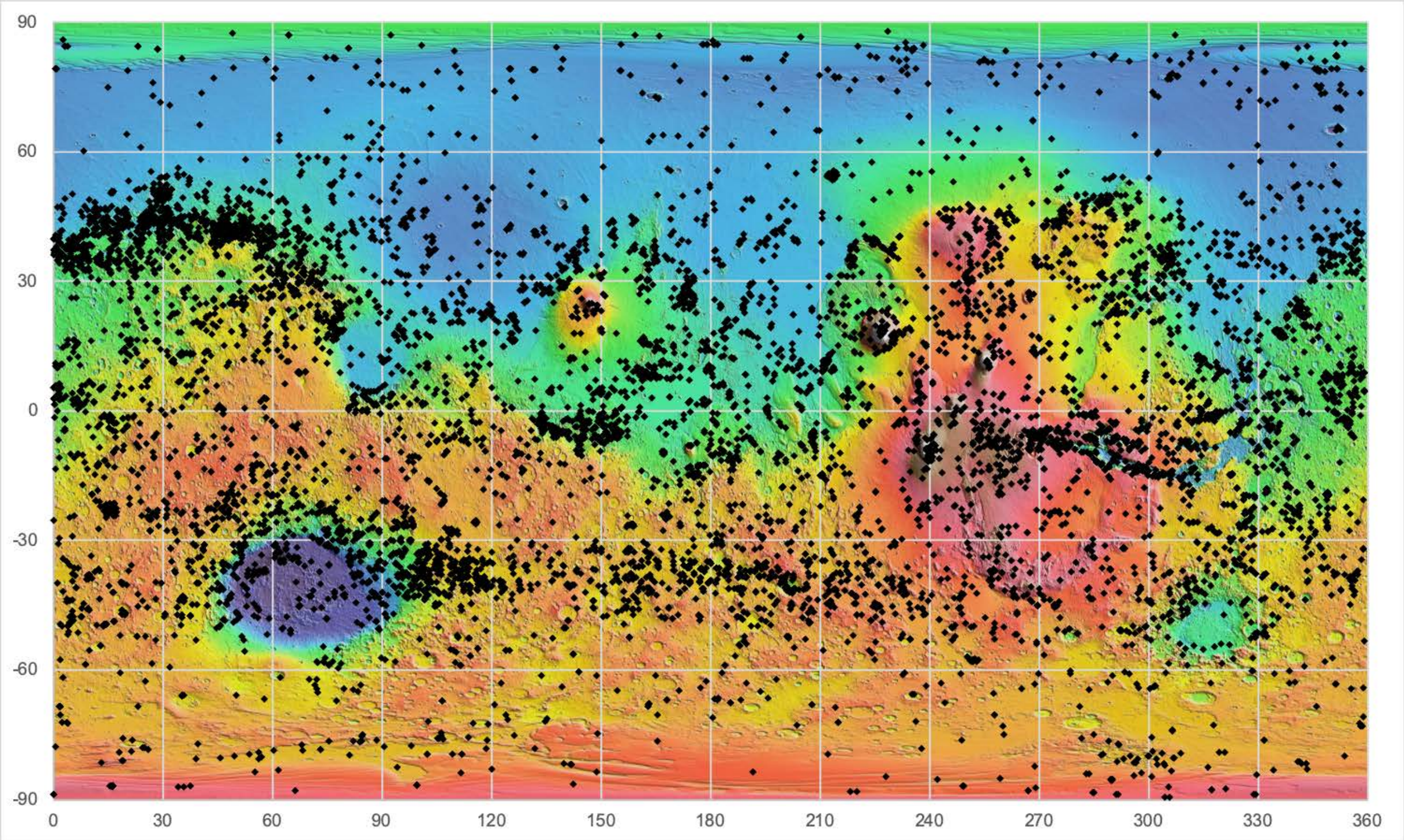
https://www.uahirise.org/ESP_060791_2550

https://www.uahirise.org/ESP_062877_1690

HiRISE: “The People’s Camera”

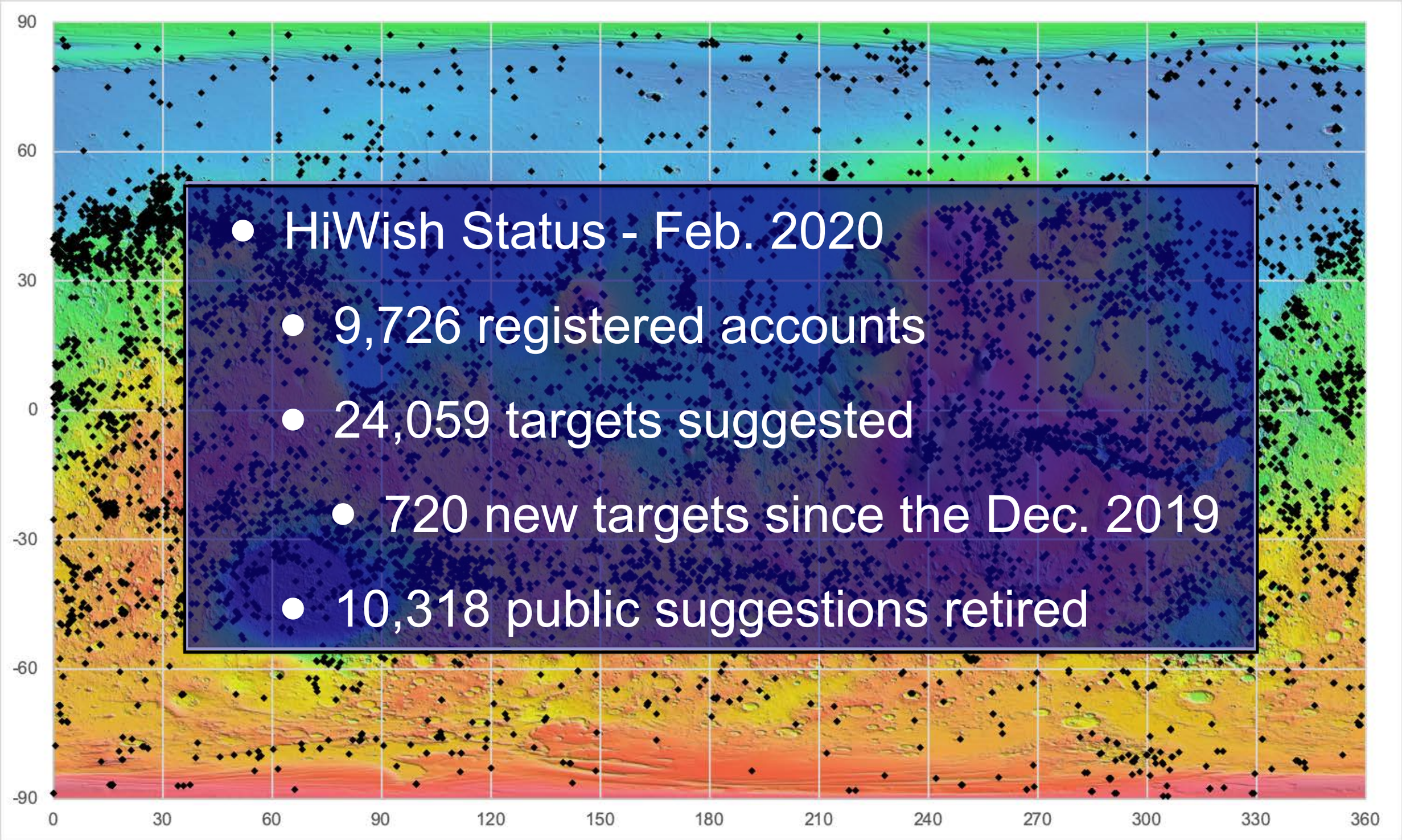
- Images and DTMs are released on a monthly cadence: uahirise.org / PDS
- Targets entered in database by team members and the public.
- “Public” includes schoolchildren, scientific colleagues, and YOU.
- Additional updates regarding HiRISE, including instrument status, spacecraft health, and long-term prospects, are described in a blog post (McEwen 2019) at https://www.uahirise.org/epo/2019-apr-23/

HiWish public suggestions and images



As of Jan 2020

HiWish public suggestions and images



- HiWish Status - Feb. 2020
  - 9,726 registered accounts
  - 24,059 targets suggested
  - 720 new targets since the Dec. 2019
  - 10,318 public suggestions retired

As of Jan 2020

1. Time-independent Observation Planning

- Target suggestions (Regions of Interest/ROIs) entered in HiWish (www.uahirise.org/hiwish/)– months or years before observation occurs
  - create an account
- Science Theme Leads (STLs) prioritize within their theme
  - E.g. Impact Processes

HiRISE Science Themes

- All suggestions need to be placed into an appropriate *Science Theme* (e.g., Aeolian, Impact Processes, Polar Geology, Tectonic Processes, Future Landing Sites etc.). Note that each theme page lists a description and contact person for that theme.

Science Theme (Required)

Primary Science Theme

Glacial/Periglacial Processes

Secondary Science Theme (optional)

Geologic Contacts/Stratigr...

HiRISE suggestions (and subsequent observations) are categorized by science themes. A suggestion **must** have a primary science theme, and may have a secondary science theme.

Science Themes

Climate Change

Targets that may provide evidence of a different or changing climate in the past.

Eolian Processes

The study of landforms and processes formed, affected, or driven by wind and wind-blown particles.

Fluvial Processes

Images of channels, valleys, gullies, or other geologic features likely formed by erosion or deposition by water.

Future Exploration/Landing Sites

Attempts to locate known spacecraft, or to provide imagery for upcoming landed missions.

Geologic Contacts/Stratigraphy

Images of bedrock exposed within crater central peaks or pits that reveal the stratigraphy at depth, as well as geologic contacts between distinct units/materials that can be used to infer stratigraphic relationships, such as relative ages or processes of deposition.

Glacial/Periglacial Processes

Landforms associated with the deposition, movement, or loss of surface and subsurface ice outside the polar caps.

Hydrothermal Processes

Images of geologic features and deposits likely formed in association with warm water (heated by volcanoes, impact craters, or subsurface magma) flowing through and beneath the ground.

Impact Processes

Images primarily intended to inform us about the impact cratering process, typically young, well-preserved craters.

Landscape Evolution

Landforms and surfaces whose shape and juxtaposition records the processes responsible for their formation

Mass Wasting Processes

Mass wasting is the downslope movement of loose rock, soil or other materials under the influence of gravity and includes features such as rockfalls, slumps, granular flows, landslides, and debris avalanches.

Polar Geology

Images of the icy polar deposits, which likely record the ancient climate history of Mars.

Seasonal Processes

Images in the seasonal processes theme study the sublimation and condensation of the seasonal polar cap and its affect on underlying terrain.

Sedimentary/Layering Processes

Images of layered bedrock typically exposed along canyon and crater walls, or layered deposits that could have been deposited by water activity.

Rocks and Regolith

Surface textures associated with soil deposits, rocks and boulders, and exposures of bedrock.

Composition and Photometry

Images intended to inform us about sites with interesting mineralogic or color properties.

Tectonic Processes

Images of rocks that have been folded, fractured, broken, or slid past each other.

Volcanic Processes

Features produced by molten rock, such as lava flows, ash beds, cinder cones, and volcanoes.

HiWish Submission

HiWish targeting portal for HiRISE

HiRISE

About Catalog Outreach Science Updates Search

Anaglyphs DTM HiView HiWish Map Press Science Nuggets Special Releases Stereo Pairs Select a language

Please make sure you have provided four things: a title, a science rationale, a region of interest on the map (rectangle with orange dot marker), and a science theme.

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Help

Science Rationale (Required, and IMPORTANT!)

Mid- and lower-wall RSL in ESP_039894_1665 etc. on a mix of talus and fans. Good area when Sun is in the South. Similar stratigraphic level and morphology as nearby fully confirmed sites on N side of the ridge. Image needed to raise status.

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Help

Special Notes

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893 characters remaining.

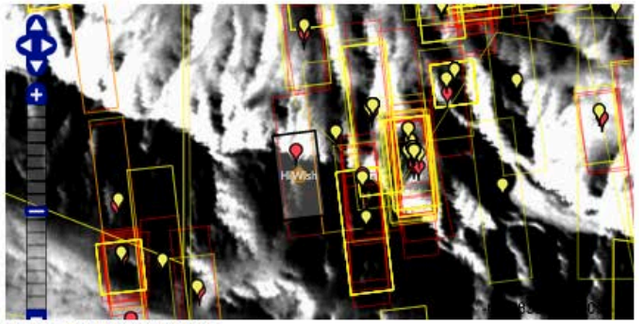
Additional notes to aid targeting specialists in planning the observation.

