A Regional View of Surface Spectral/Color Variability at the 2020 Candidate Sites Derived From CRISM Mapping Data

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4th Mars 2020 Landing Site Workshop
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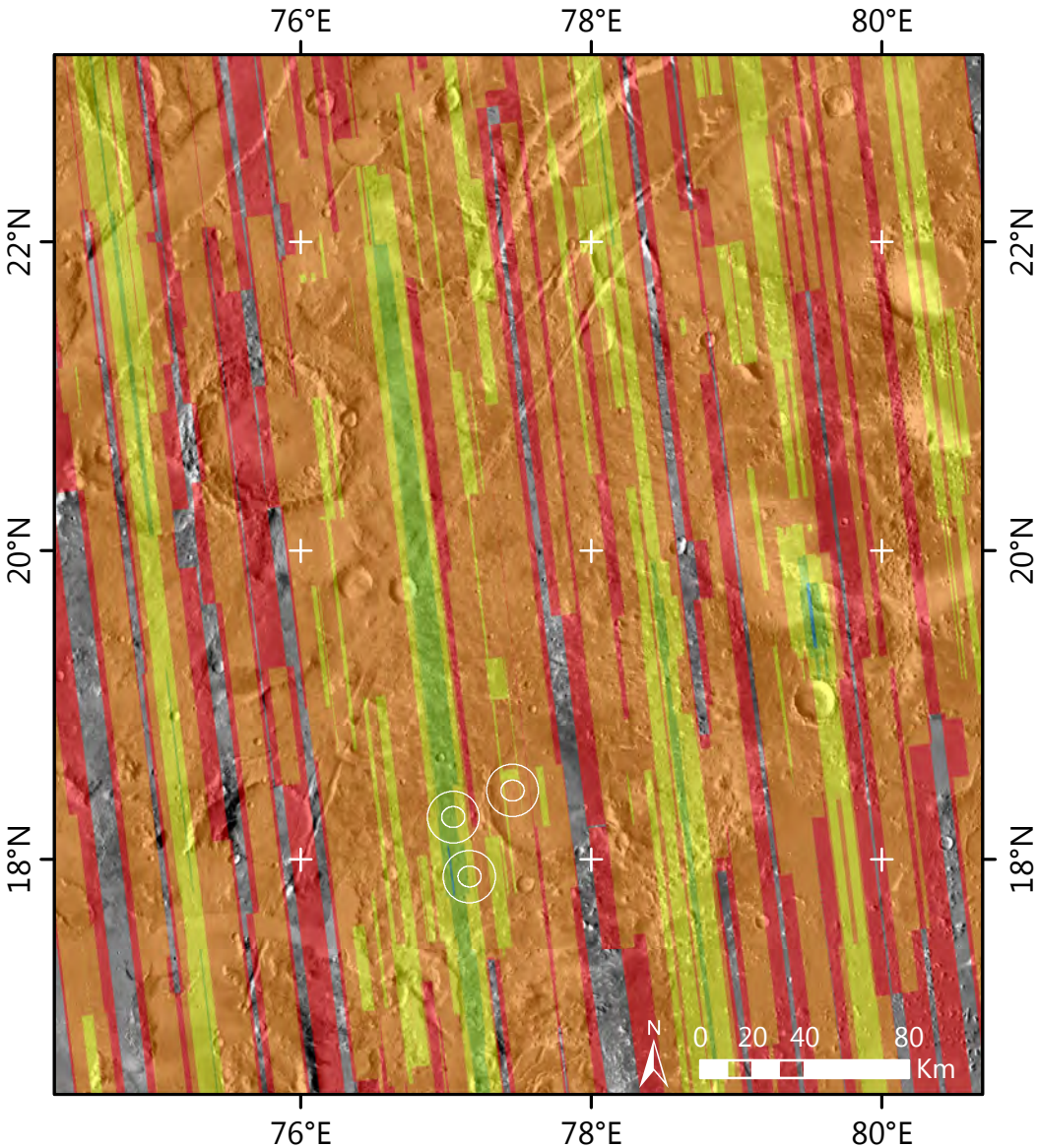
- CRISM Mapping Observations
  - Push-broom (gimbal nadir) data acquisition
    - "Noodles" rather than targeted observation "bow ties"
  - Multiple mapping observation class types
    - MSP – Multispectral Survey – VNIR+IR; 74 (19 + 55) channel; ~180 m/pxl
    - HSP – Hyperspectral Survey - VNIR+IR; 261 (107 + 154) channel; ~180 m/pxl
    - HSV – Hyperspectral Survey - VNIR; 107 channel; ~180 m/pxl
    - MSW – Multispectral Window - VNIR+IR; 74 (19 + 55) channel; ~90 m/pxl
    - MSV – 'Multispectral' VNIR – VNIR; 90 channel; ~ 90 m/pxl
  - Mapping data are designed to be assembled into mosaic products ("map-tiles") to **provide reduced spatial/(spectral) resolution/sampling context for hyperspectral targeted observations**
  - Current CRISM SOC development efforts involve the empirical radiometric reconciliation of the map-tile constituent observations to **improve radiometric consistency across the assembled products**

- The map-tile data products for the Mars 2020 candidate site region allow the surface spectral/color characteristics to be evaluated and compared in a common radiometric framework

