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# Landing Site Considerations Related to the Potential Sample Retrieval and Launch Mission

August 4, 2015

Austin Nicholas

Pre-Decisional: For planning and discussion purposes only.

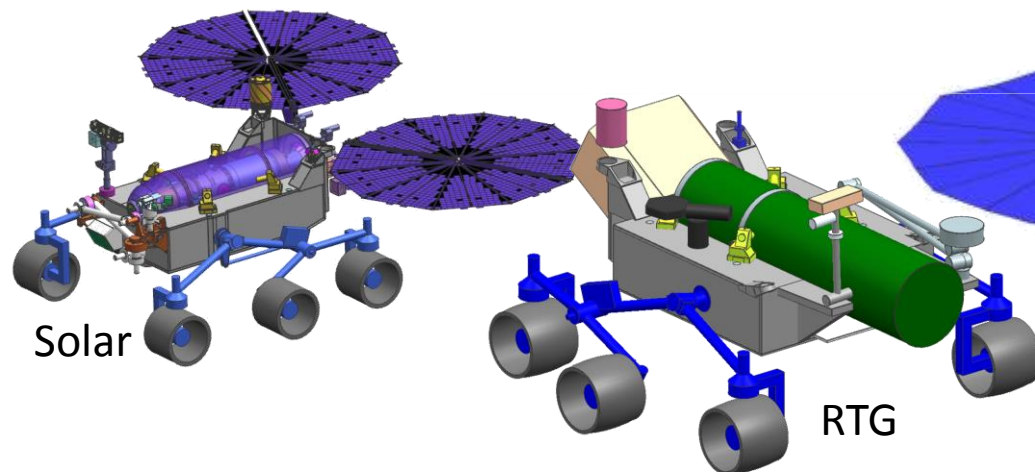
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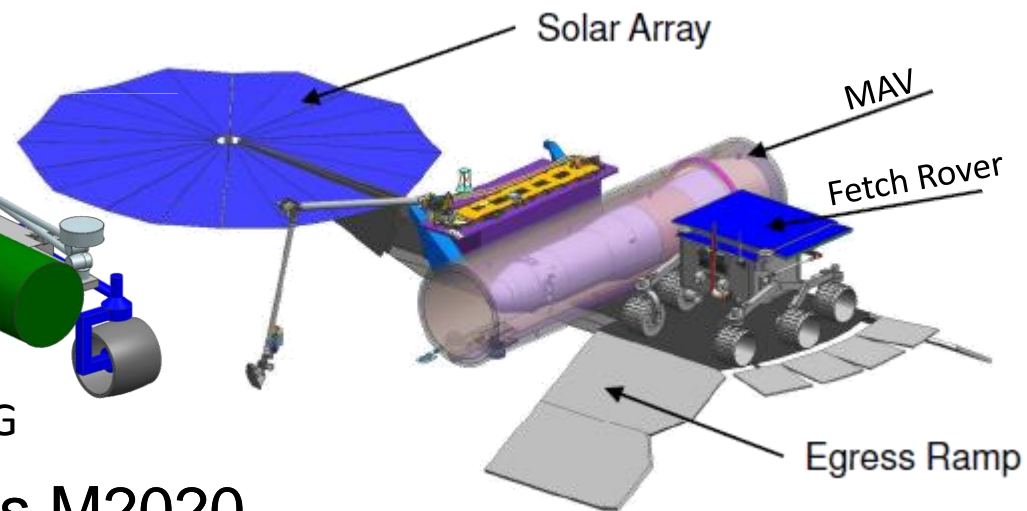
- Mars Program Requirements Review (July 2014) addressed the implications of M2020 design/operations on potential future Mars Sample Return-related missions
  - The fundamental direction received was that **future missions will be designed to successfully operate at the landing site chosen for M2020**
- In today's discussion, we are quite clear that:  
**Future Mars mission considerations should not be treated as constraints on M2020 landing site selection**
  - But we do want the community to understand these considerations!
- Three major areas of influence
  - EDL
  - Traversability
  - Latitude

} We will address these factors in the next few slides

## Mobile MAV Concept



## Platform + Fetch Concept



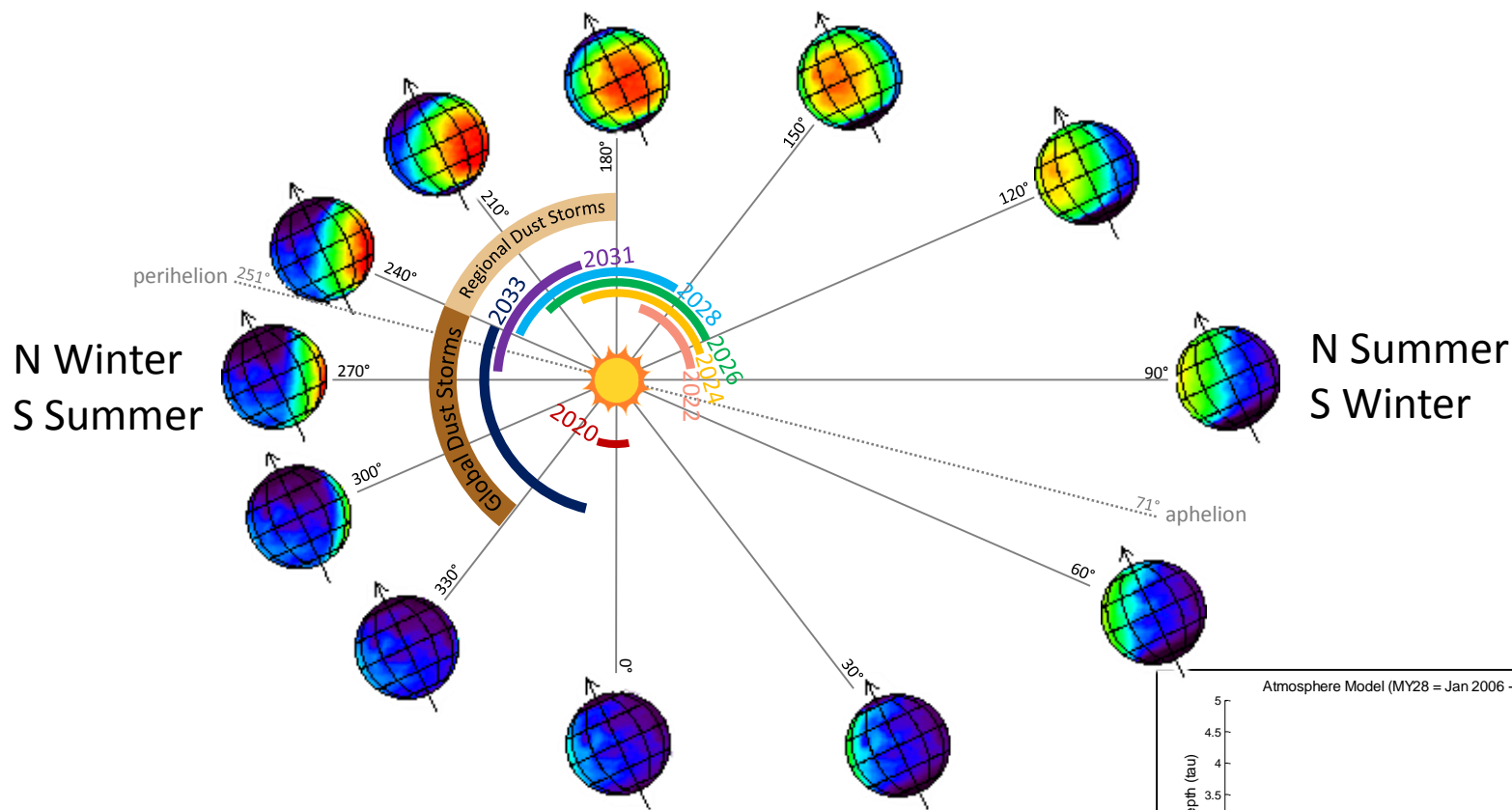
- Land near the same site as M2020
  - Traverse to location(s) of tubes
  - Pick up tubes from the ground
  - (Return to landing site, if fetch)
  - Load tubes into MAV
  - Launch MAV
- Affected by landing site choice