Help

Priority

4

Region Of Interest (Required)



Viewing -13.010°, 294.310°E

Mode

Pan & Zoom | Move | Edit | Resize

Find

Background Visible

Map Input	Action	Feature Input	Action
Double Click	Place/Move Target	Hover	Highlight Footprint
Single Click	Zoom In	Marker Click	Enable Drag
Drag	Pan	Marker Drag	Move Target
Scroll	Zoom		

Show

- [x] HiRISE suggestions
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Target located at -13.043°, 294.262°E

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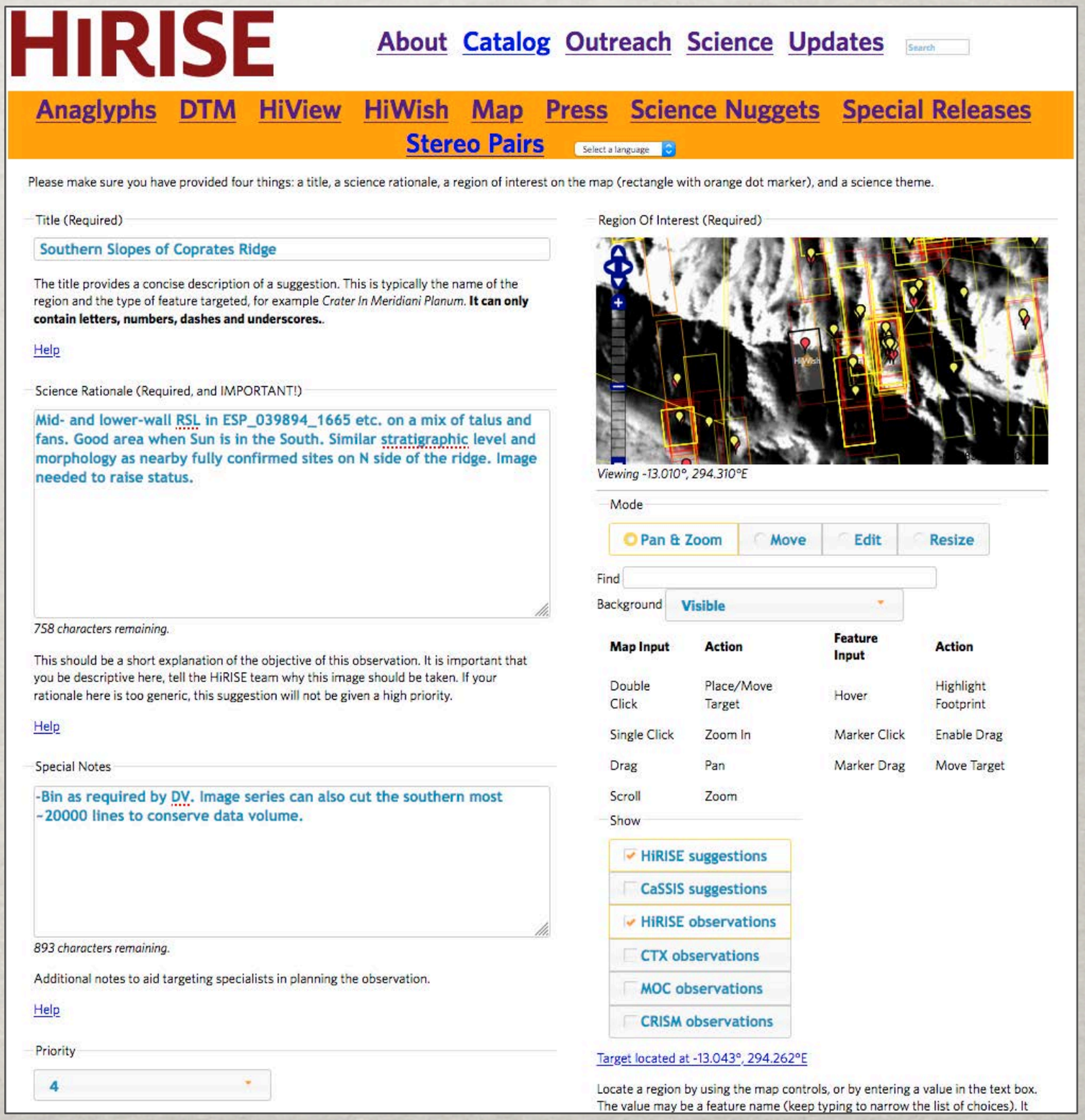

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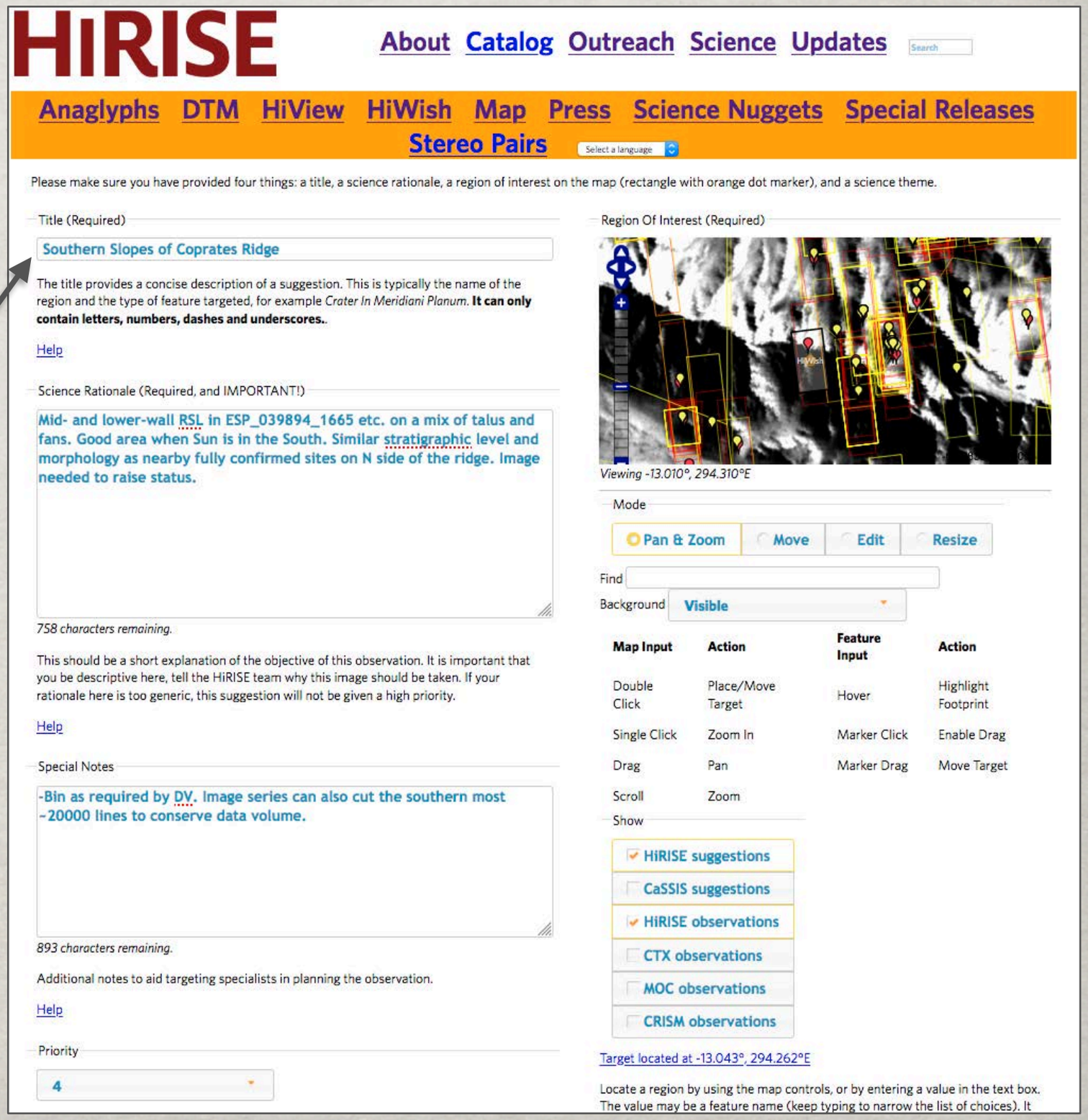

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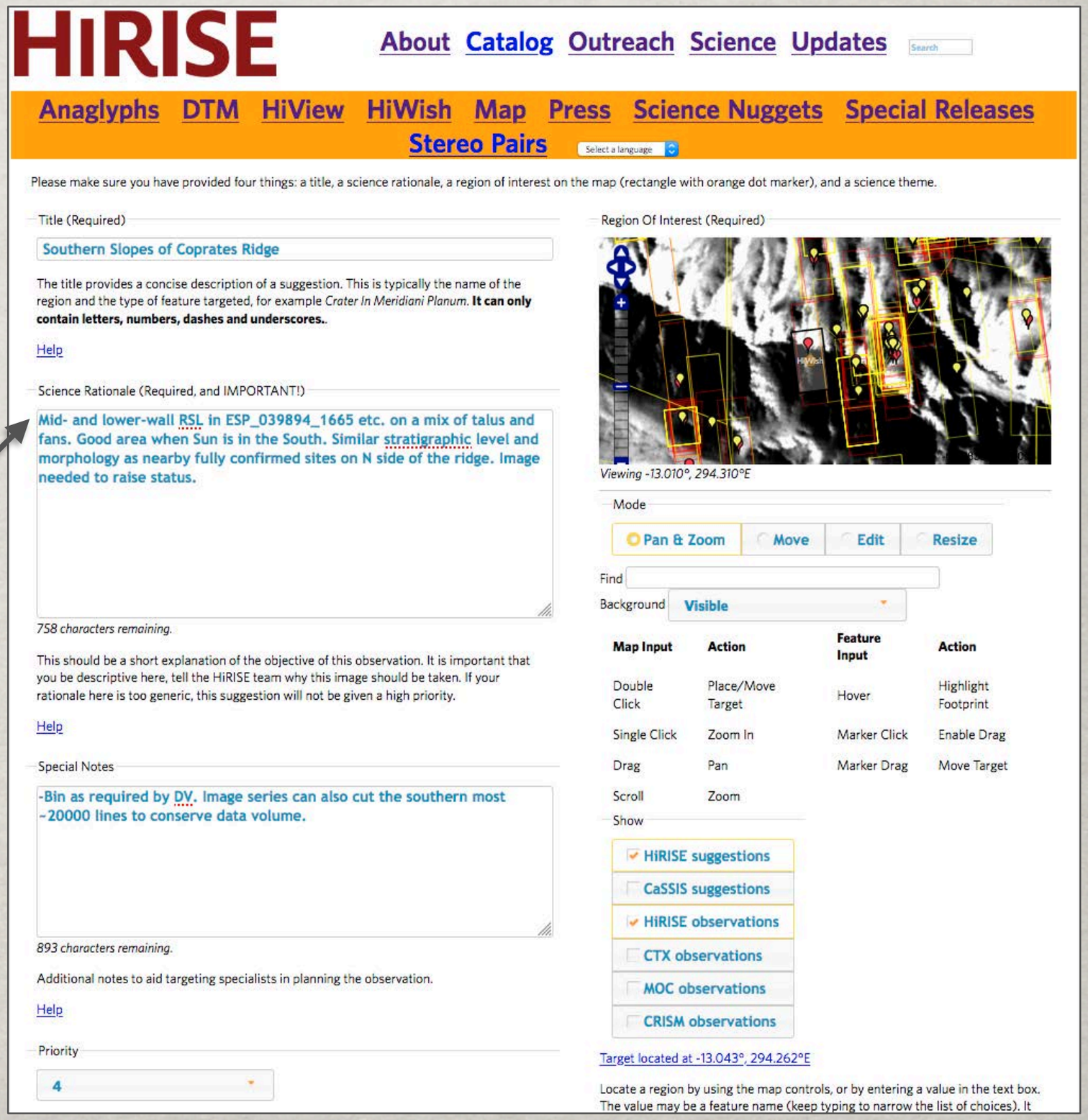