CRISM Map Tile T1250

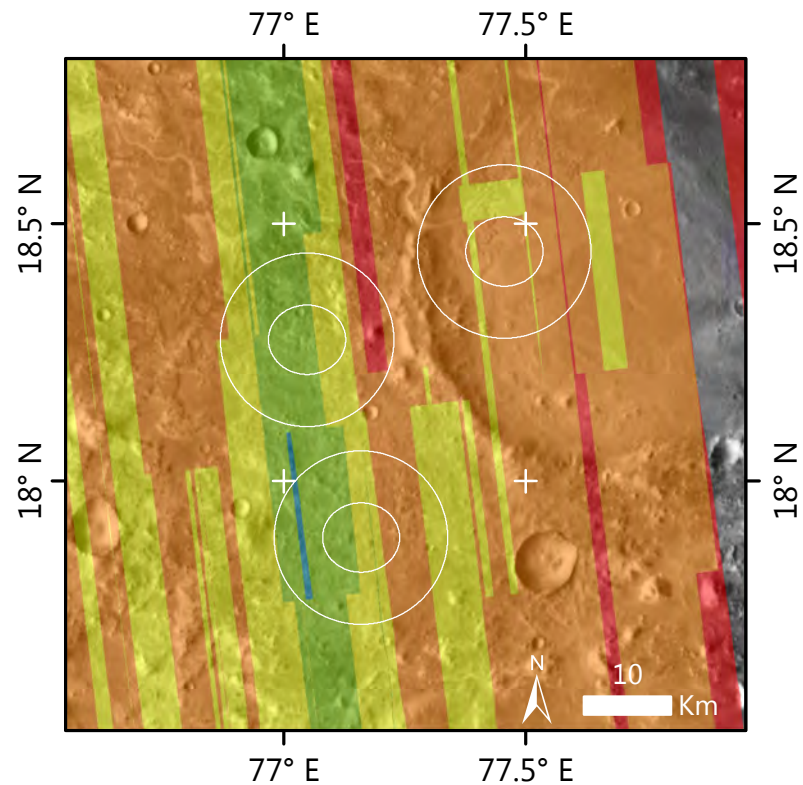


180 m/px VNIR (MSP, HSP, HSV)

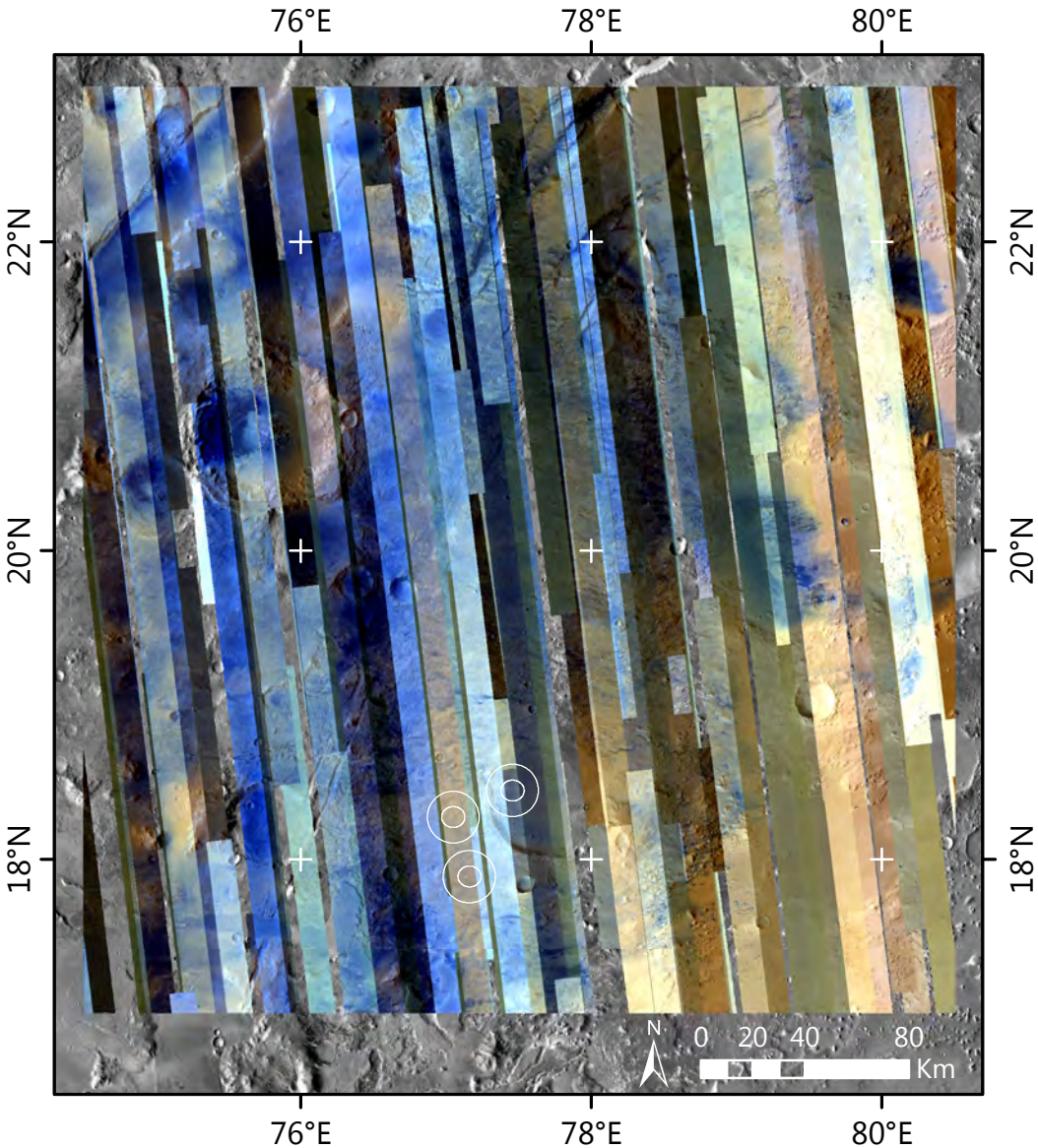
Data Density

Number of Overlapping Obs. (Max = 12)

- 1
- 2 – 4
- 5 – 7
- 8 – 10
- >10



CRISM Map Tile T1250



180 m/px VNIR (MSP, HSP, HSV)