# SRL Arrival Opportunities, 2020-2033

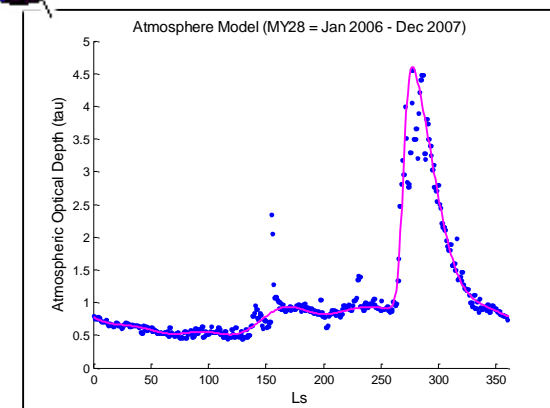


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Mars Formulation

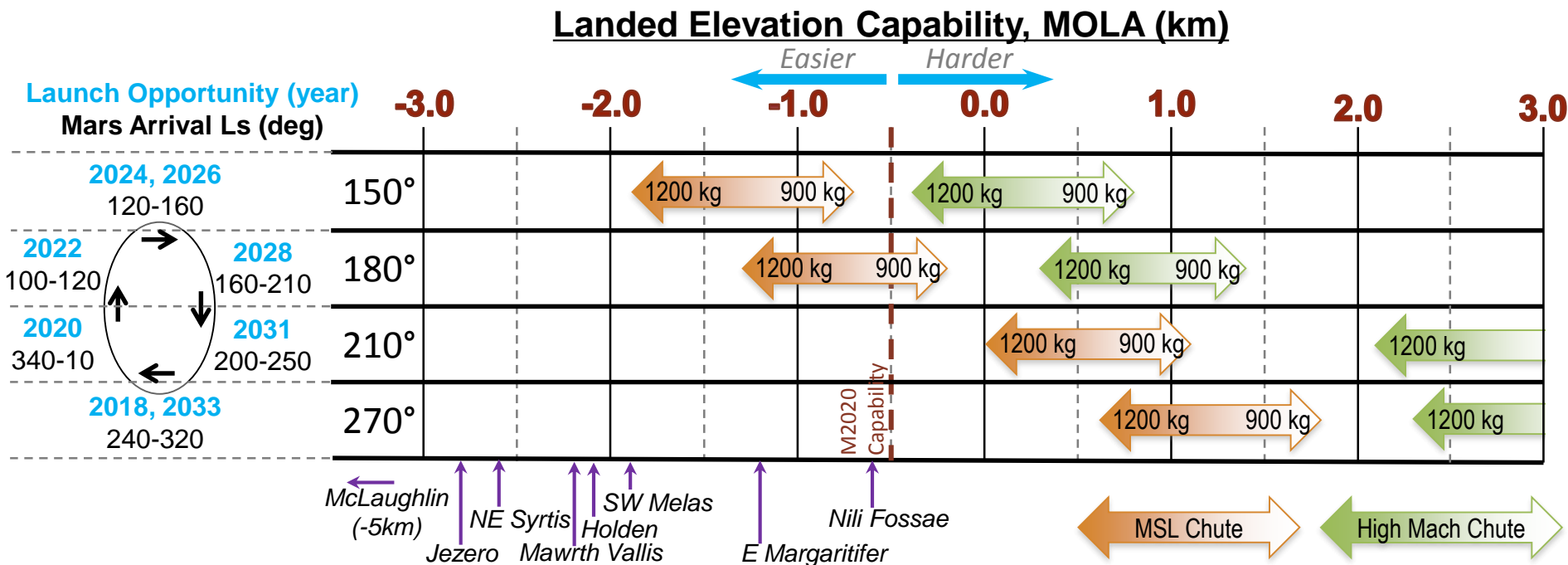


Likely SRL opportunities arrive in northern fall and winter, which makes northern landing sites more challenging from thermal and solar power perspectives.



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- Assume an M2020-like EDL system with similar capability
  - Elevation
  - Accuracy
  - Obstacle/Slope Tolerance
  - TRN (if M2020 uses it)



# Revisit Traverse Analysis for SRL



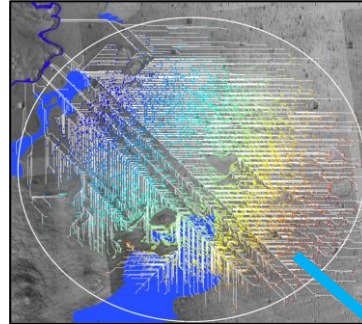
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Mars Formulation

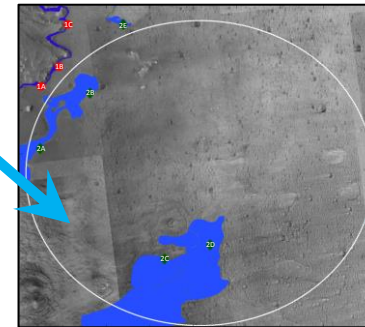
1. Simulate M2020
2. Identify ROIs visited
3. Cluster ROIs for analysis
4. Identify revisit cases
5. Simulate each SRL revisit
6. Combine statistics

\*Using M2020 Traversability Tools (MTTT)

## M2020 Drive Simulation



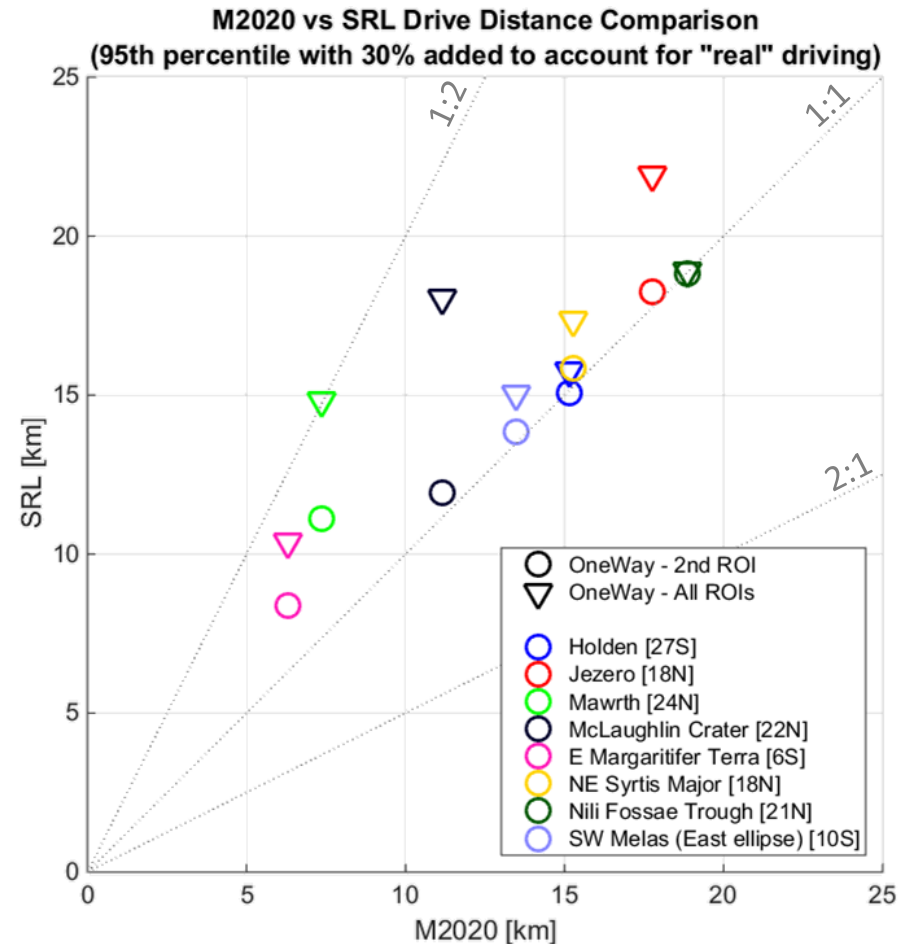
## Tube Locations



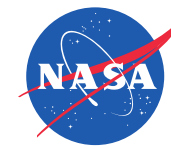
# SRL Traverse Results



- When dropping all prime mission tubes at the 2<sup>nd</sup> ROI visited, **SRL traverse distances are similar to M2020**
- SRL drive distances at Mawrth, McLaughlin and Margaritifer are longer than M2020, but still shorter than all other sites
- Results shown for one-way, round trip traverse distances are approximately double