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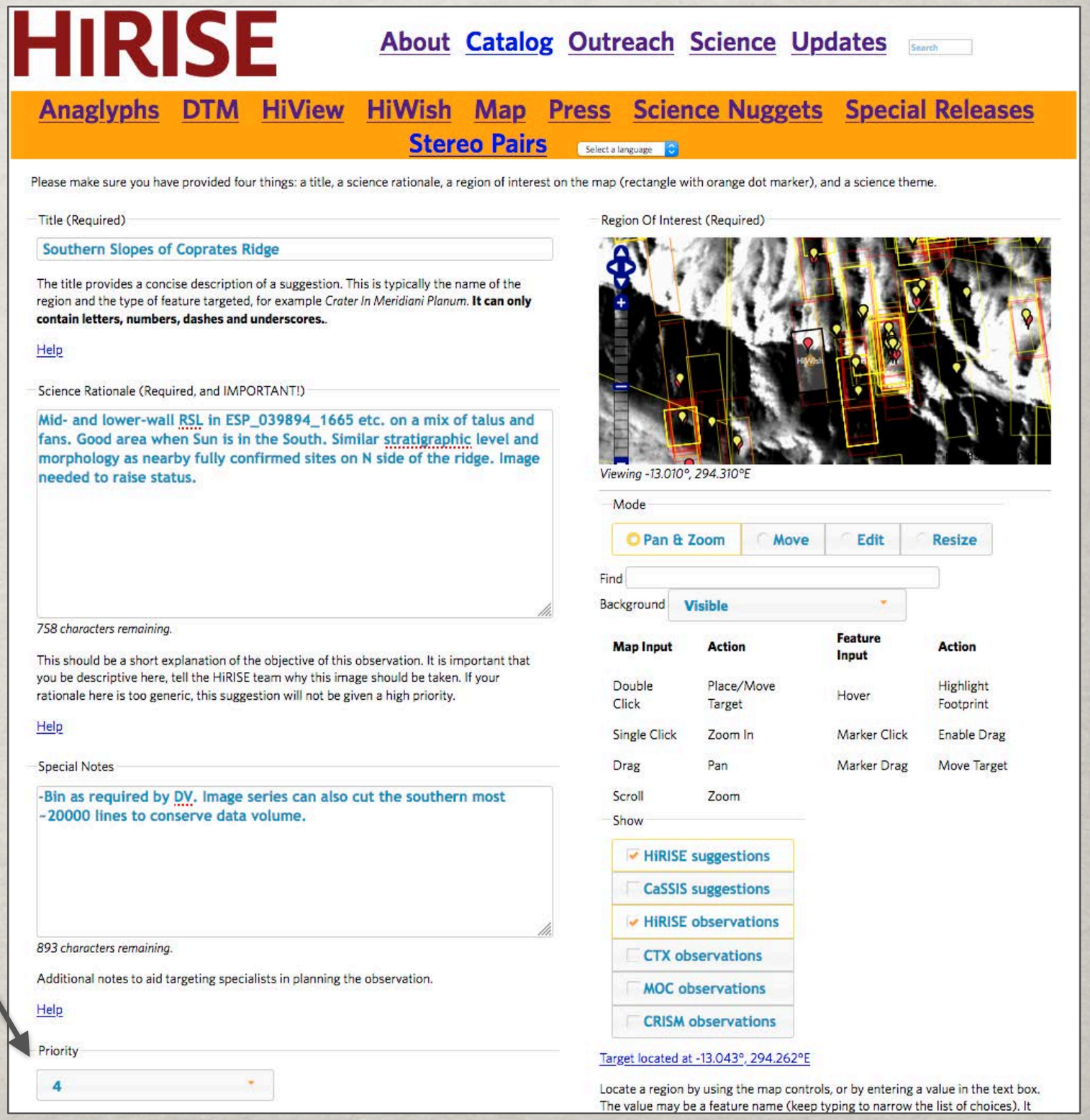
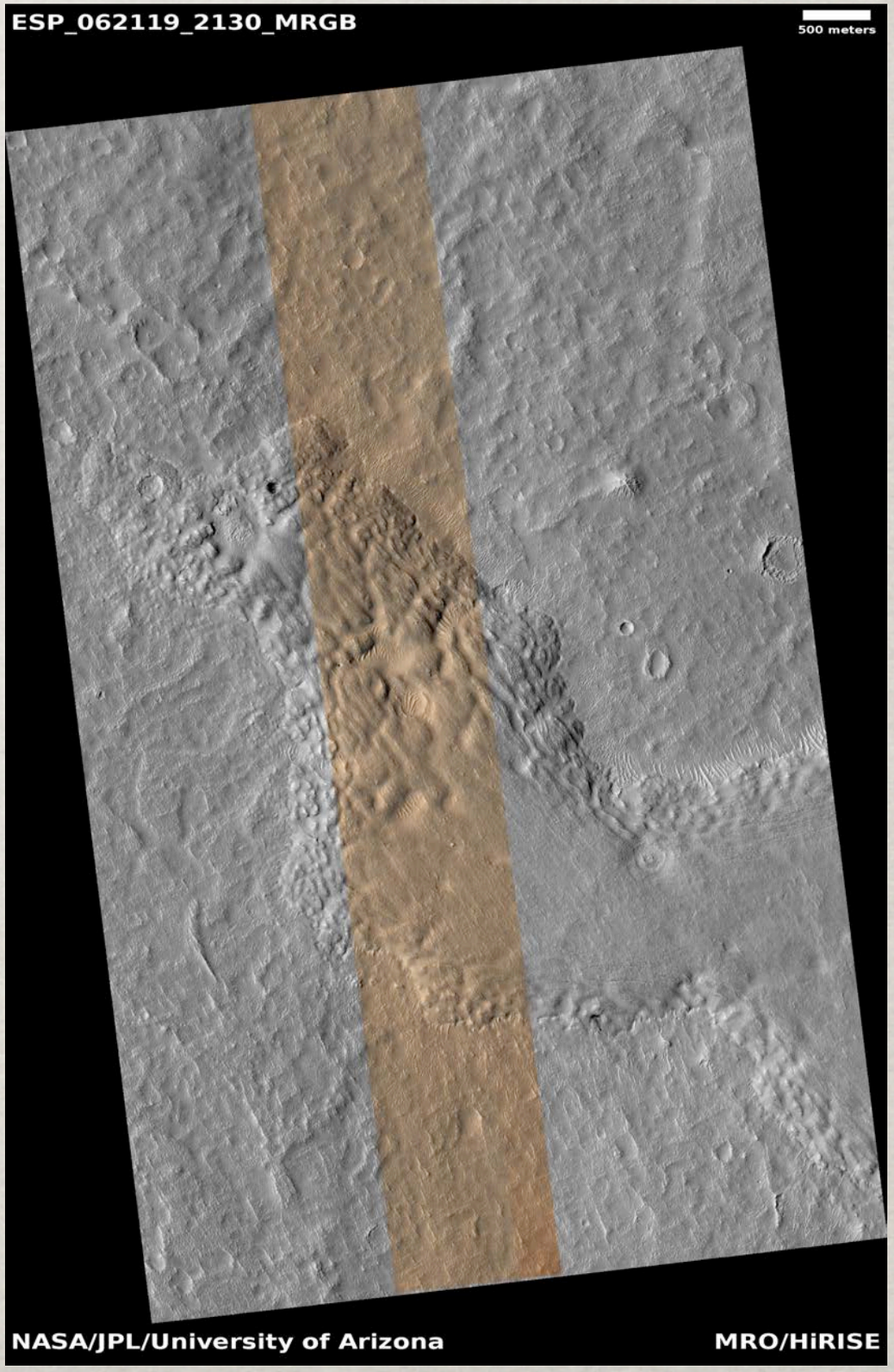
- Set your suggestion's relative *Priority* (1-lowest to 5-highest) among the rest of your suggestions.



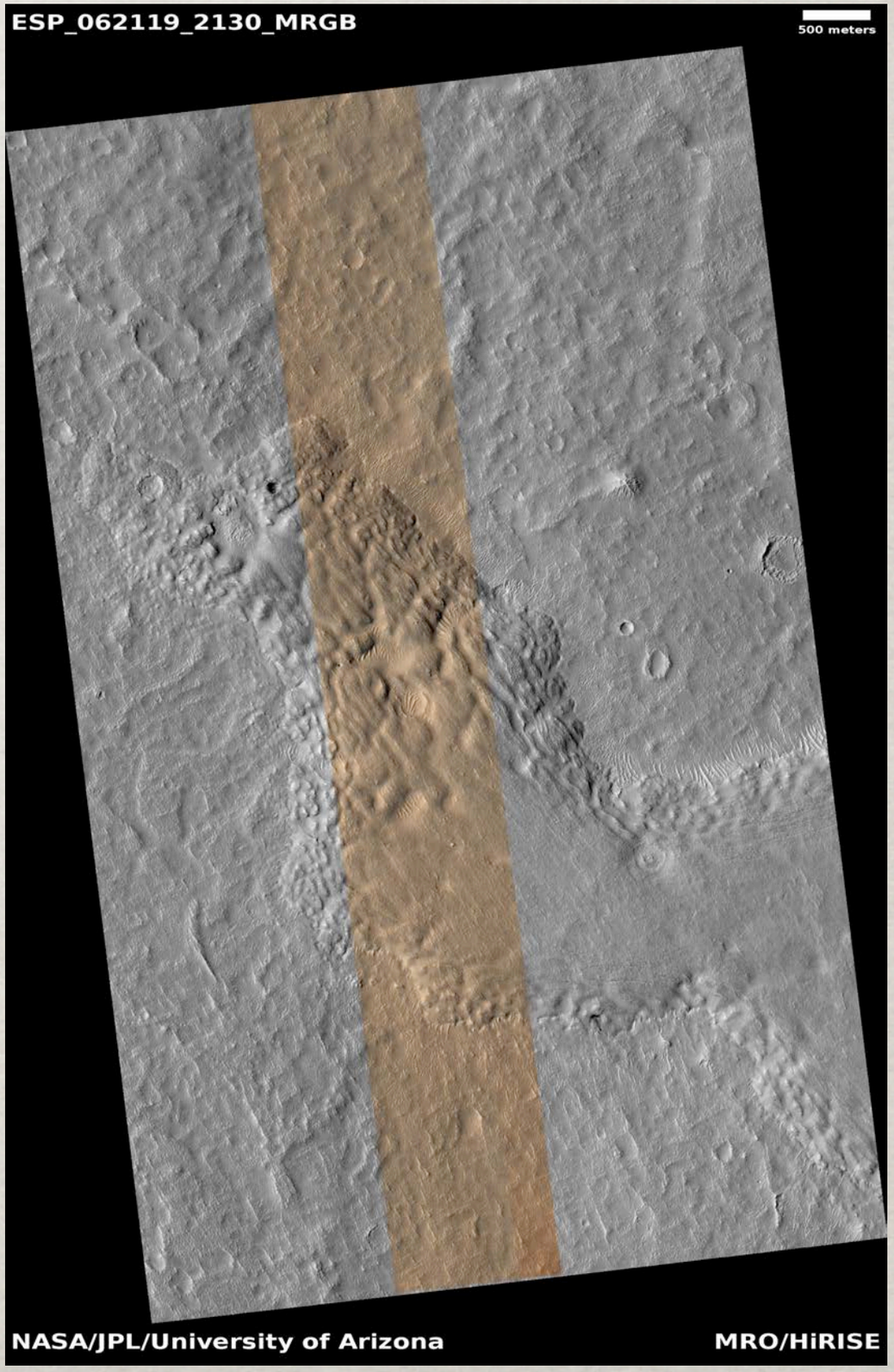
HiWish Submission



HiWish Submission

Science Rationale Examples

- *James Secosky* - The objective of this observation is to examine a lobe of a lava flow. The margins of the flow seem to be made up of many smaller structures, as compared to the center of the flow. The scene can be found in CTX image: P19_008595_2125.