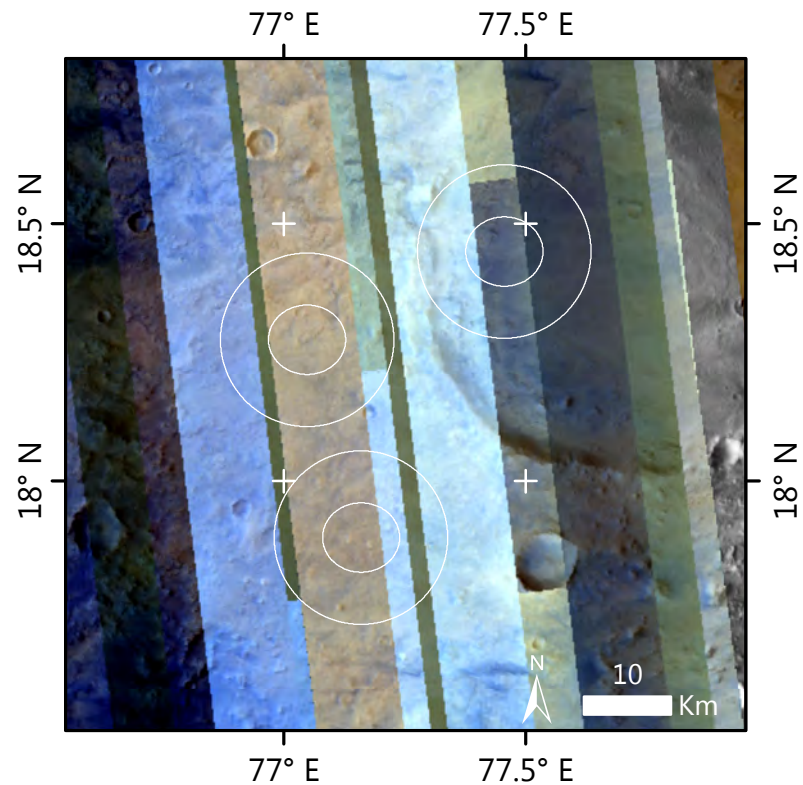
Data as Acquired

Stretch: linear 2% per band

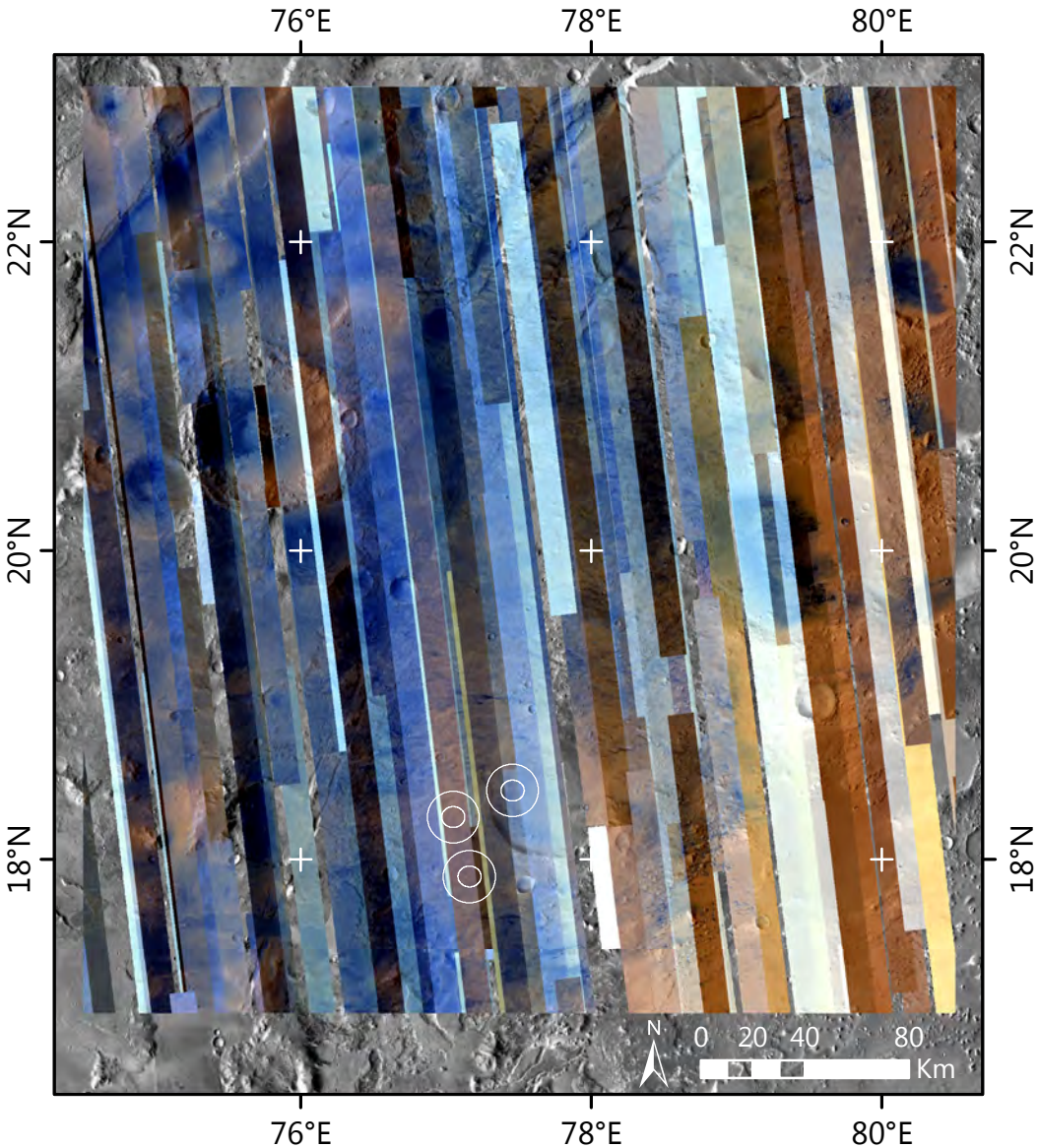
599 nm

534 nm

443 nm



CRISM Map Tile T1250



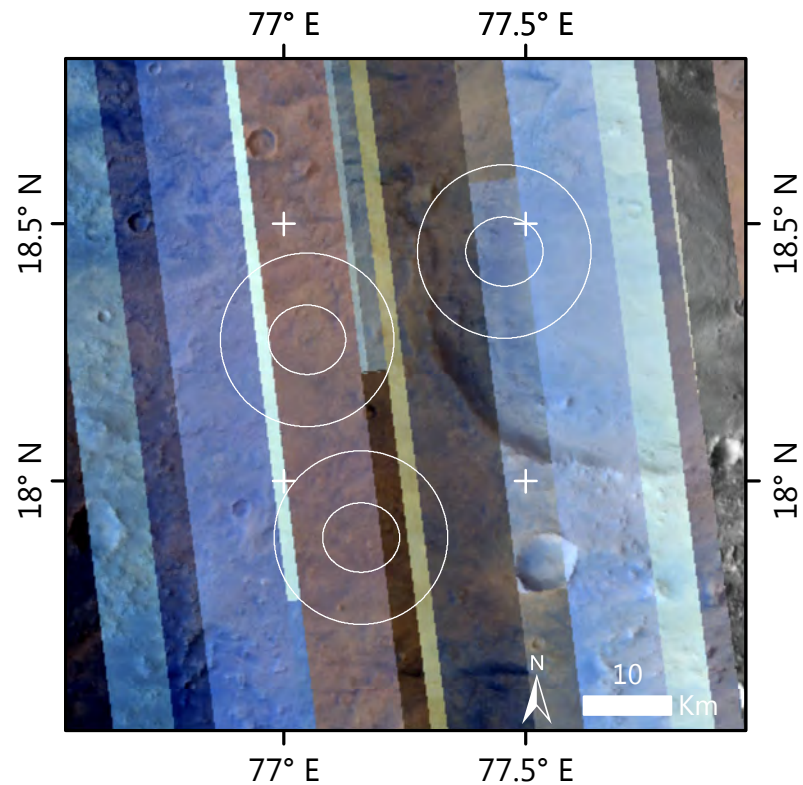
180 m/px VNIR (MSP, HSP, HSV)