- Three major areas:
  - **EDL** — higher altitude landing sites are more challenging
    - Future opportunities may have less favorable atmospheric conditions than 2020
  - **Traversability** — SRL considerations generally parallel M2020
  - **Latitude** — Northern latitude sites are more challenging for solar concepts



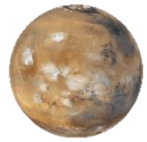
# Backup

# Mars Sample Return (Reference Concept)

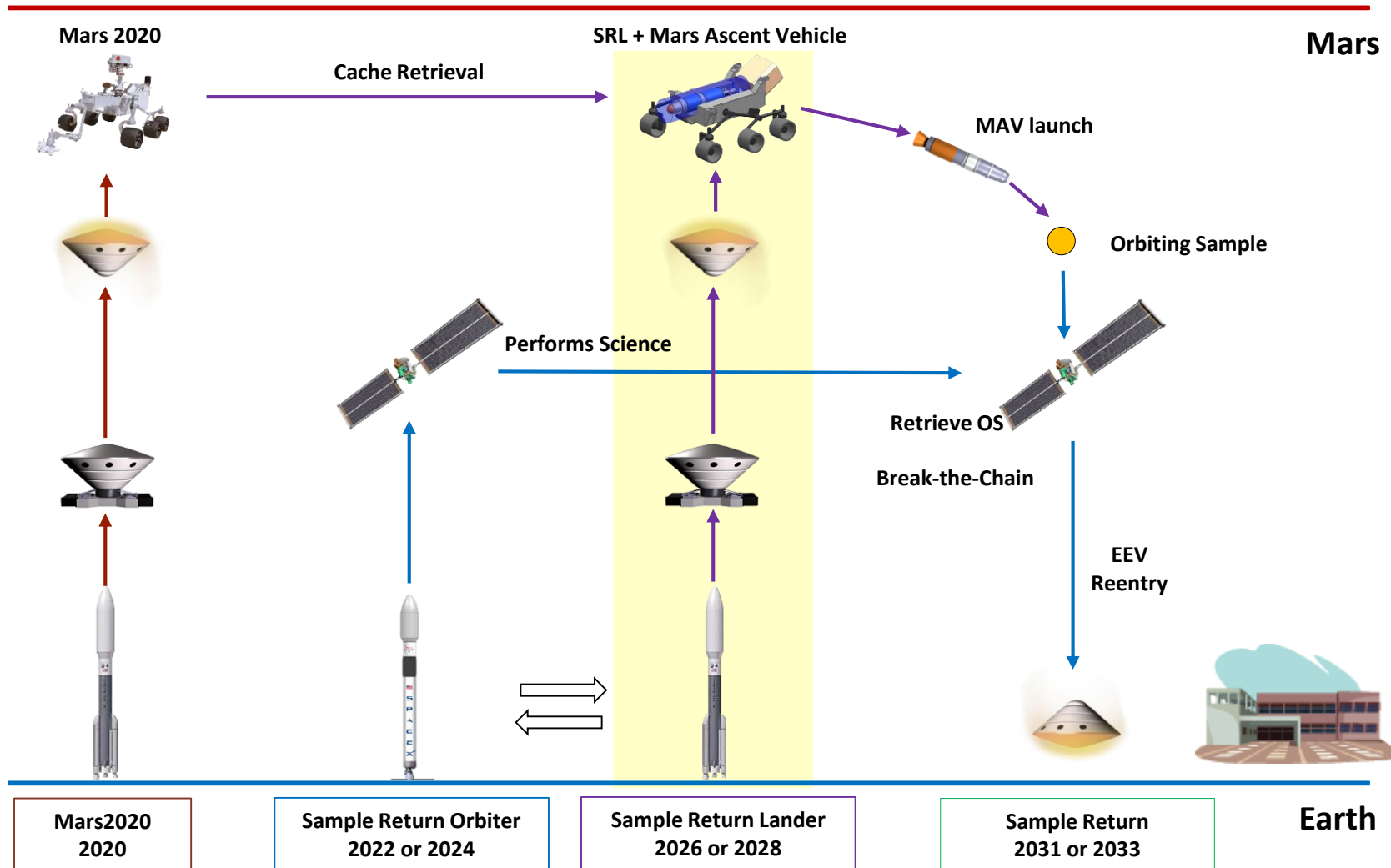


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Mars Formulation



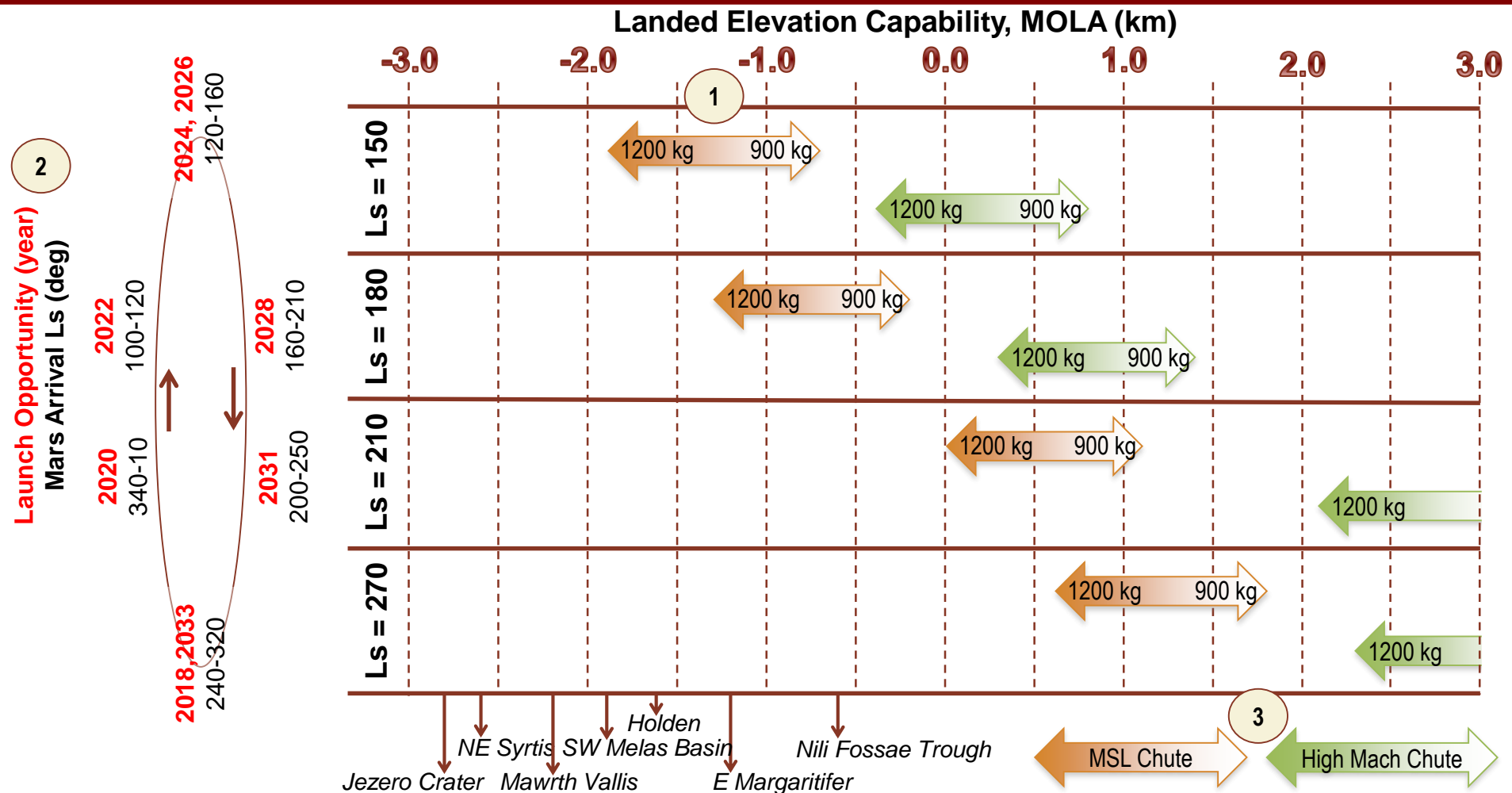
Mars



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# Summary of SRL Elevation Considerations