HiWish Submission

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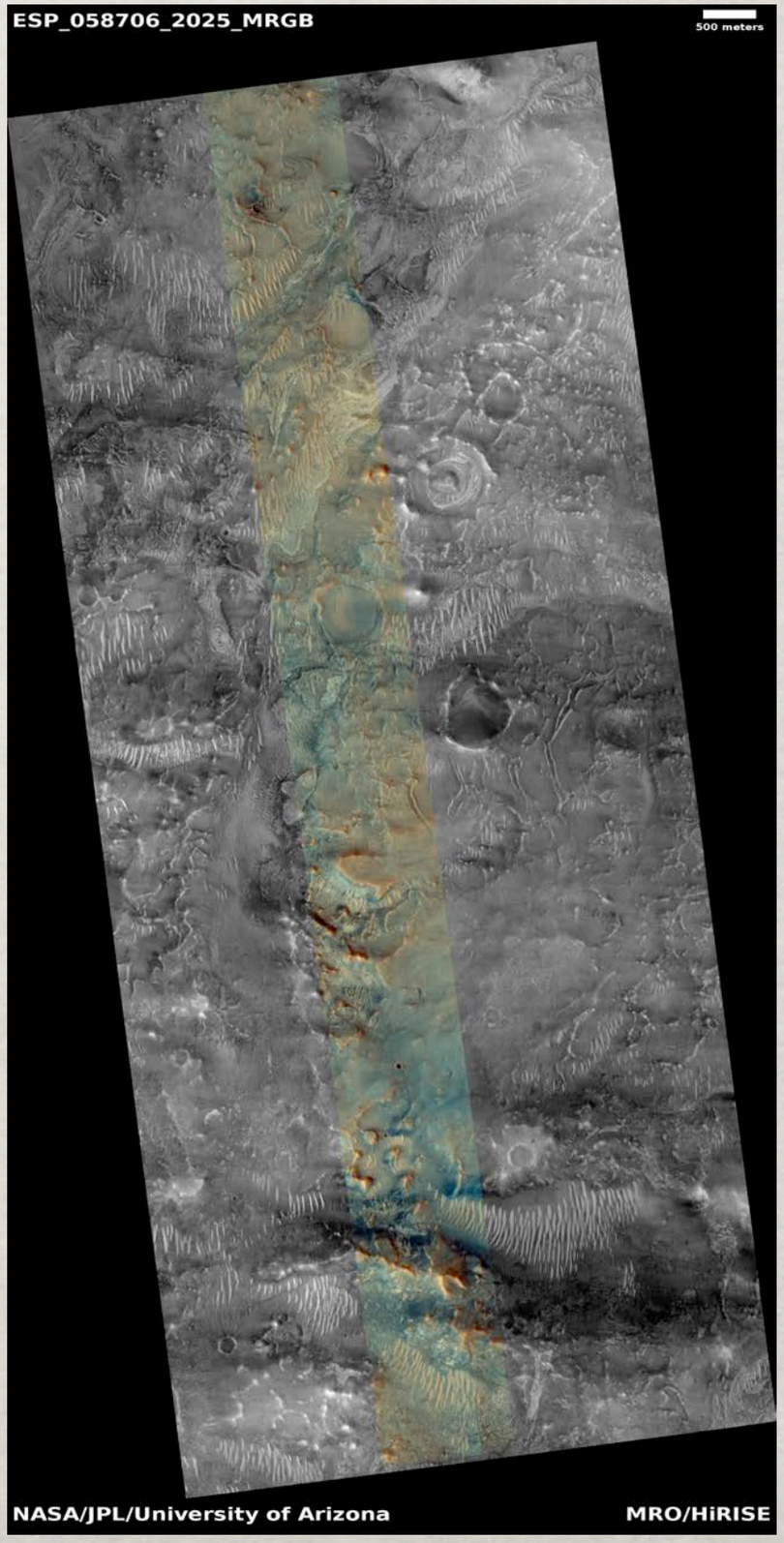
- *Edwin Kite* - Constraints on the past atmospheric pressure of Mars are obtained if small ancient craters can be found (Vasavada et al. JGR 1993, Kite et al. Nature Geoscience 2014). and ESP_047471_2015 shows large ancient syn-sedimentary impact craters exist at this site. Hypothesis: Small craters exist too, meaning the atmosphere was thin at the time of sedimentation. Test: I have found that HiRISE anaglyphs are needed (and HiRISE DTMs are desirable) to confirm small ancient impact craters on Mars. Urgency: This image is to support first-year project of incoming first-year UChicago PhD-program student Alexandra (Sasha) Warren.



HiWish Submission

Special Notes Examples

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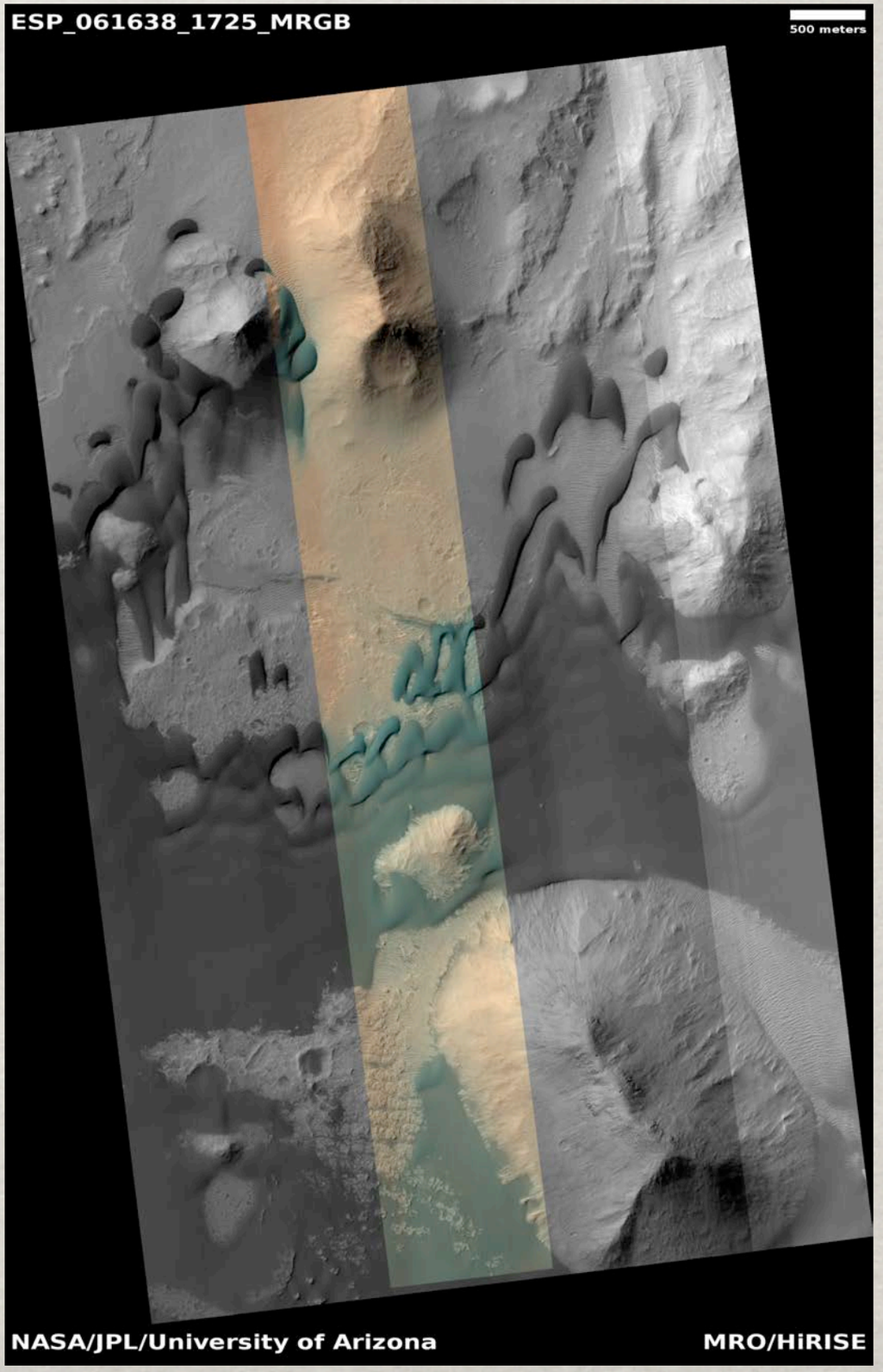

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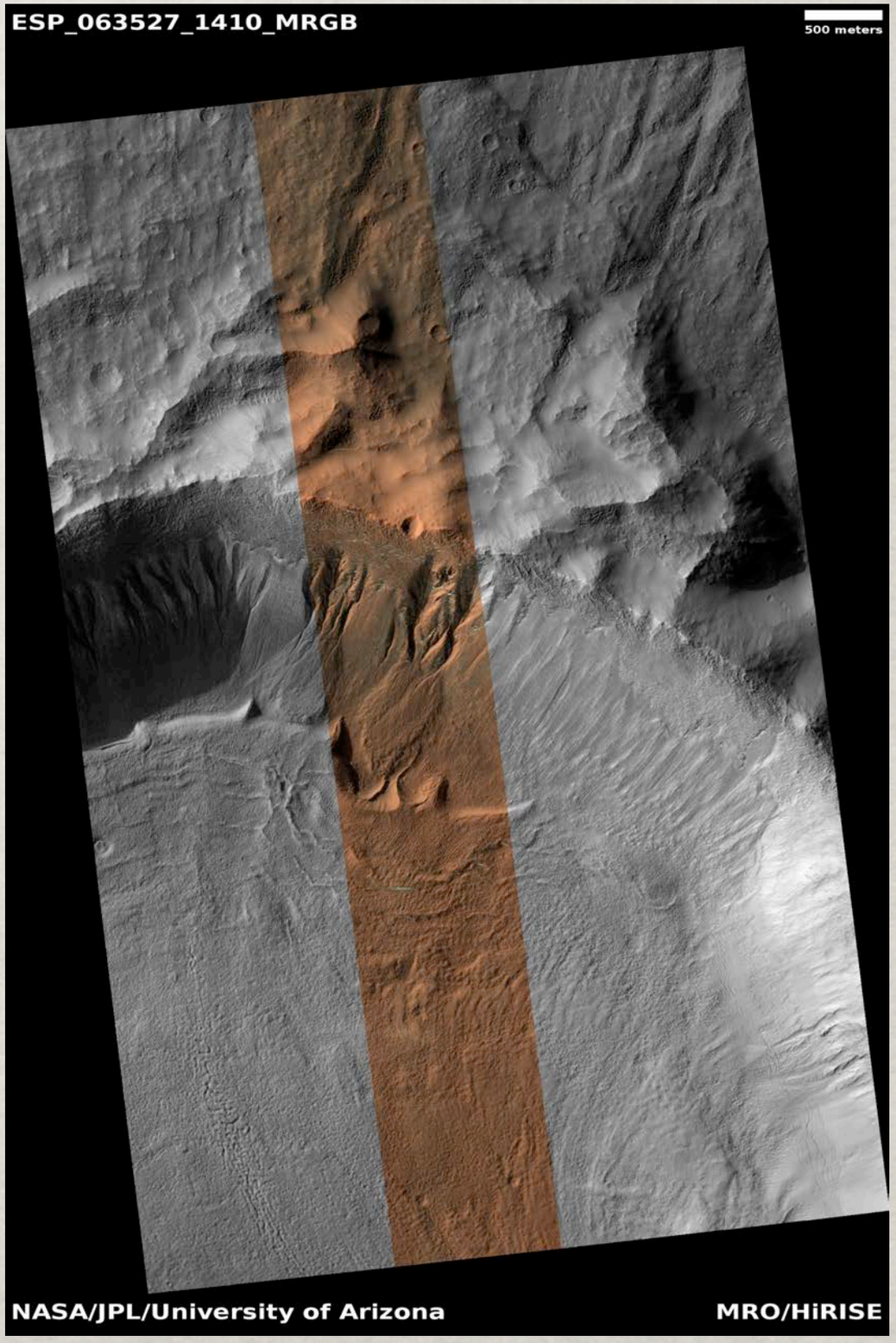
- *Colin Dundas* - Frost of interest will be in shadow for these images. This is deliberate--go ahead and image. Bin as needed.