Standard Hybrid Processing

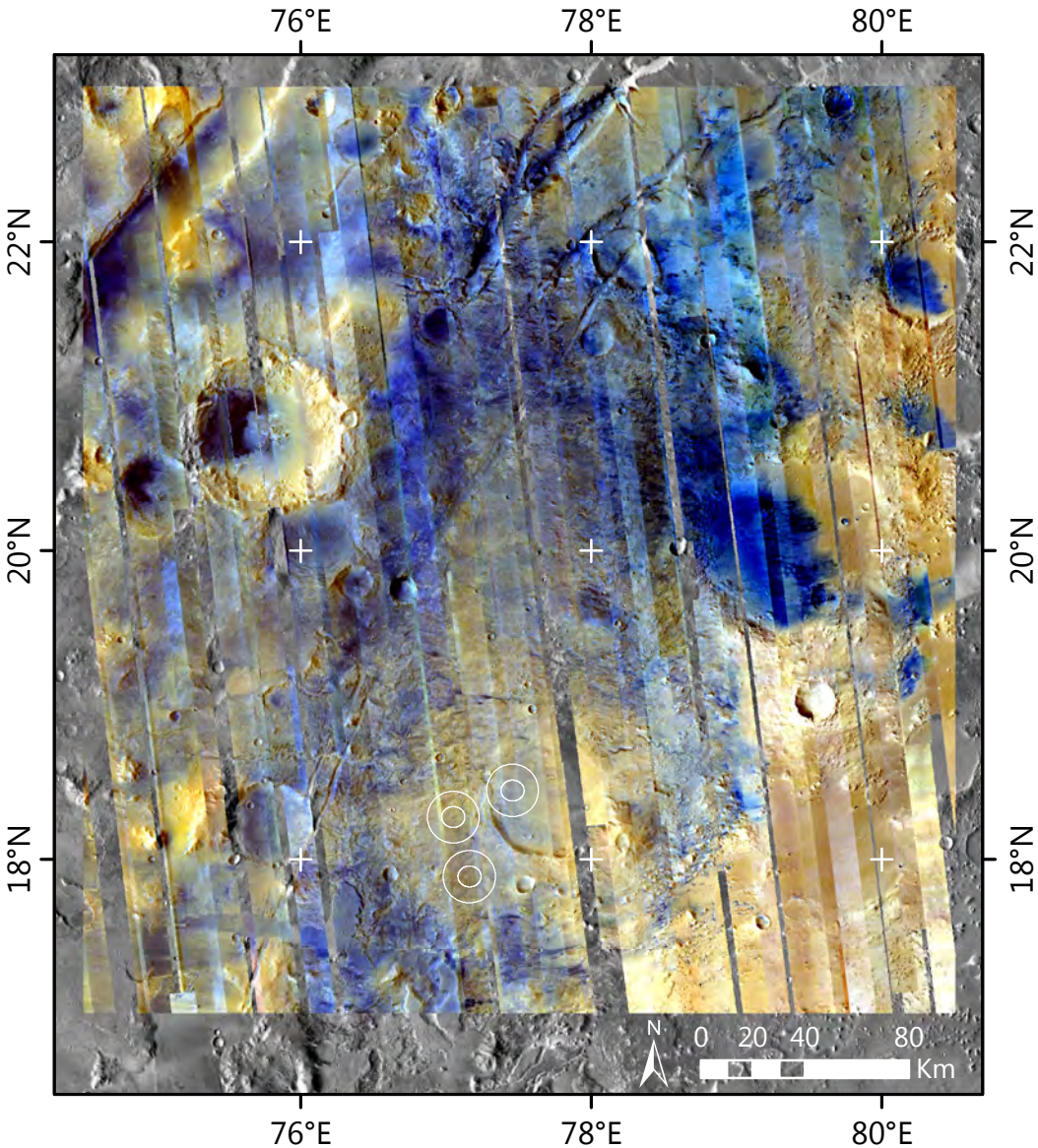
Optimization Input

Stretch: linear 2% per band

- 599 nm
- 534 nm
- 443 nm



CRISM Map Tile T1250



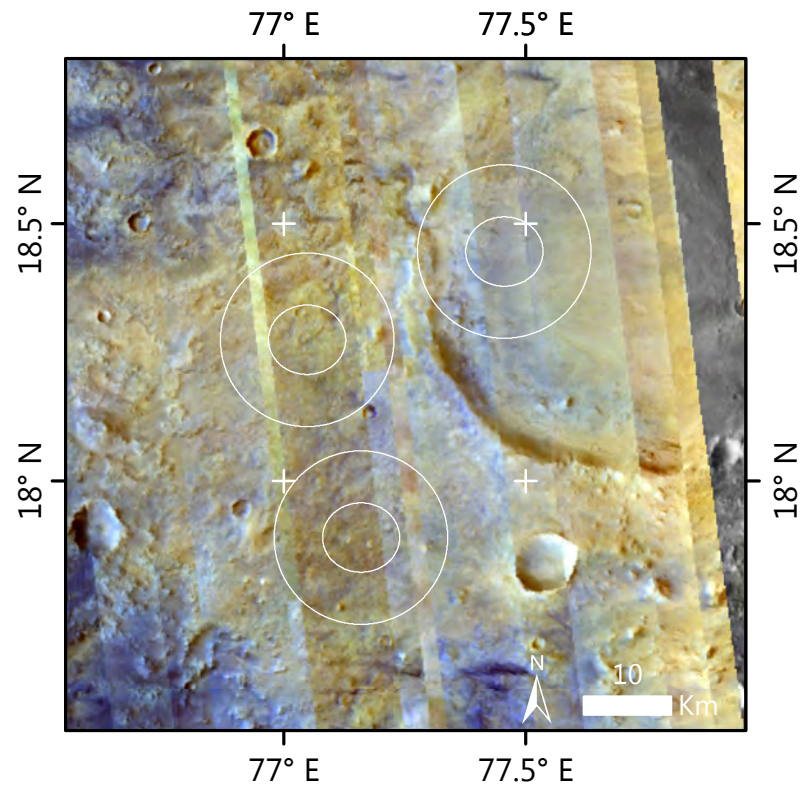
180 m/px VNIR (MSP, HSP, HSV) Optimization Result