Mars Formulation

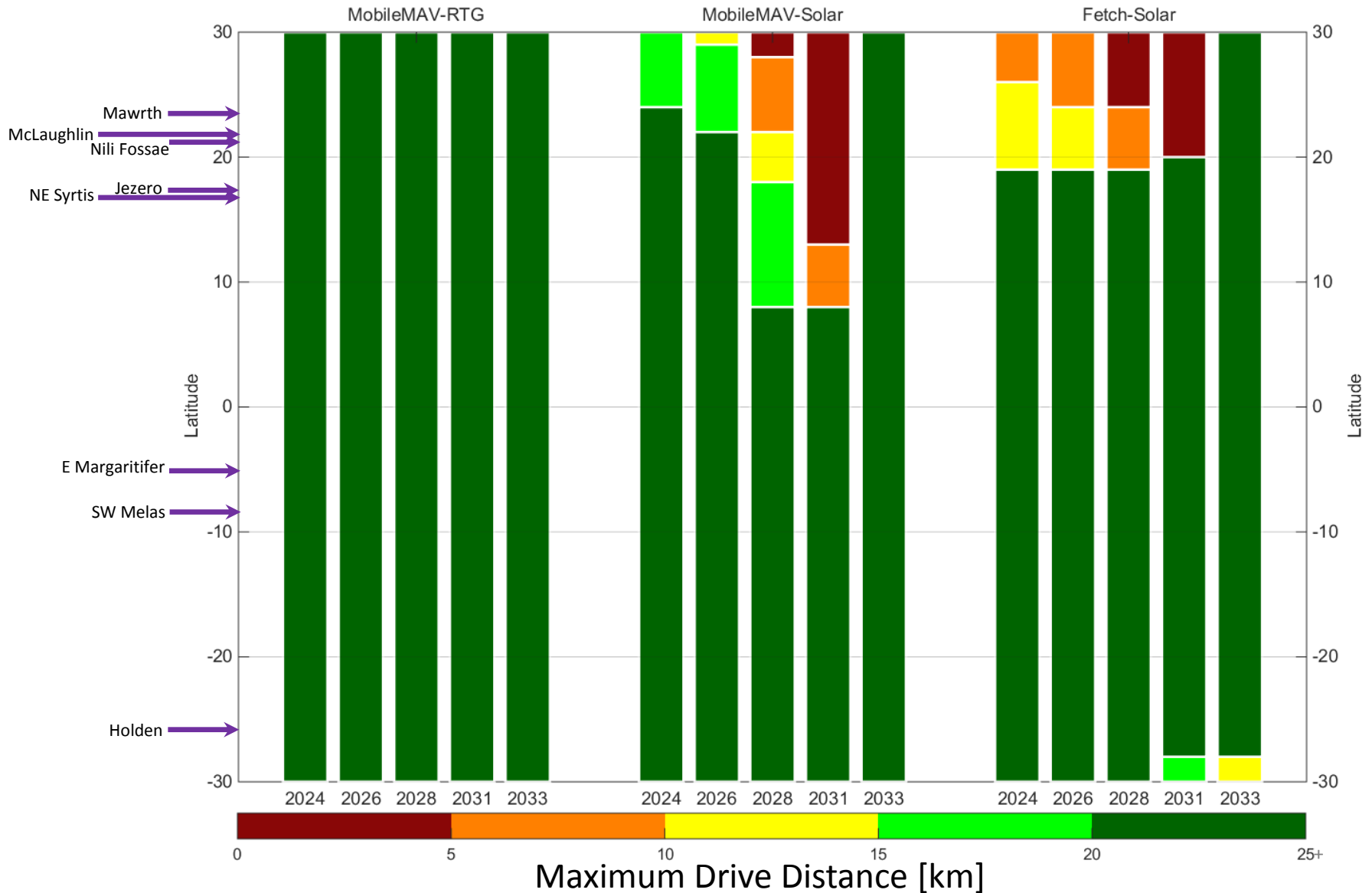


# Latitude and Opportunity Impacts to Surface Performance



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Mars Formulation



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# Revisit Traverse Analysis for SRL

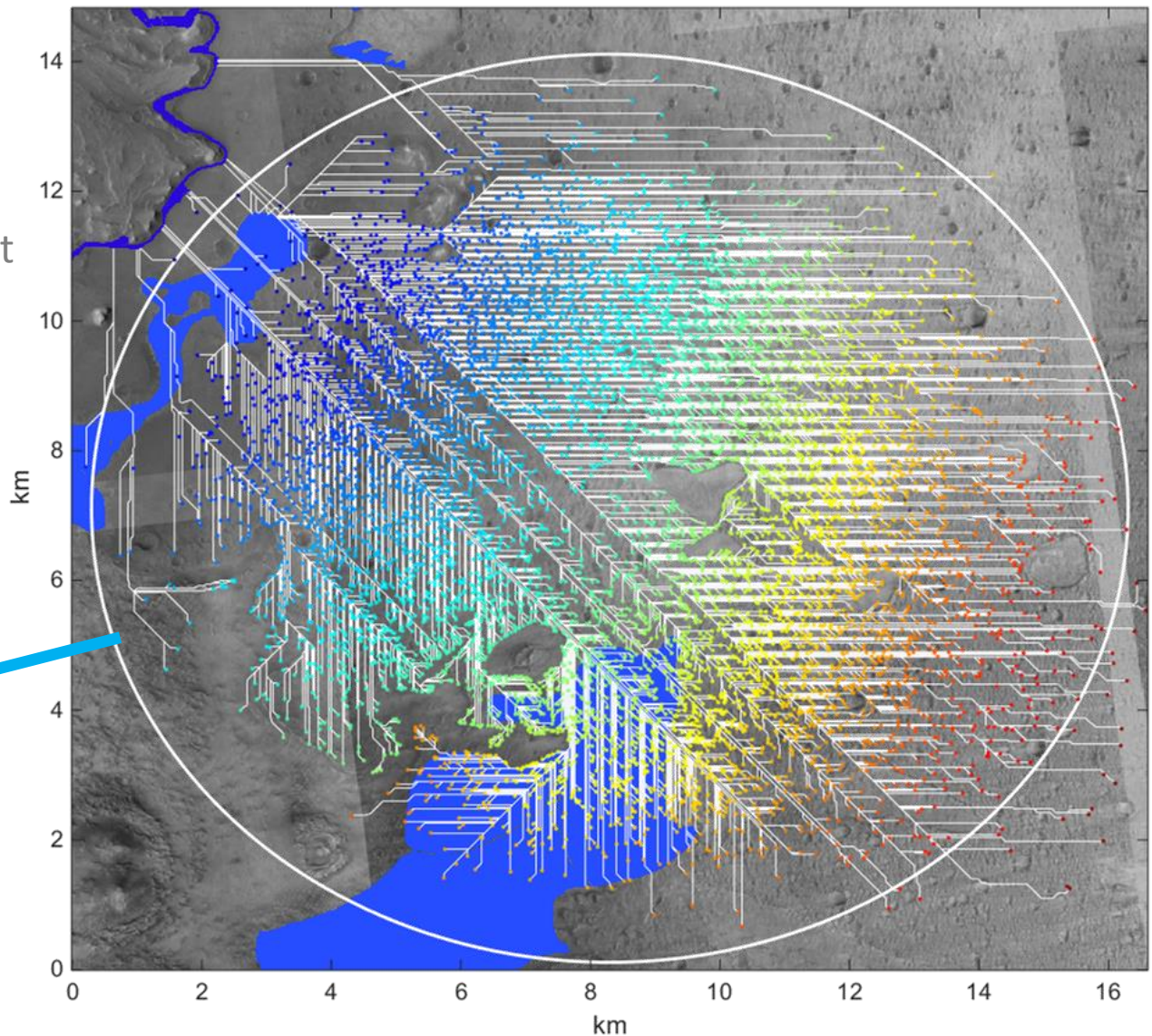
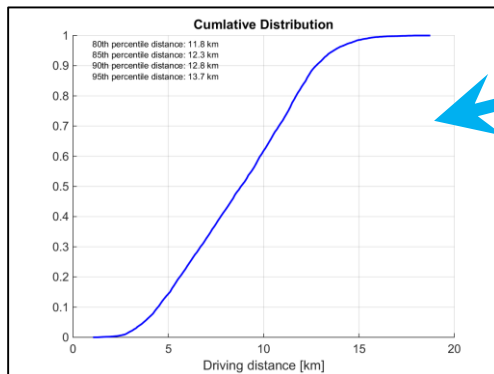