HiWish Submission

Placing your HiWish target

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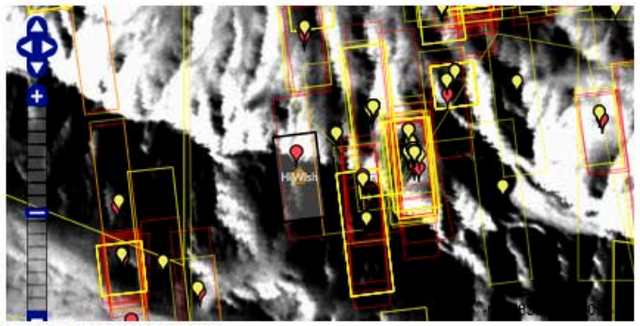

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Pan & Zoom | Move | Edit | Resize

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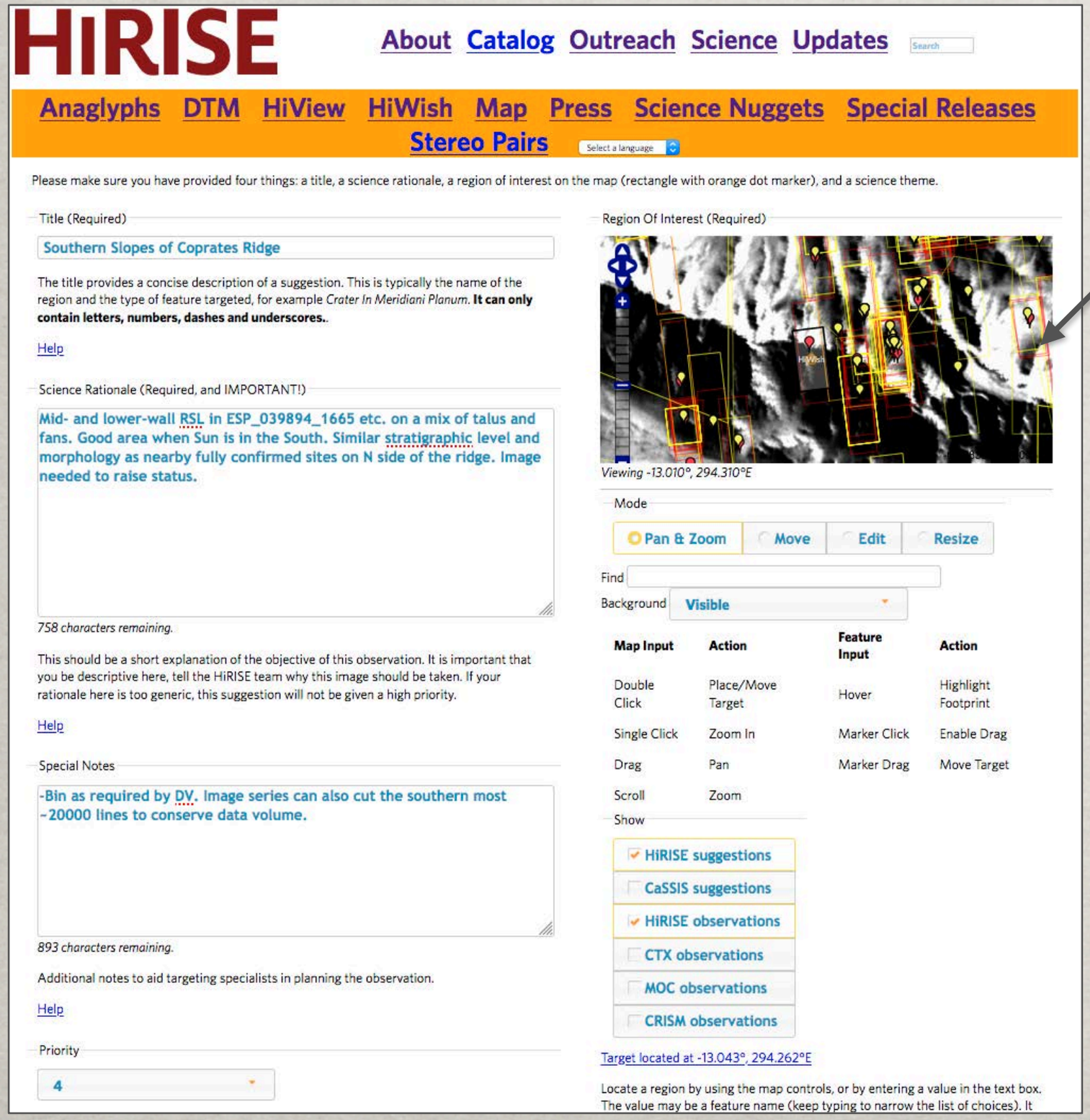

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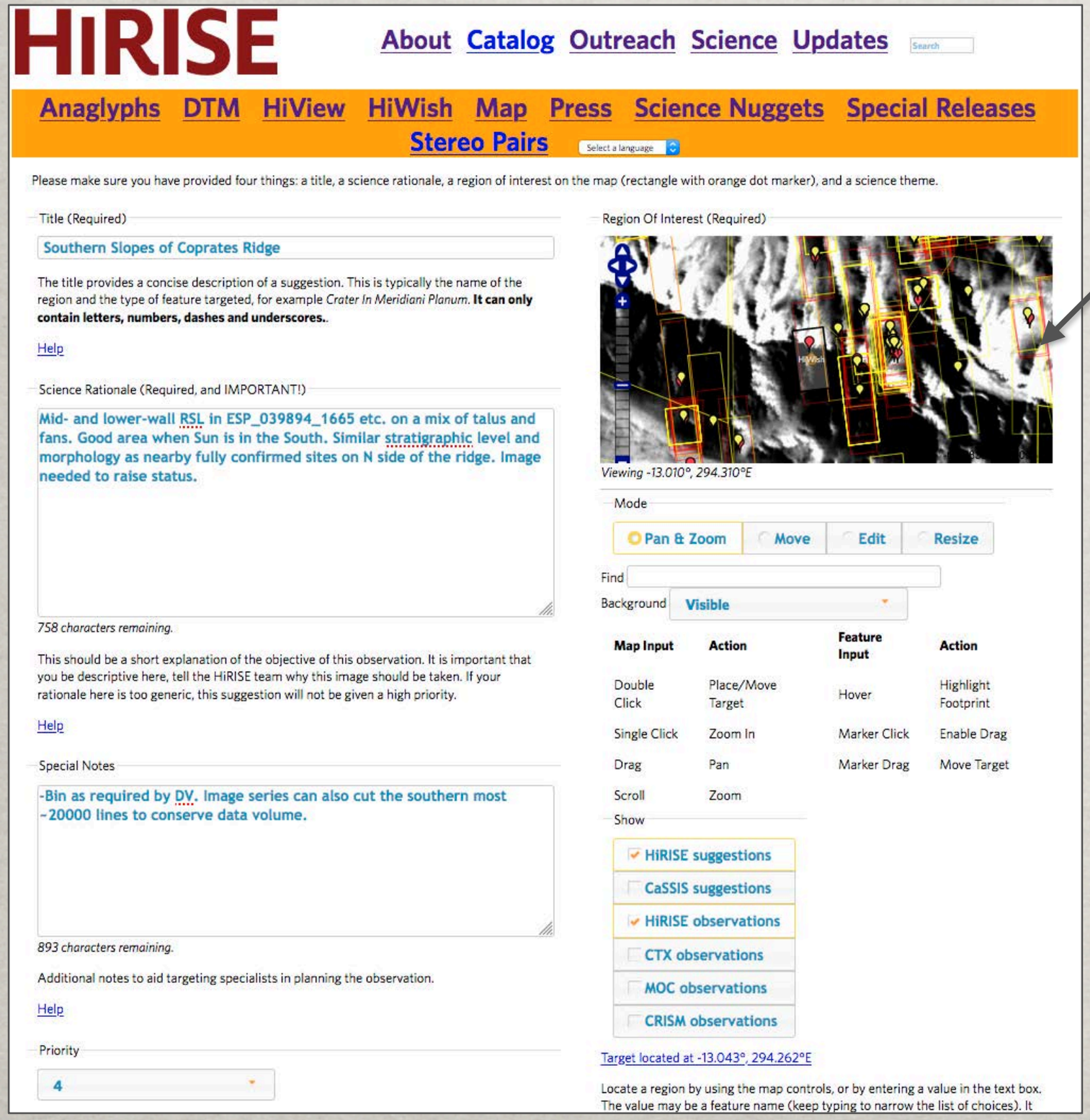

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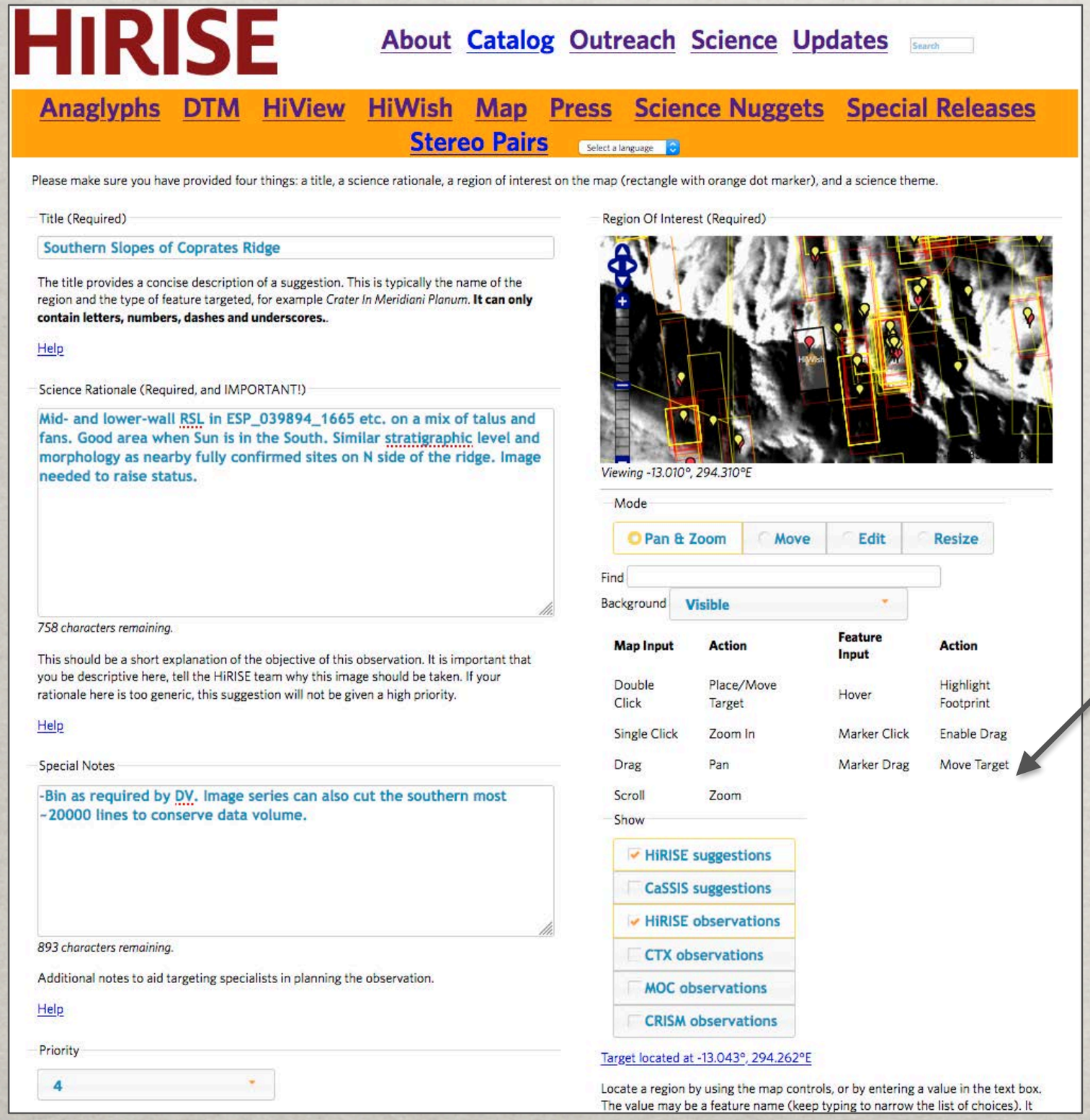

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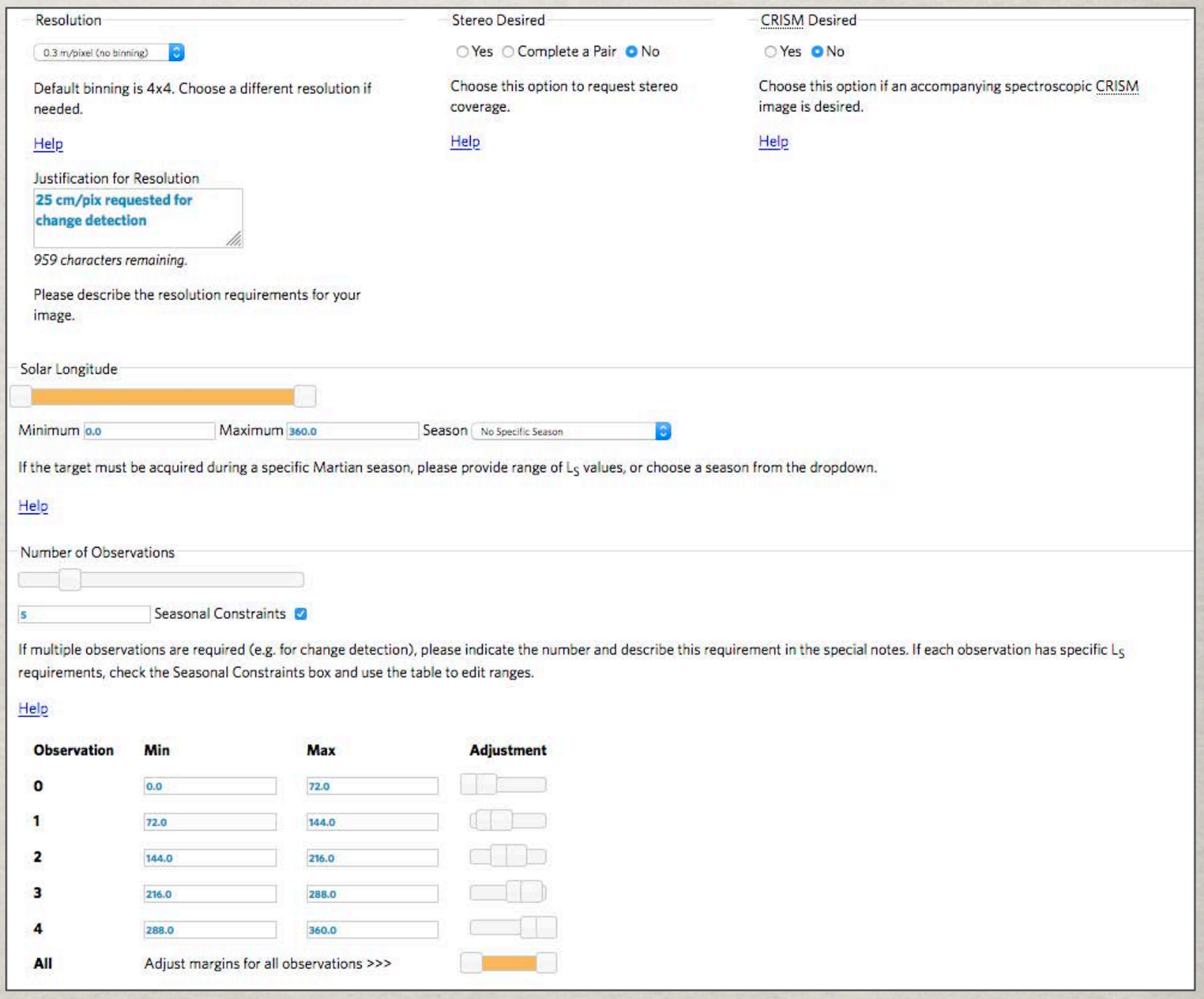
    - Each of those instrument footprints links to the image in ASU's Mars Image Explorer.