Stretch: linear 2% per band

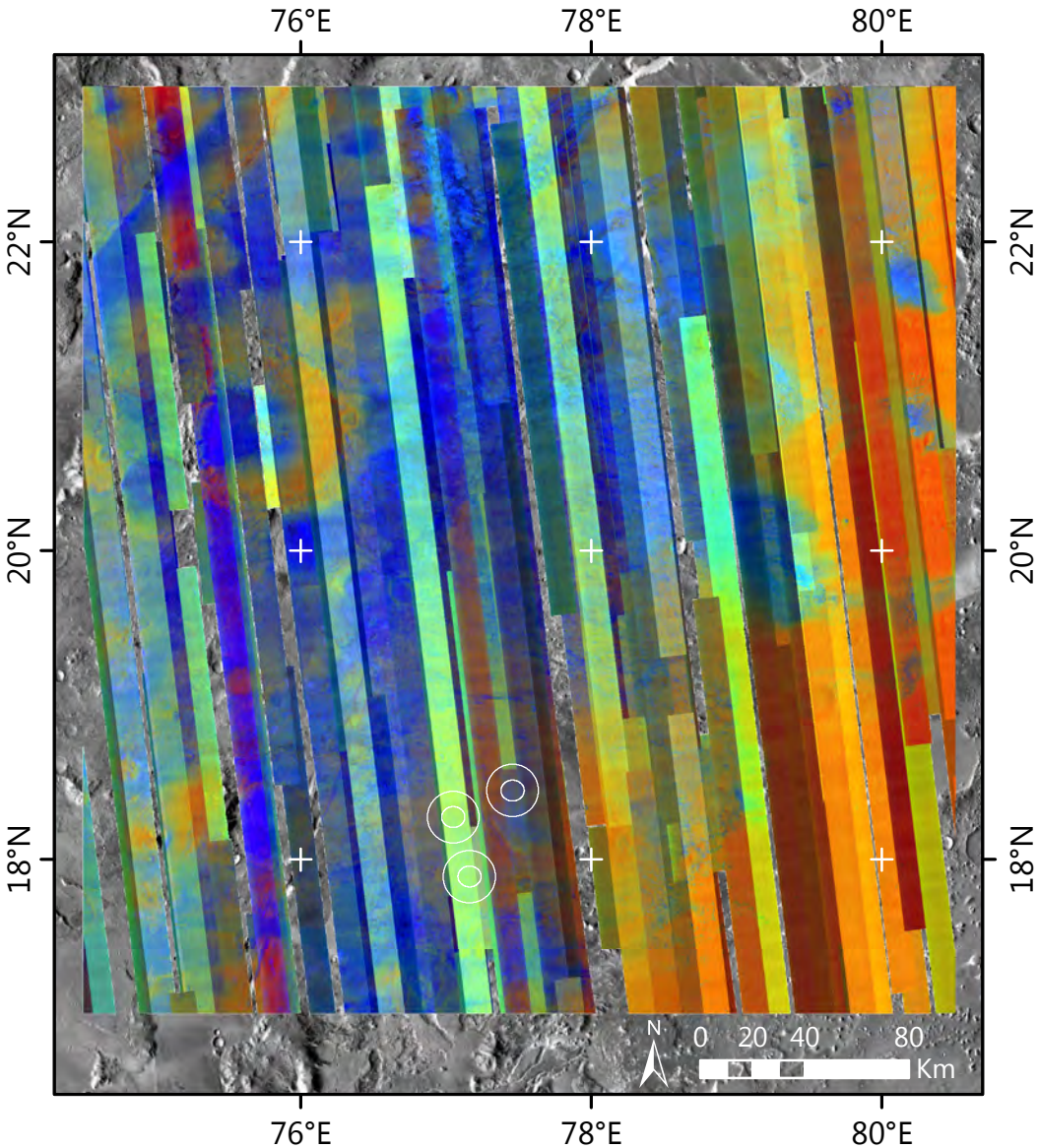
599 nm

534 nm

443 nm



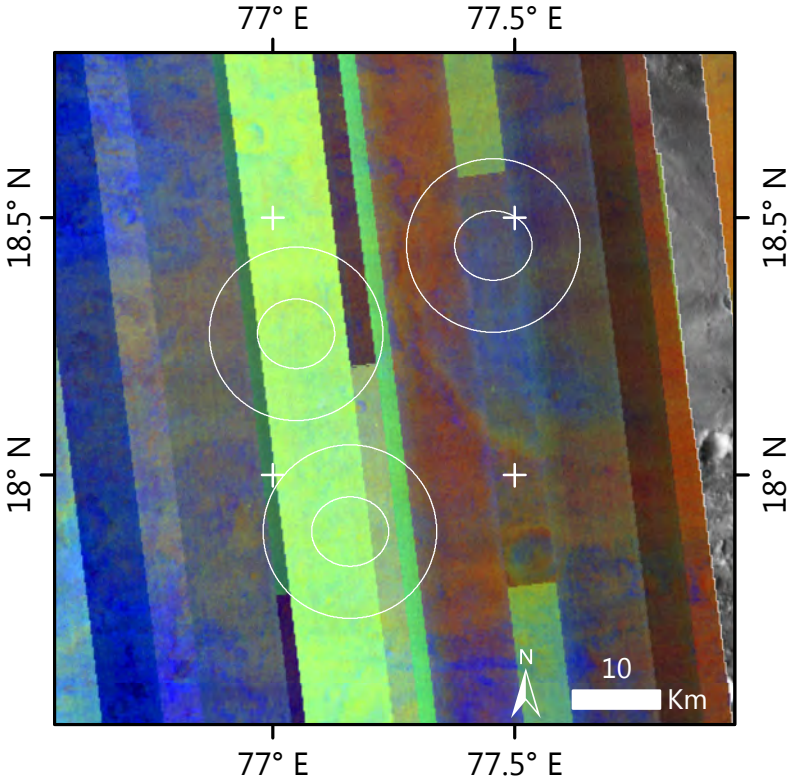