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Mars Formulation

1. Simulate M2020
2. Identify ROIs visited
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5. Simulate each SRL revisit
6. Combine statistics

M2020 CDF



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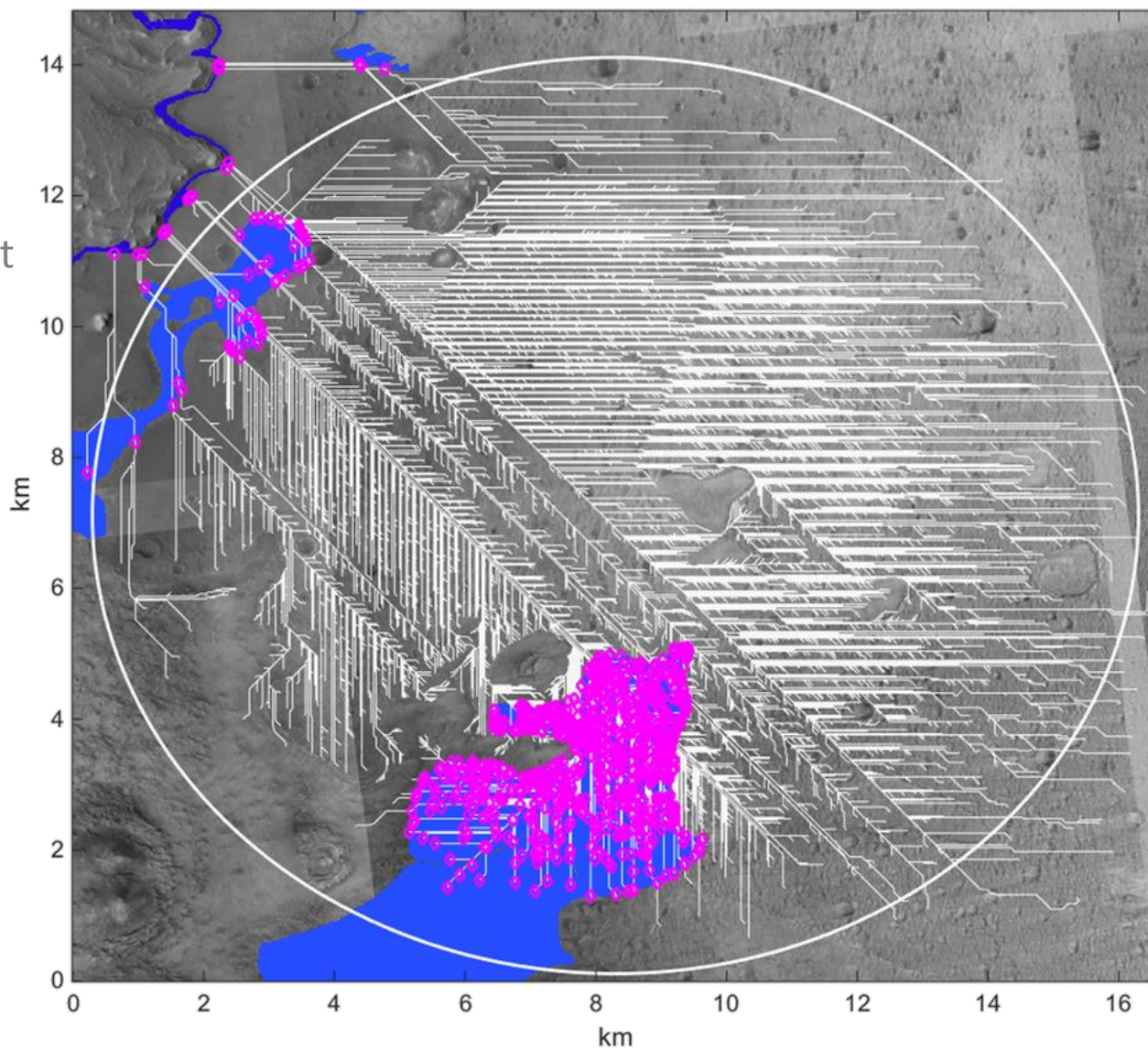