HiWish Submission

- The lower *HiWish* panel allows users to request *advanced options* such as stereo, seasonal targeting, high resolution, or potential CRISM targeting. These options may delay image acquisition.

Advance HiWish targets



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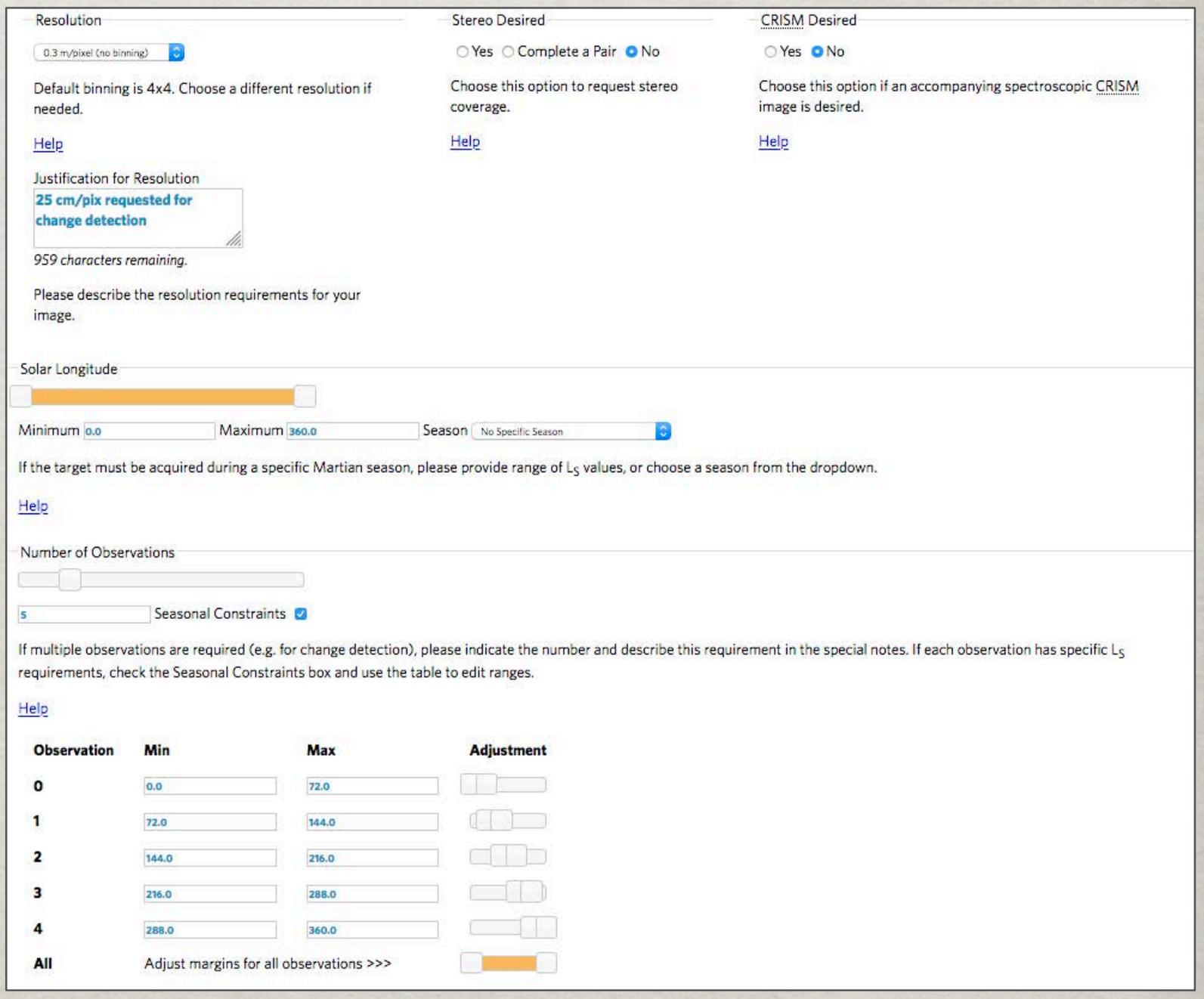

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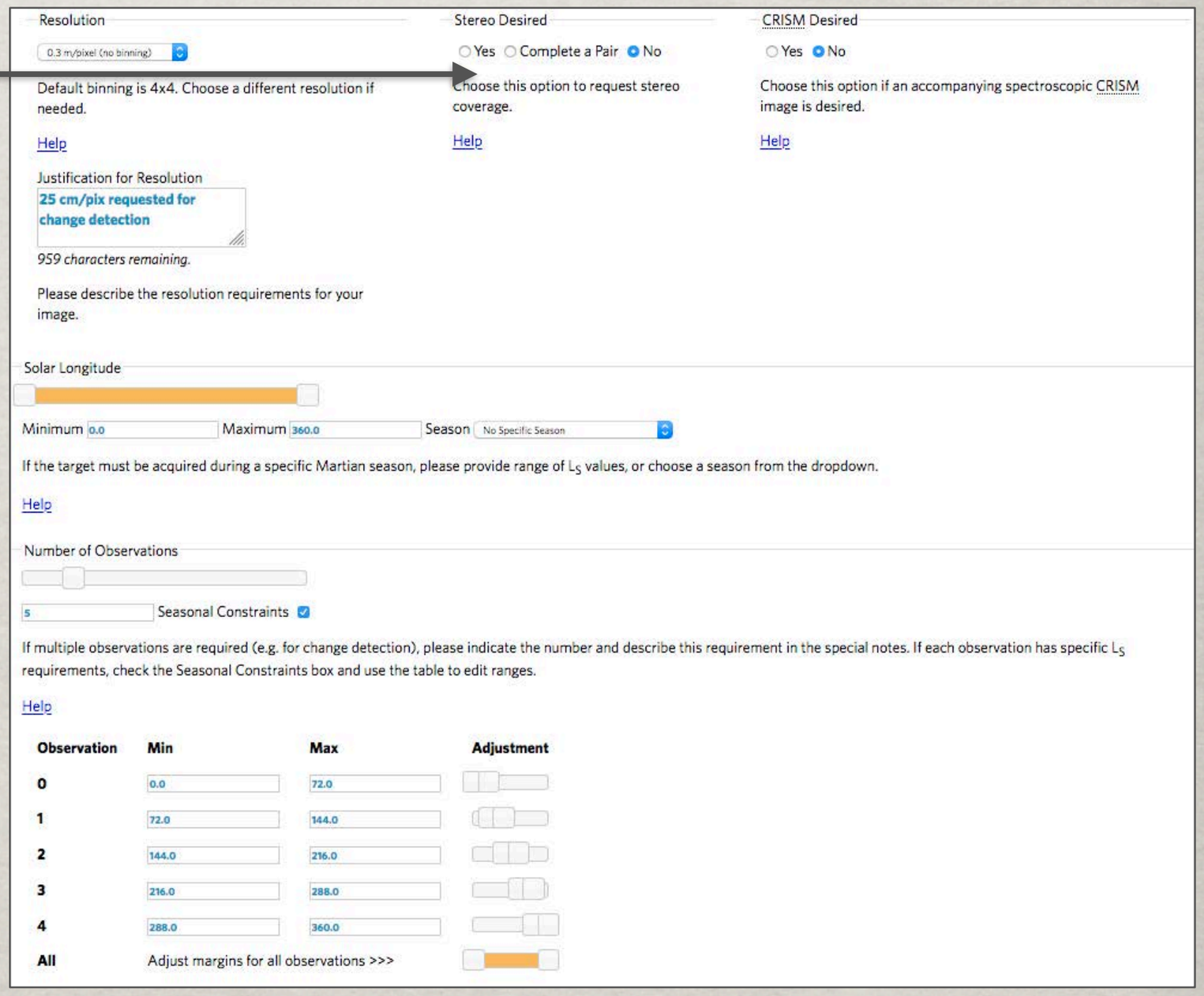

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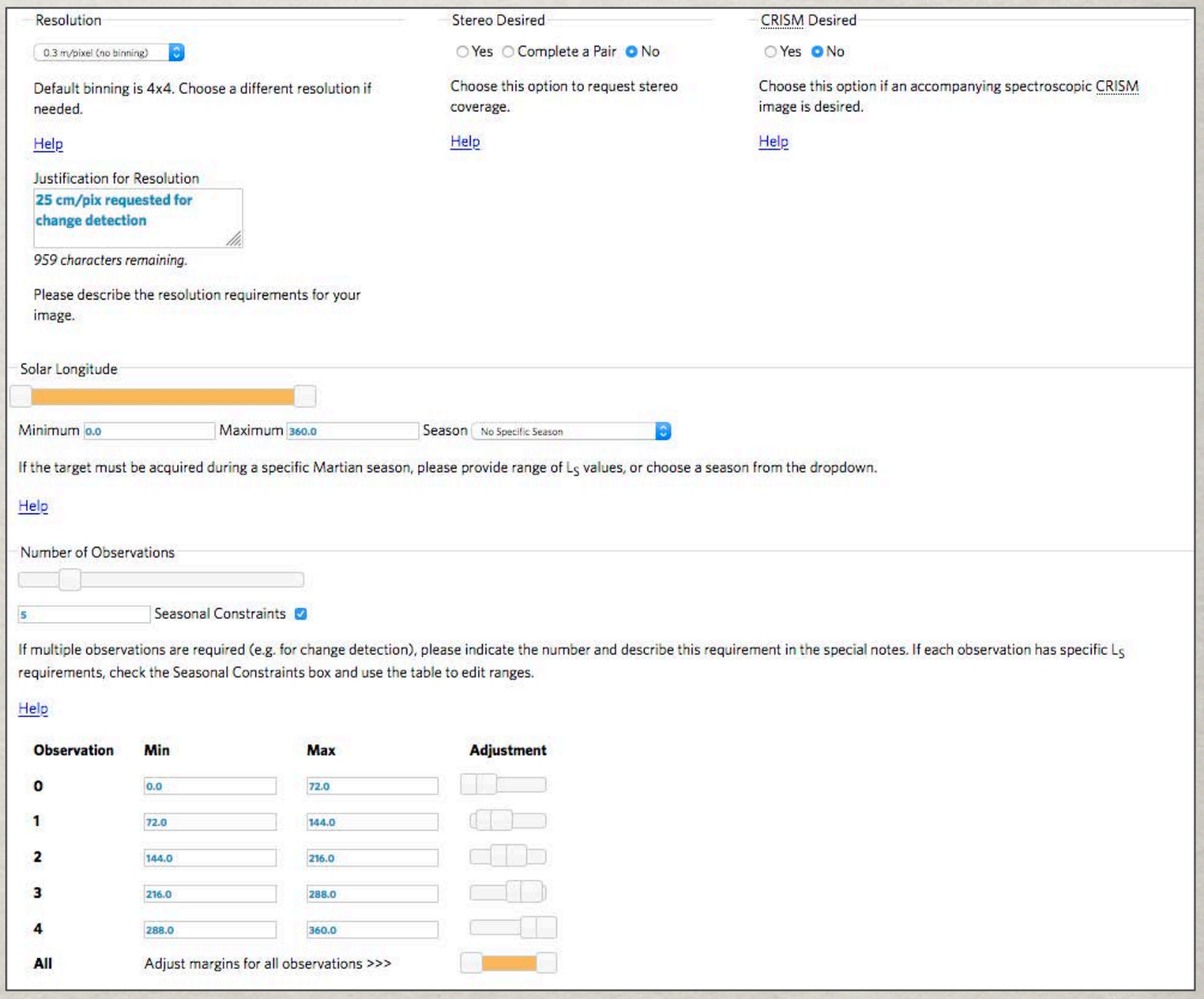