CRISM Map Tile T1250



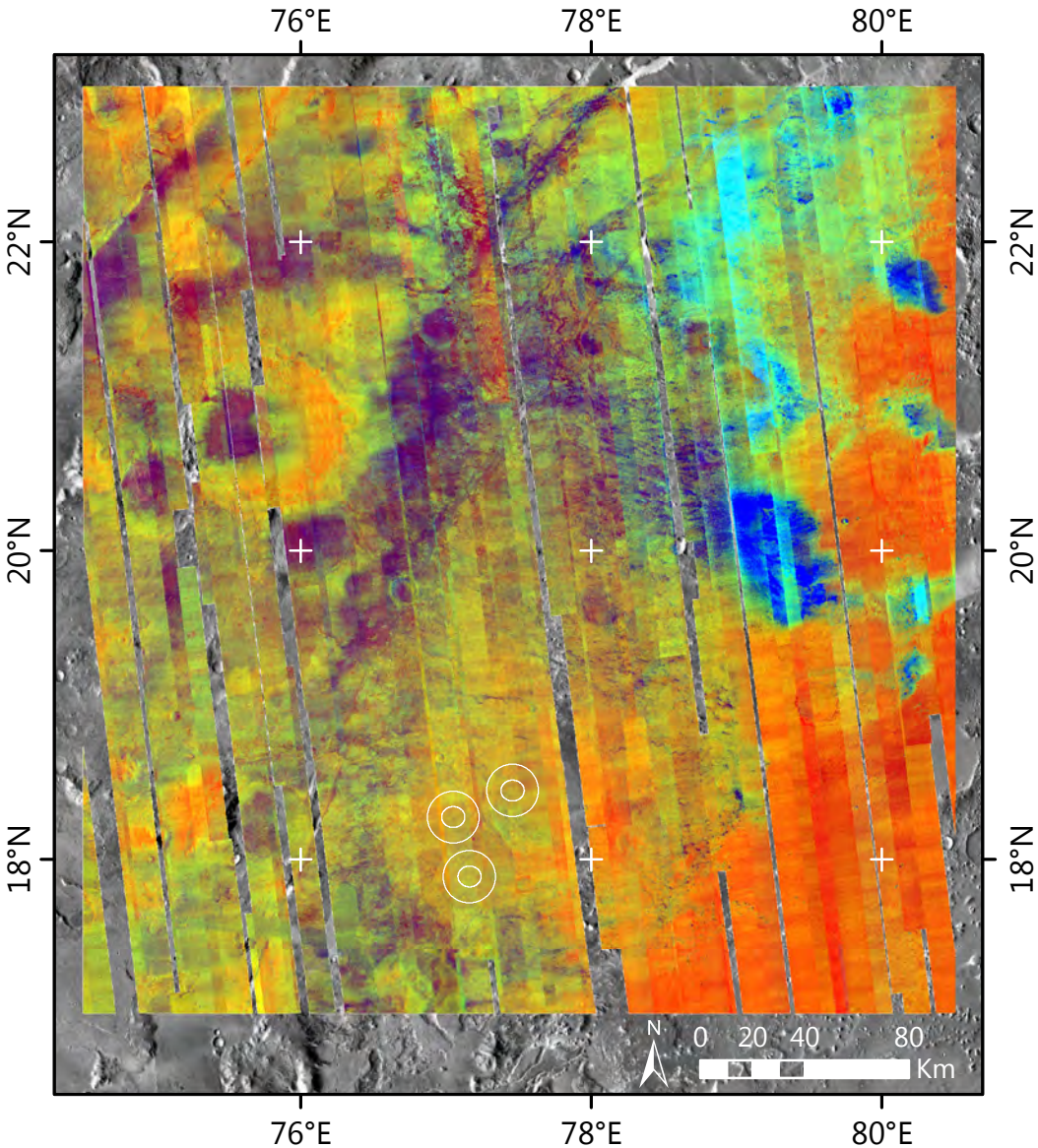
180 m/px VNIR (MSP, HSP, HSV) Fe Minerals Browse Product (FEM) Optimization Input