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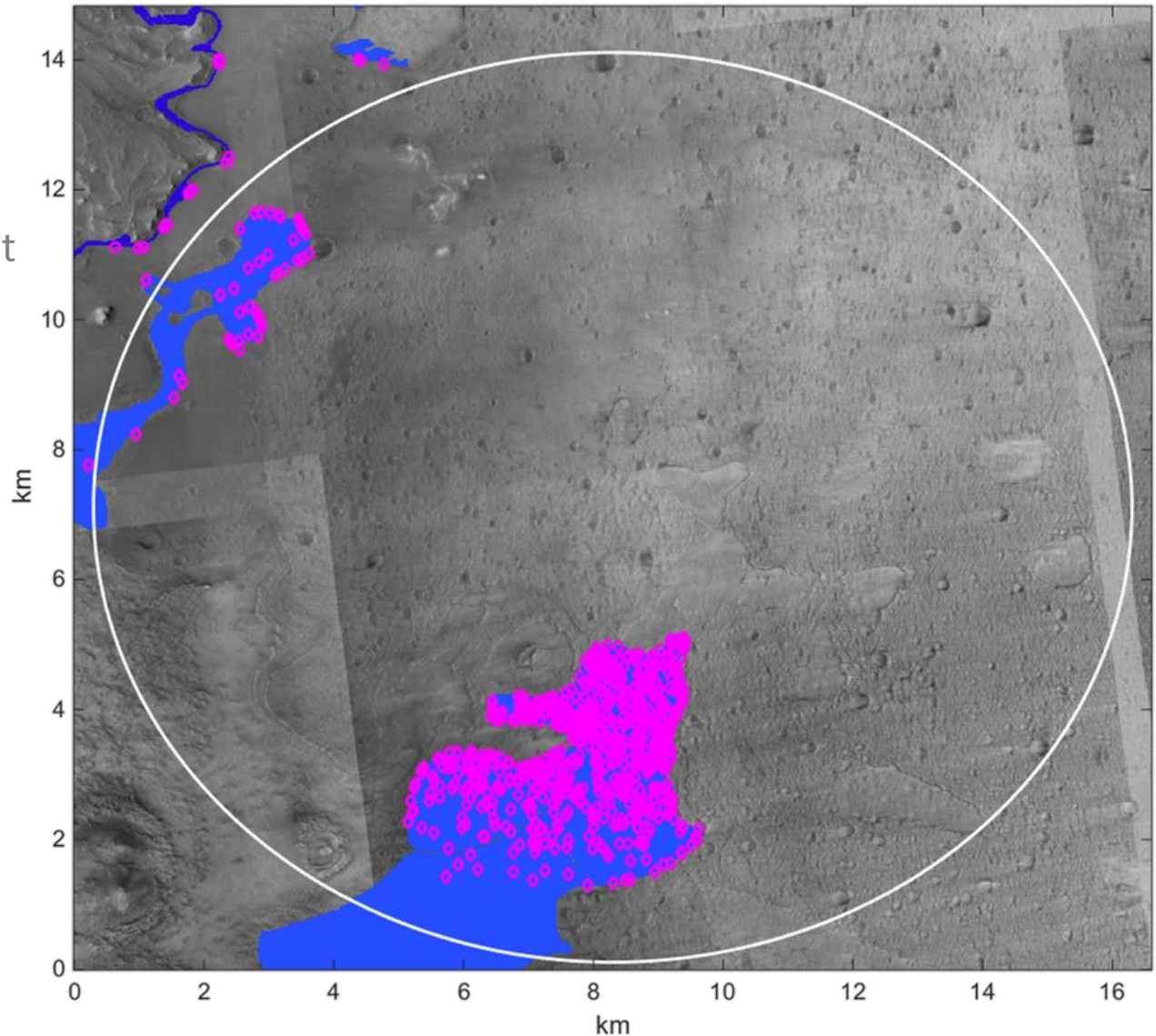
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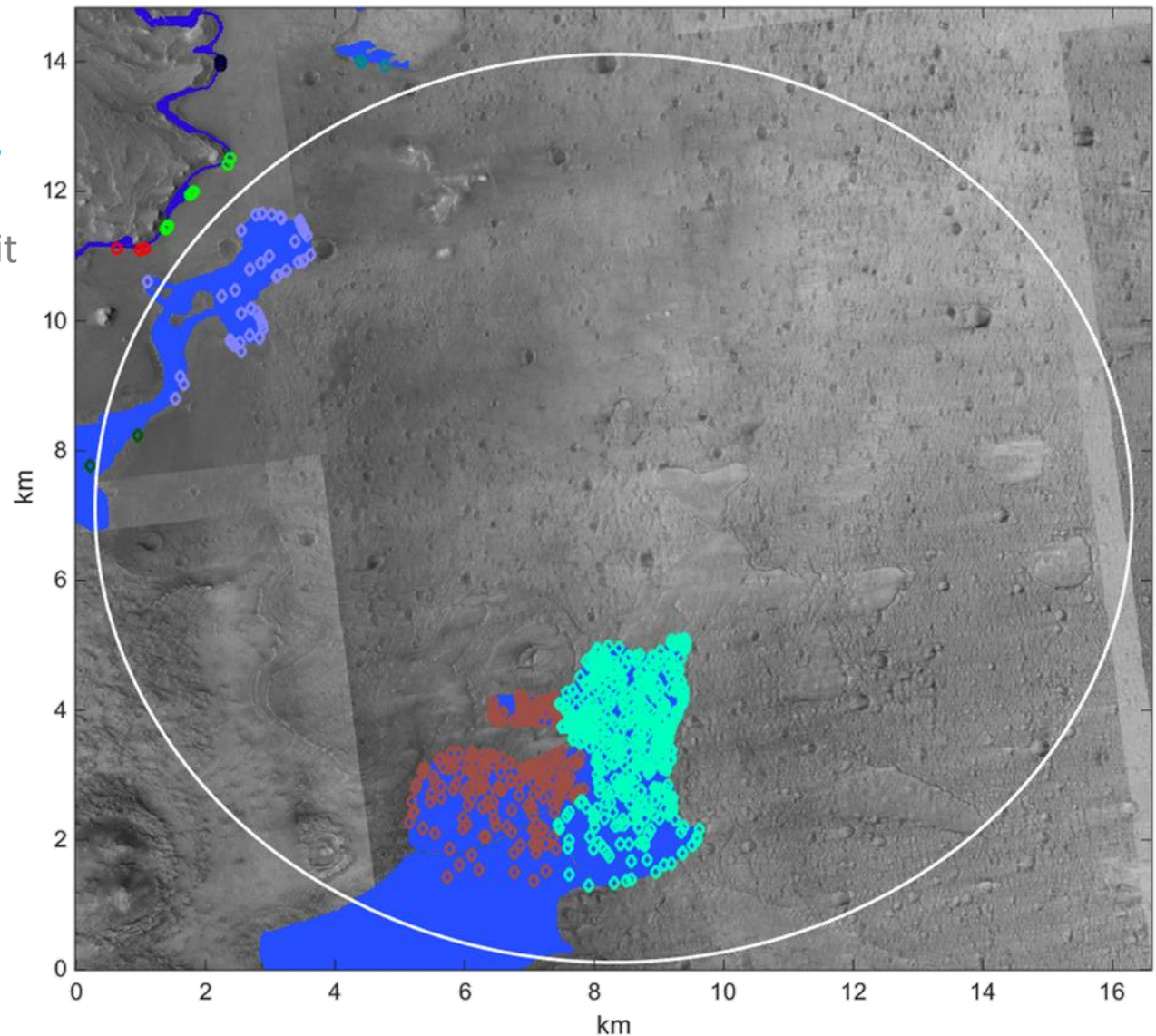
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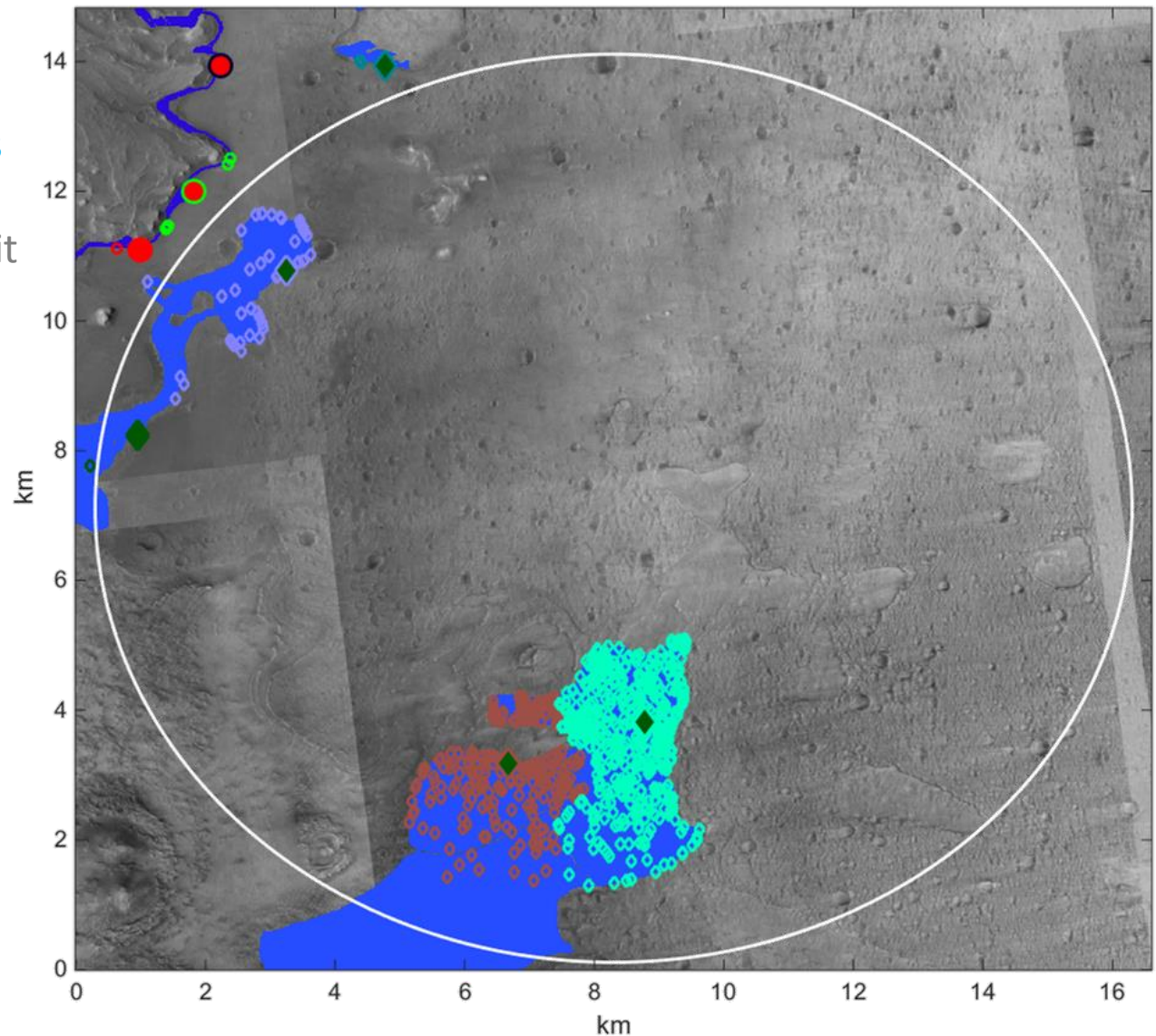
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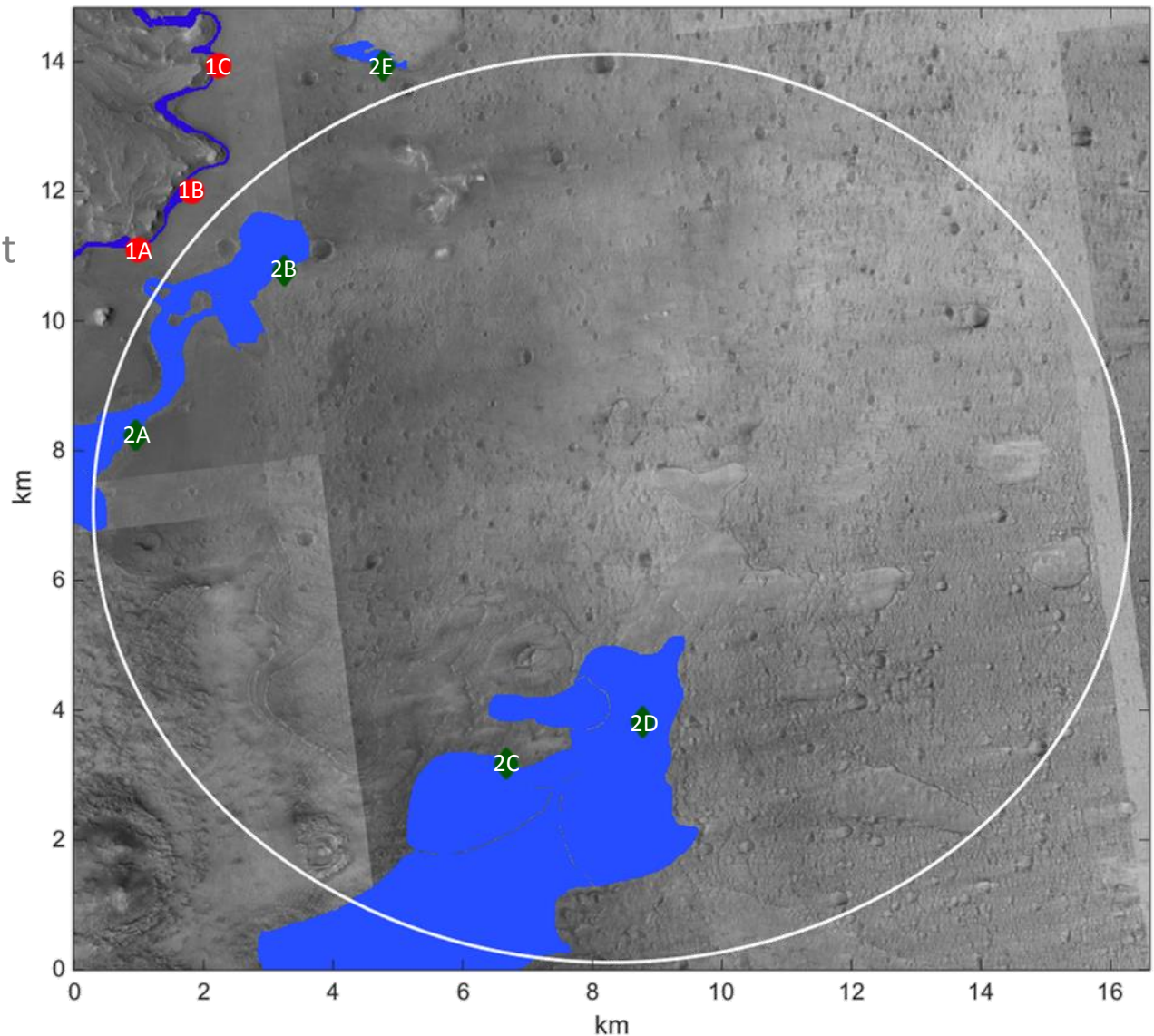