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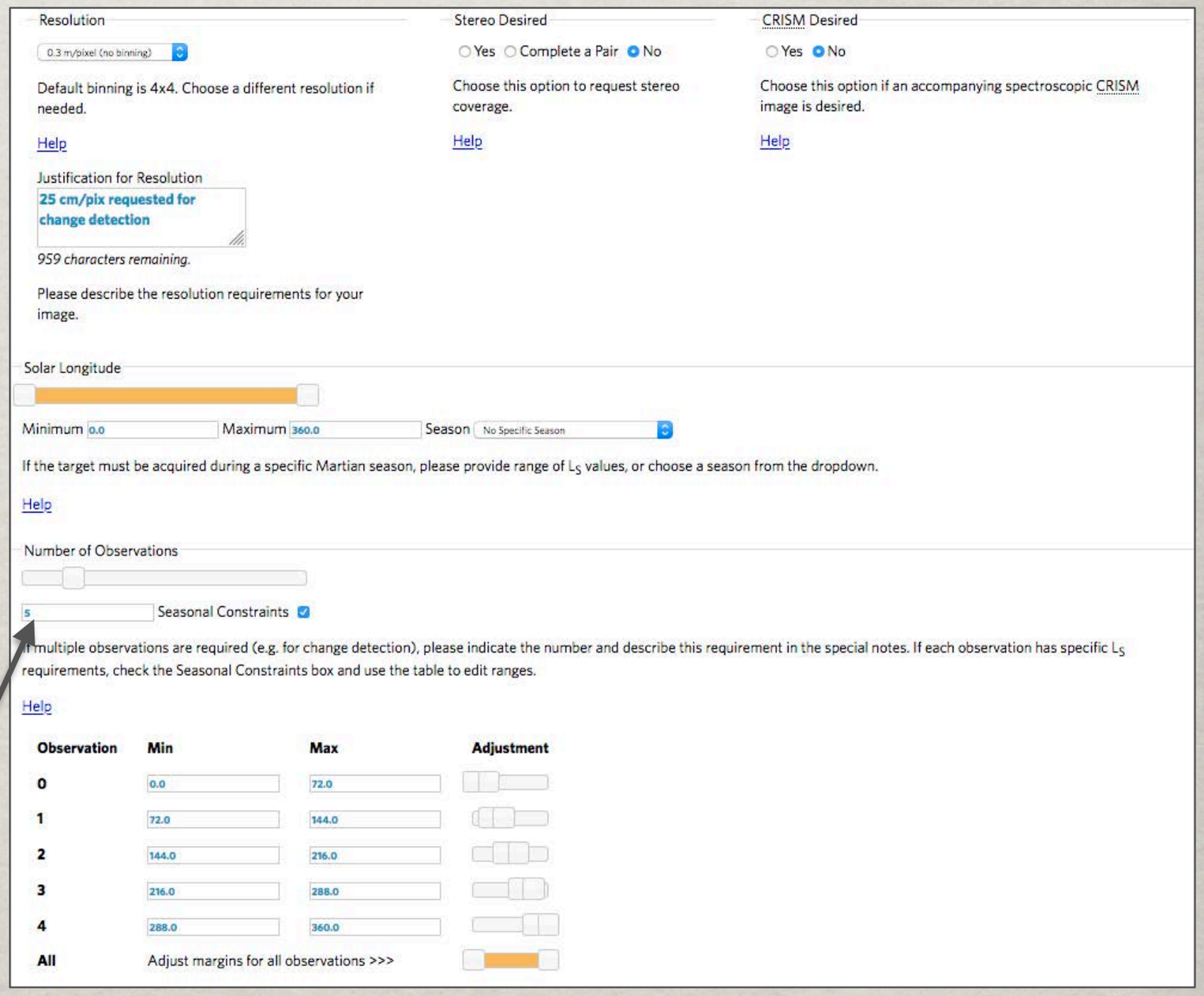
- Repeat targeting may be requested by entering the *Number of Observations* and, if desired, checking the box for *Seasonal Constraints.*



2. Time-dependent Observation Planning

- Mars Reconnaissance Orbiter (MRO) plans two-week cycles with requests from all instruments (e.g., CRISM, SHARAD etc.).
  - Planning starts ~3 weeks ahead of time
- One science team member works with one operations team member to plan entire 2 weeks of HiRISE observations
  - Operational constraints: what's visible, spacecraft keep out zones, downlink data volume, instrument temperature, other instruments observations and coordinated science…
  - Prioritization according to that science team member's preferences

Why does it take so long to get my image?

HiWish Submission

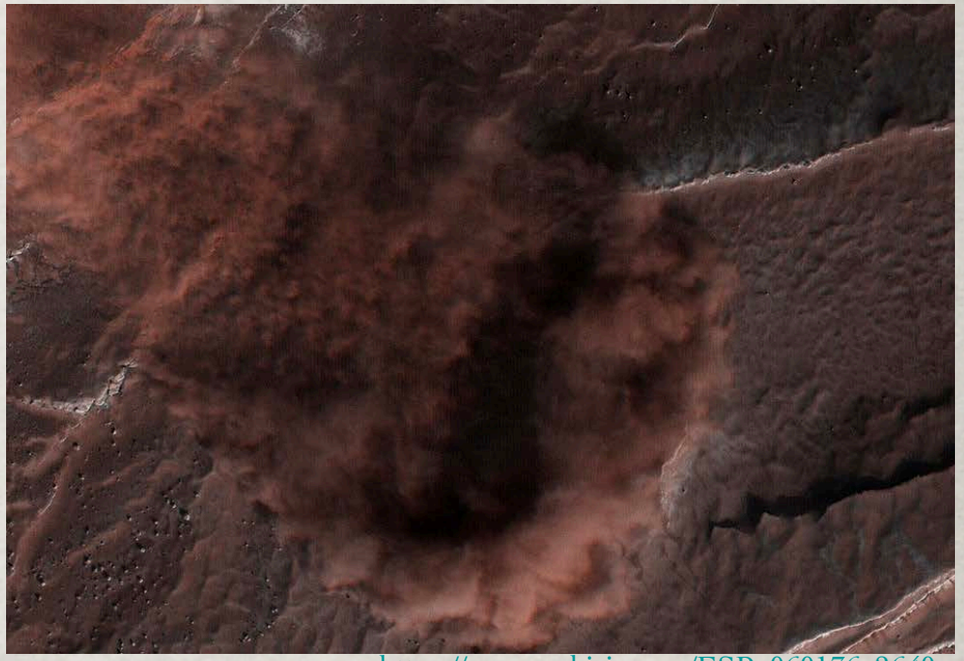
STL Prioritization — **Ongoing, but sometimes a delay**

Cycle planning — **3 weeks minimum**

Cycle execution — **2 weeks**

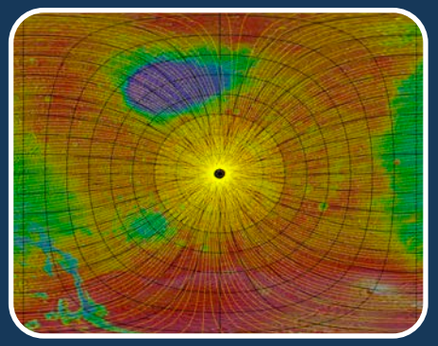
Image processing, validation — **Requires reconstructed SPICE, 1-2 weeks**

PDS release — **Monthly to uahirise.org**



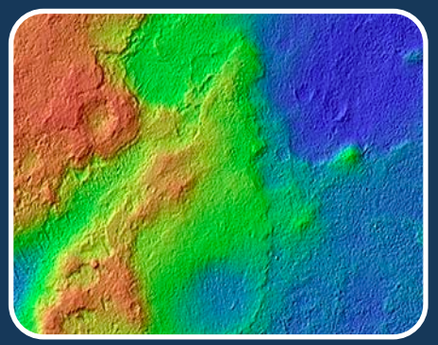
https://www.uahirise.org/ESP_060176_2640

What makes it more difficult to acquire my image?



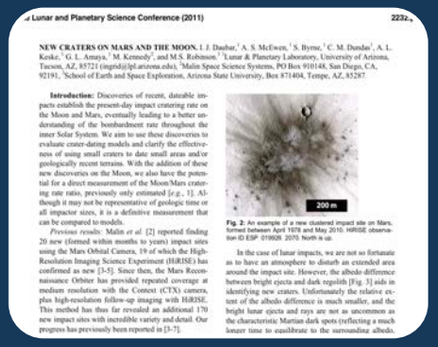
Location

- Competition from other targets nearby/same orbit
- Latitude – polar easier but only ½ year



Using Advanced Options

- Stereo – requires 2 images, large rolls
- Seasonal constraints or repeats
- Limiting any viewing angles



Lunar and Planetary Science Conference (2011) 2232.

NEW CRATERS ON MARS AND THE MOON. I. J. Daubar,[1] A. S. McEwen,[1] S. Byrne,[1] C. M. Dundas[1], A. L. Keske,[1] G. L. Amaya,[1] M. Kennedy[2], and M.S. Robinson,[1] [1]Lunar & Planetary Laboratory, University of Arizona, Tucson, AZ, 85721 (ingrid@lpl.arizona.edu), [2]Malin Space Science Systems, PO Box 910148, San Diego, CA, 92191, [3]School of Earth and Space Exploration, Arizona State University, Box 871404, Tempe, AZ, 85287.

Introduction: Discoveries of recent, dateable impacts establish the present-day impact cratering rate on the Moon and Mars, eventually leading to a better understanding of the bombardment rate throughout the inner Solar System. We aim to use these discoveries to evaluate crater-dating models and clarify the effectiveness of using small craters to date small areas and/or geologically recent terrains. With the addition of these new discoveries on the Moon, we also have the potential for a direct measurement of the Moon/Mars cratering rate ratio, previously only estimated [e.g., 1]. Although it may not be representative of geologic time or all impactor sizes, it is a definitive measurement that can be compared to models.

Previous results: Malin *et al.* [2] reported finding 20 new (formed within months to years) impact sites using the Mars Orbital Camera, 19 of which the High-Resolution Imaging Science Experiment (HiRISE) has confirmed as new [3-5]. Since then, the Mars Reconnaissance Orbiter has provided repeated coverage at medium resolution with the Context (CTX) camera, plus high-resolution follow-up imaging with HiRISE. This method has thus far revealed an additional 170 new impact sites with incredible variety and detail. Our progress has previously been reported in [3-7].

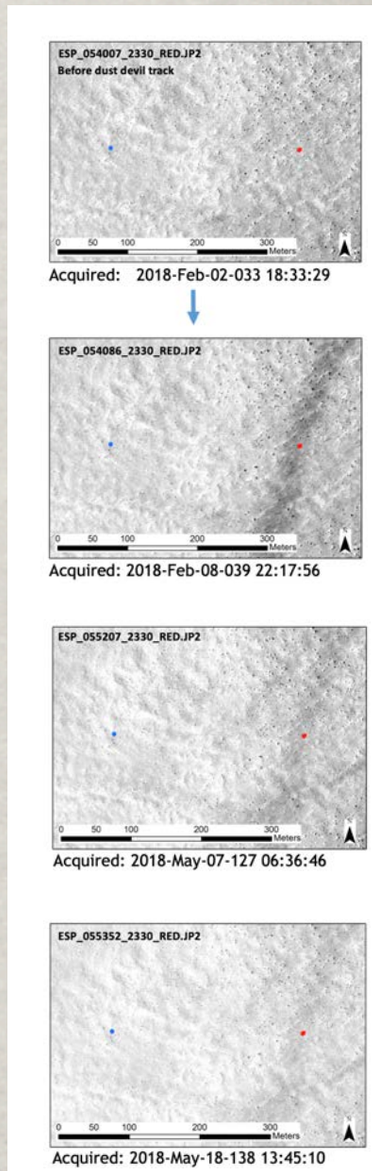
200 m

Fig. 2: An example of a new clustered impact site on Mars, formed between April 1978 and May 2010. HiRISE observation ID ESP_019928_2070. North is up.