Stretch: linear 1% per band

- Crystalline Fe^{3+} (e.g. hematite) (BD530_2)
- Fe^{3+} textural/coatings (SH600_2)
- Fe^{2+}(e.g. olivine, pyroxene) (BDI1000VIS)



CRISM Map Tile T1250



180 m/px VNIR (MSP, HSP, HSV) Fe Minerals Browse Product (FEM) Optimization Result

Stretch: linear 1% per band

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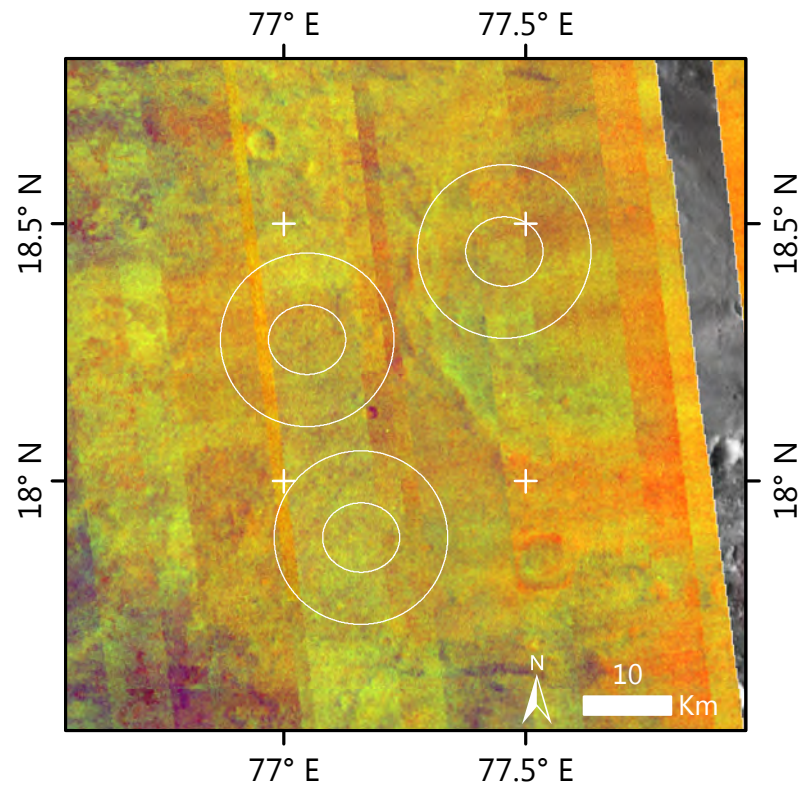
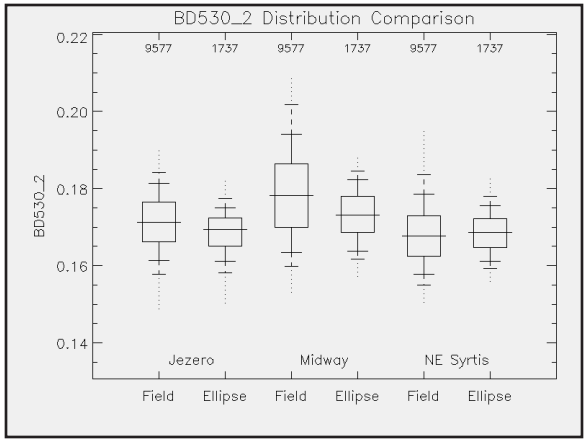
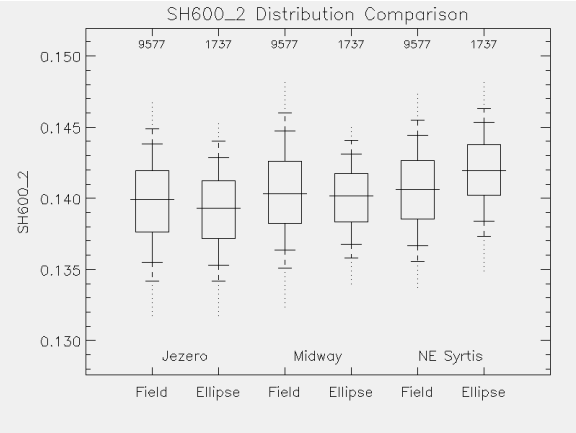
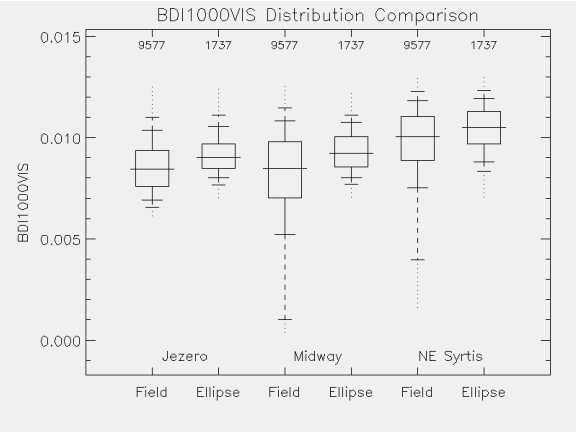