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Mars Formulation

1. Simulate M2020
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6. Combine statistics

Clusters	Frequency
1B 2B	79.0%
1B 2D	9.4%
1A 2B	7.0%
1B 2C	3.7%
1C 2E	0.5%
1A 2A	0.2%



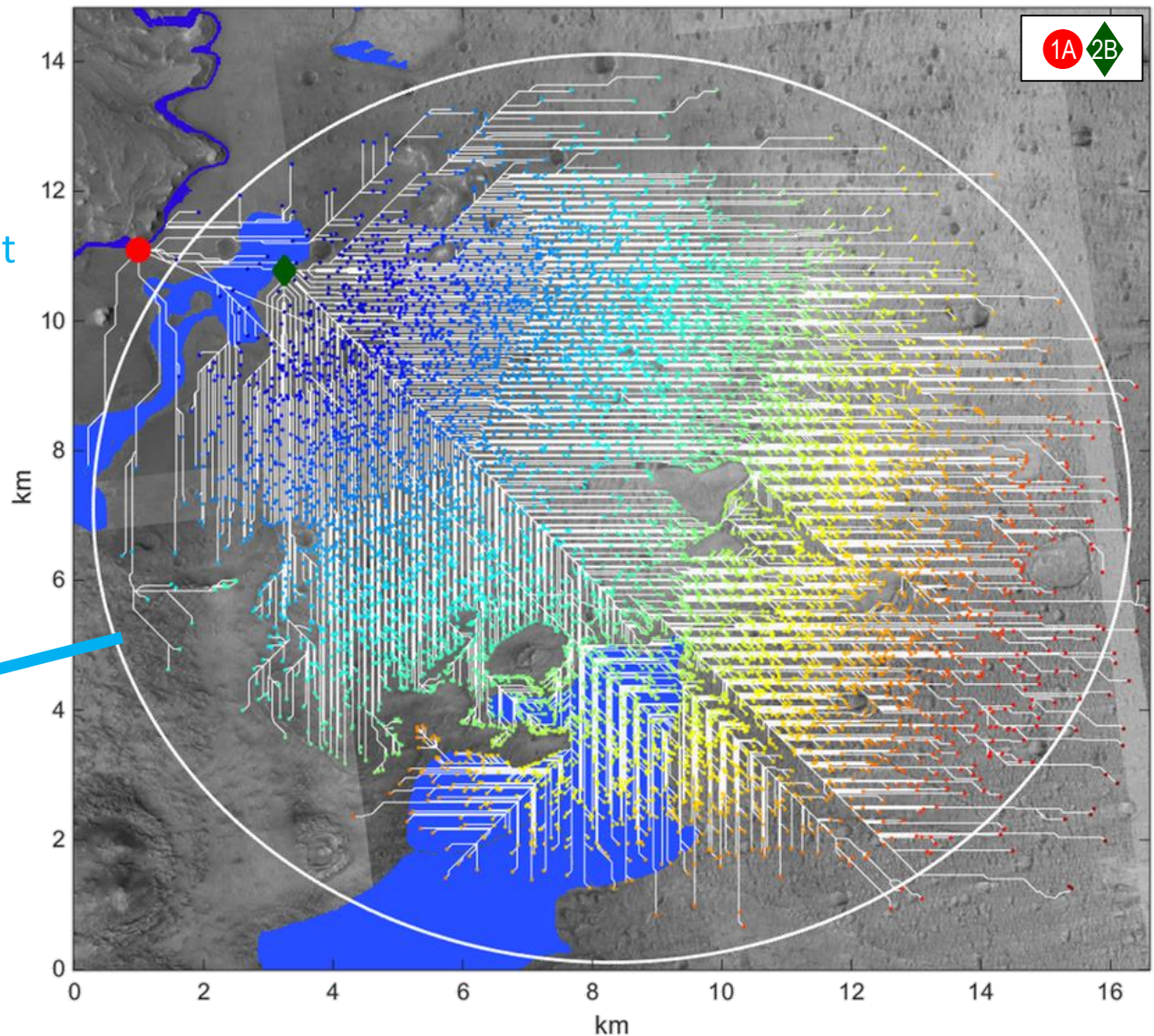
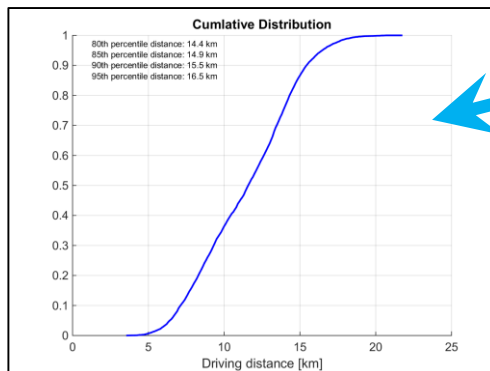
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# Revisit Traverse Analysis for SRL