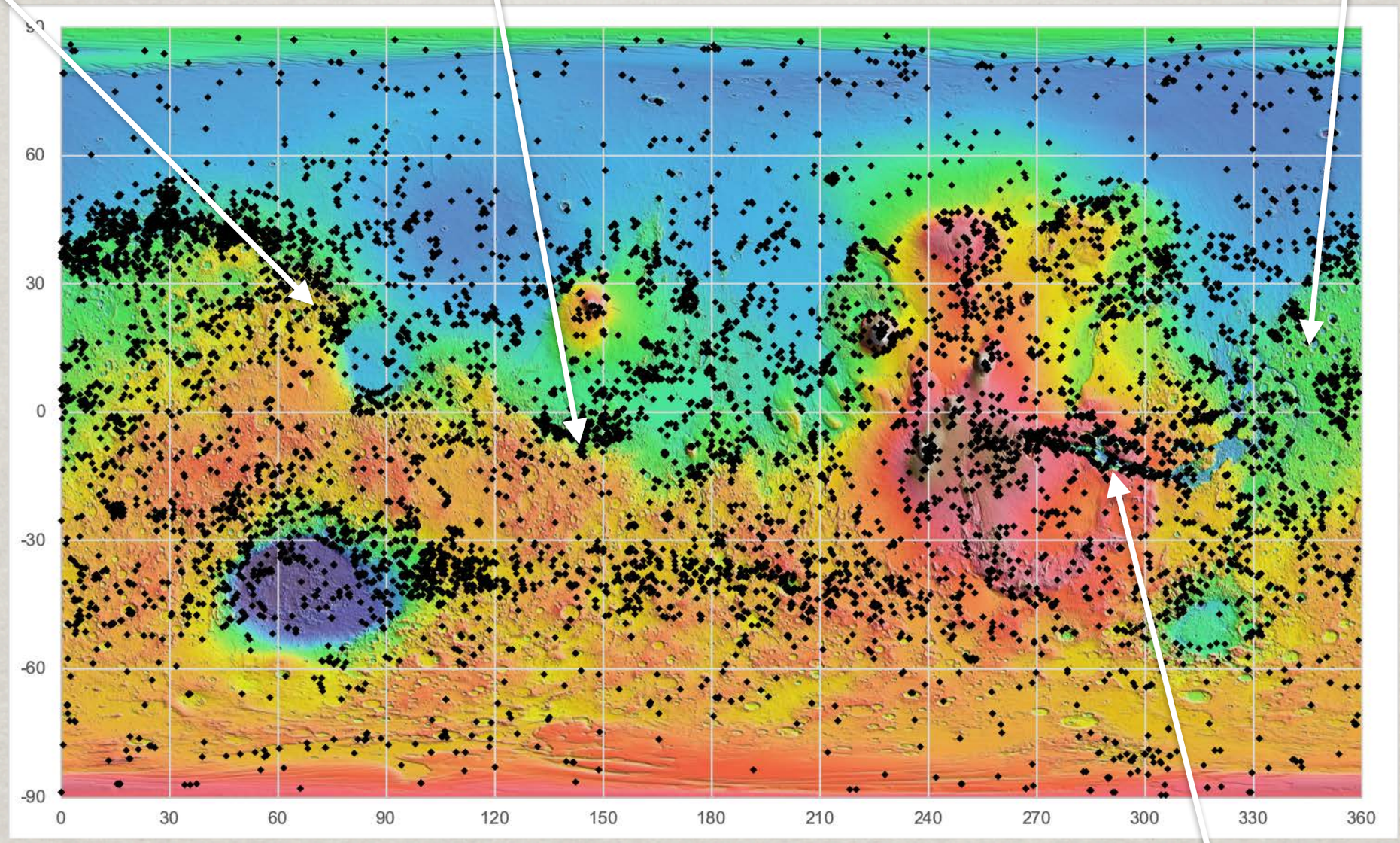
In the case of lunar impacts, we are not so fortunate as to have an atmosphere to disturb an extended area around the impact site. However, the albedo difference between bright ejecta and dark regolith [Fig. 3] aids in identifying new craters. Unfortunately the relative extent of the albedo difference is much smaller, and the bright lunar ejecta and rays are not as uncommon as the characteristic Martian dark spots (reflecting a much longer time to equilibrate to the surrounding albedo.

Not Giving Enough Information

- Convince the STL and the science planners that you've thought about it and that it's interesting
- It helps if you're actively working on it



Competitive Regions

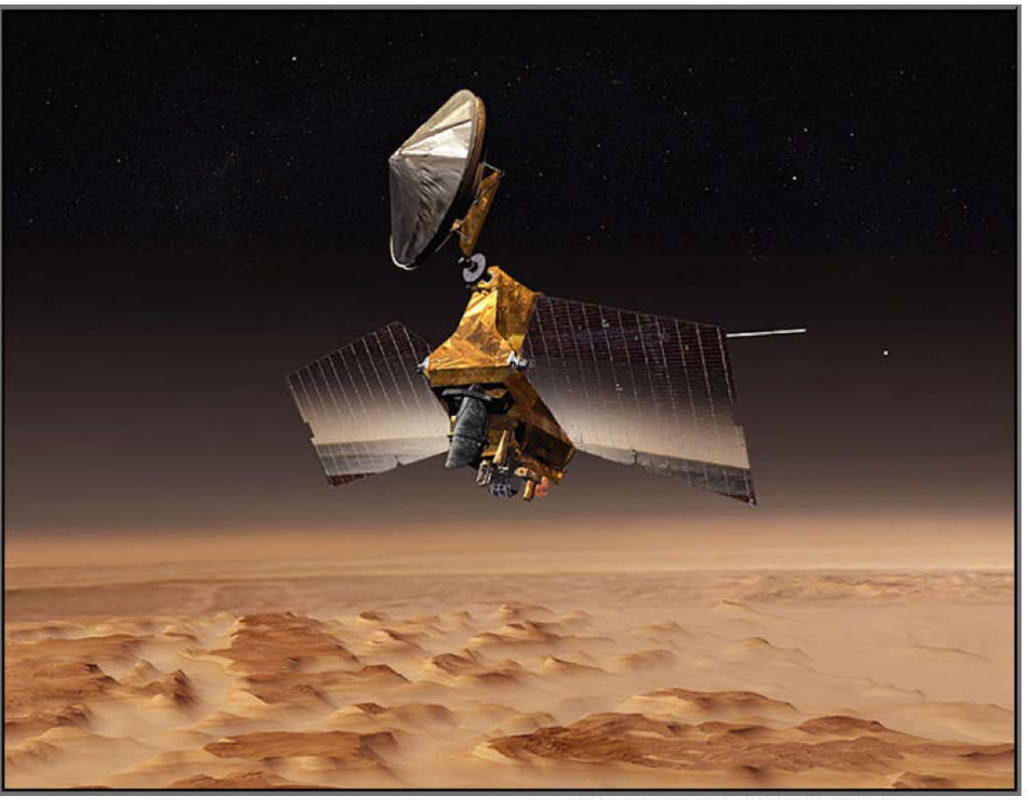


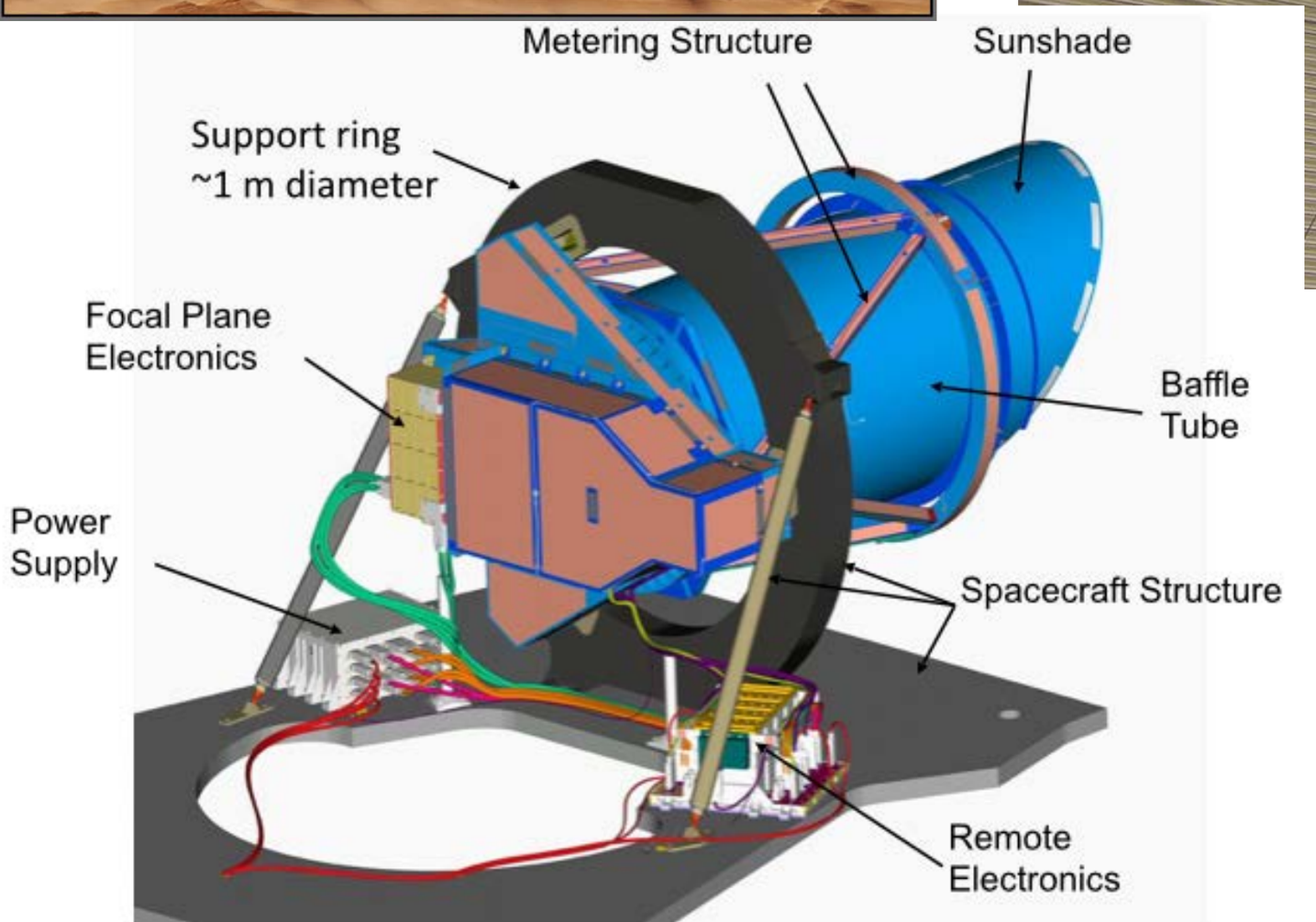
Other useful links and resources

- HiRISE website
- HiRISE Digital Terrain Models (DTMs) as well as locations with DTMs.
- Database for past suggested HiRISE images
- *Science Themes*
- HiWish: The High Resolution Imaging Science Experiment (HiRISE) Suggestion Tool. M. Chojnacki, A. S. McEwen, S. Byrne, C. Hansen, I. J. Daubar, R. Beyer, G. McArthur. LPSC (2020), Abstract #2095

BACKUP

Mars Reconnaissance Orbiter/HiRISE





- S/C orbital motion (Nadir) “pushes” sensor projection across ground

- Line integration timing is identically matched to orbital ground speed (~3.2 km/s or 19,200 mph!)

- 25-32 cm/pixel (1 foot)

- Sensor (linear array of pixels) integrates during motion of single pixel: ~0.0001 second!

- Launch date: August 12, 2005
-

The Planning Cycle - why is it so Complex?

- Complex planning cycle that requires several iterations between instrument teams and project to come up with final plan for the cycle - why?
  - Must balance diverse science objectives of the instrument teams -> complex planning process!
    - Spacecraft rolls are a limited resource that the teams compete for (time to roll to off-nadir and back is really the limiting factor)
    - HiRISE, CTX, CRISM, & SHARAD all want the s/c to roll to their specific targets, while MCS and MARCI want the s/c to stay nadir-pointing
  - Coordinated science is extremely high priority
    - Allowing instruments to coordinate with each other and “ride-along” on observations of other instrument teams requires multiple target deliveries from instrument teams

Target Information

- Target information includes lat-lon, science theme, resolution, season, request for stereo, and science rationale
- Stored in a database used for planning, end-to-end traceability, and linked to final acquired observations