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SRL CDF

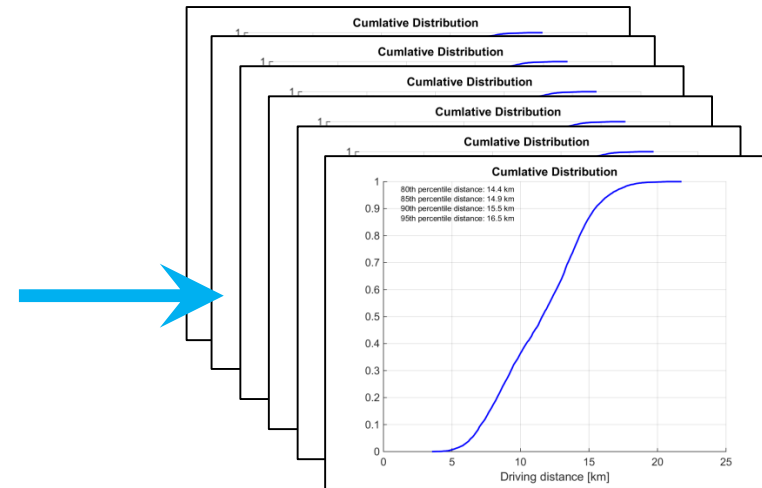
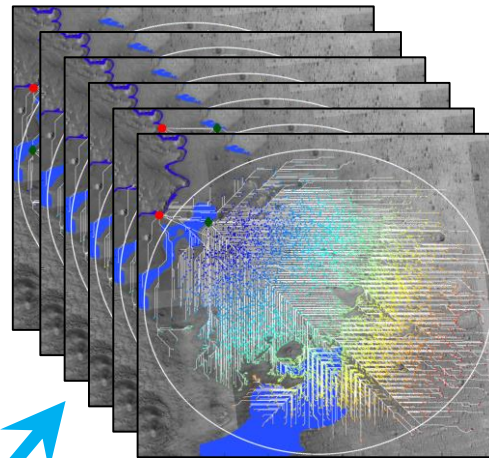


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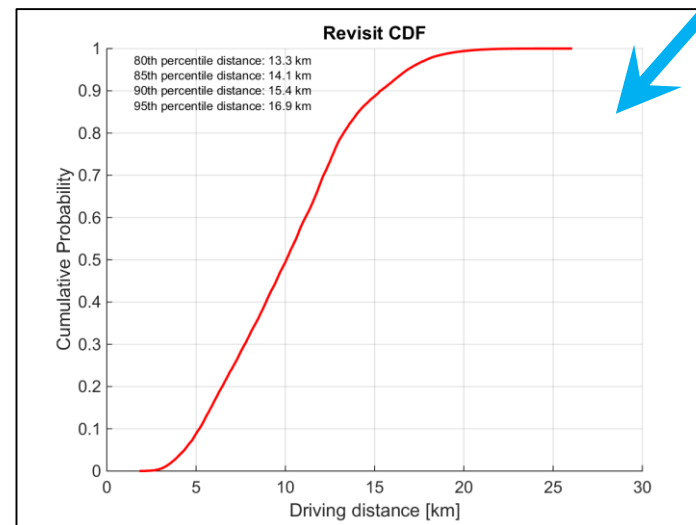
# Revisit Traverse Analysis for SRL



1. Simulate M2020
2. Identify ROIs visited
3. Cluster ROIs for analysis
4. Identify revisit cases
5. Simulate each SRL revisit
6. **Combine statistics**



Clusters	Frequency
1B 2B	79.0%
1B 2D	9.4%
1A 2B	7.0%
1B 2C	3.7%
1C 2E	0.5%
1A 2A	0.2%



# Drive Distance Results



Site	95th Percentile Drive + 30% for "Real" Driving						SRL Relative to M2020			
	M2020	SRL OneWay 2nd ROI	SRL OneWay All ROIs	SRL RoundTrip 2nd ROI	SRL RoundTrip All ROIs		SRL OneWay 2nd ROI	SRL OneWay All ROIs	SRL RoundTrip 2nd ROI	SRL RoundTrip All ROIs
Holden [27S]	15.1	15.1	15.8	30.2	30.9		1.0	1.0	2.0	2.0
Jezero [18N]	17.8	18.3	21.9	36.5	37.9		1.0	1.2	2.1	2.1
Mawrth [24N]	7.4	11.1	14.8	22.2	26.5		1.5	2.0	3.0	3.6
McLaughlin Crater [22N]	11.1	11.9	18.0	23.9	31.0		1.1	1.6	2.1	2.8
E Margaritifer Terra [6S]	6.3	8.4	10.4	16.8	19.9		1.3	1.6	2.7	3.1
NE Syrtis Major [18N]	15.3	15.8	17.4	31.7	32.8		1.0	1.1	2.1	2.1
Nili Fossae Trough [21N]	18.9	18.8	18.9	37.7	37.7		1.0	1.0	2.0	2.0
SW Melas [10S]	13.5	13.9	15.0	27.7	28.6		1.0	1.1	2.1	2.1

Site	Maximum Driving Capability [km] (1 Mars Year or Full Life)						
	RTG	Solar			Fetch (One-Way)		
		2026	2028	2031	2026	2028	2031
Holden [27S]	>25	>25	>25	>25	23.5	23.9	22.2
Jezero [18N]	>25	>25	15.8	5.2	>25	>25	>25
Mawrth [24N]	>25	18.2	9.3	0.1	10.0	5.6	0.5
McLaughlin Crater [22N]	>25	20.1	11.4	1.3	11.1	6.8	1.8
E Margaritifer Terra [6S]	>25	>25	>25	>25	>25	>25	>25
NE Syrtis Major [18N]	>25	>25	15.8	5.2	>25	>25	>25
Nili Fossae Trough [21N]	>25	21.3	12.5	2.5	12.0	7.5	2.5
SW Melas [10S]	>25	>25	>25	>25	>25	>25	>25

Site	Maximum Driving [Fraction of Requirement] (1 Mars Year or Full Life)						
	RTG	Solar			Fetch		
		2026	2028	2031	2026	2028	2031
Holden [27S]	>2	>2	>2	>2	1.6	1.6	1.5
Jezero [18N]	>2	1.4	0.9	0.3	>2	>2	>2
Mawrth [24N]	>2	1.6	0.8	0.0	0.9	0.5	0.0
McLaughlin Crater [22N]	>2	1.7	1.0	0.1	0.9	0.6	0.2
E Margaritifer Terra [6S]	>2	>2	>2	>2	>2	>2	>2
NE Syrtis Major [18N]	>2	1.6	1.0	0.3	>2	>2	>2
Nili Fossae Trough [21N]	>2	1.1	0.7	0.1	0.6	0.4	0.1
SW Melas [10S]	>2	>2	>2	>2	>2	>2	>2

- All results are preliminary
- Many assumptions
- Assumes no EDL accuracy improvements

# Drive Distances Plot