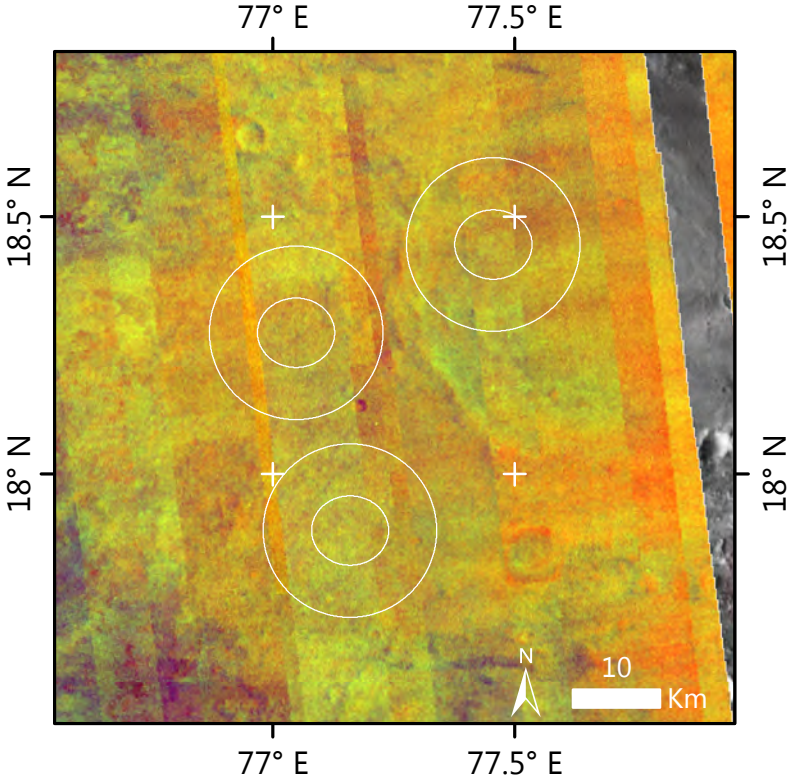


180 m/px VNIR (MSP, HSP, HSV)

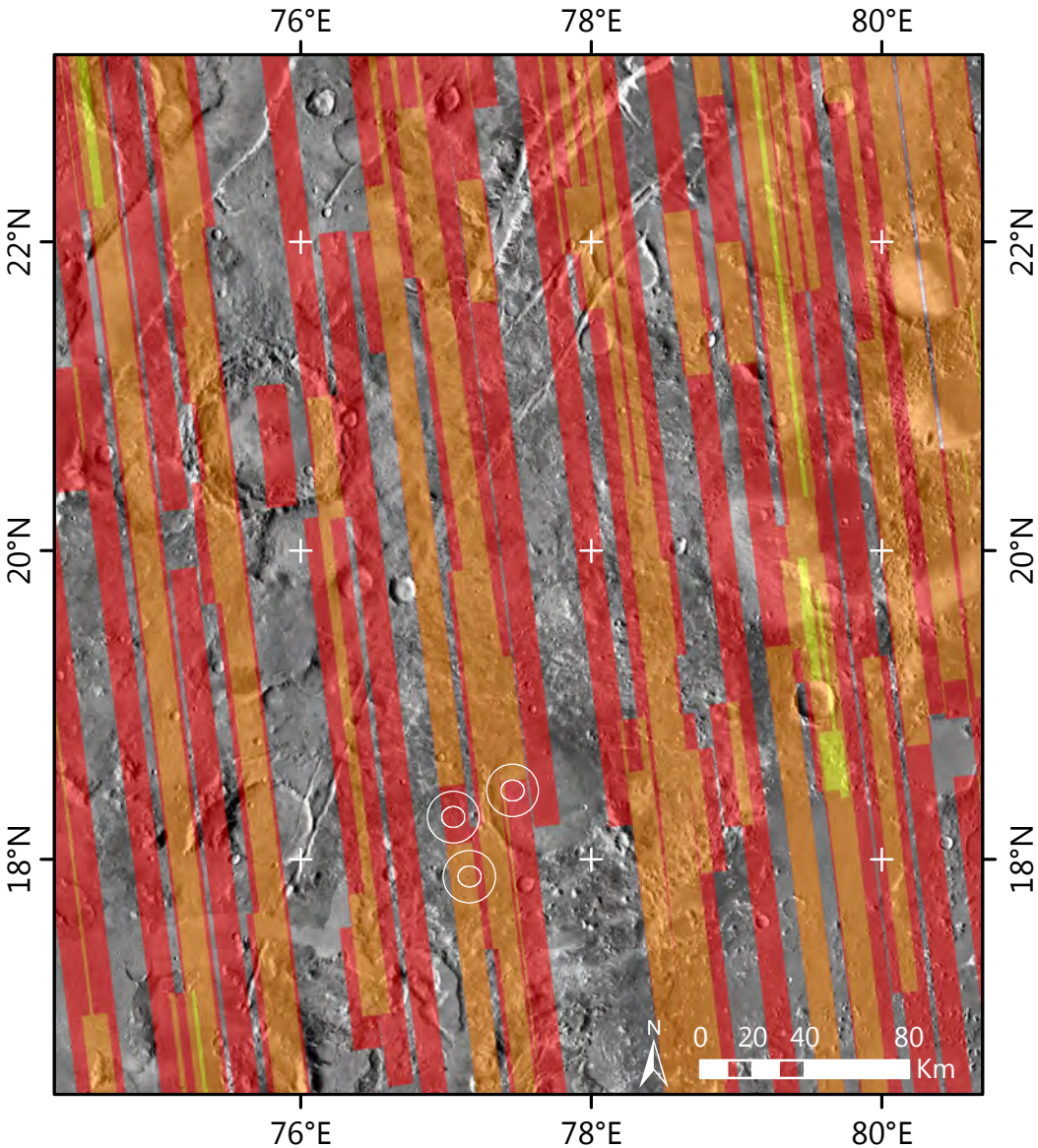
Fe Minerals Browse Product (FEM)

Stretch: linear 1% per band

- Crystalline Fe^{3+} (e.g. hematite) (BD530_2)
- Fe^{3+} textural/coatings (SH600_2)
- Fe^{2+}(e.g. olivine, pyroxene) (BDI1000VIS)



CRISM Map Tile T1250

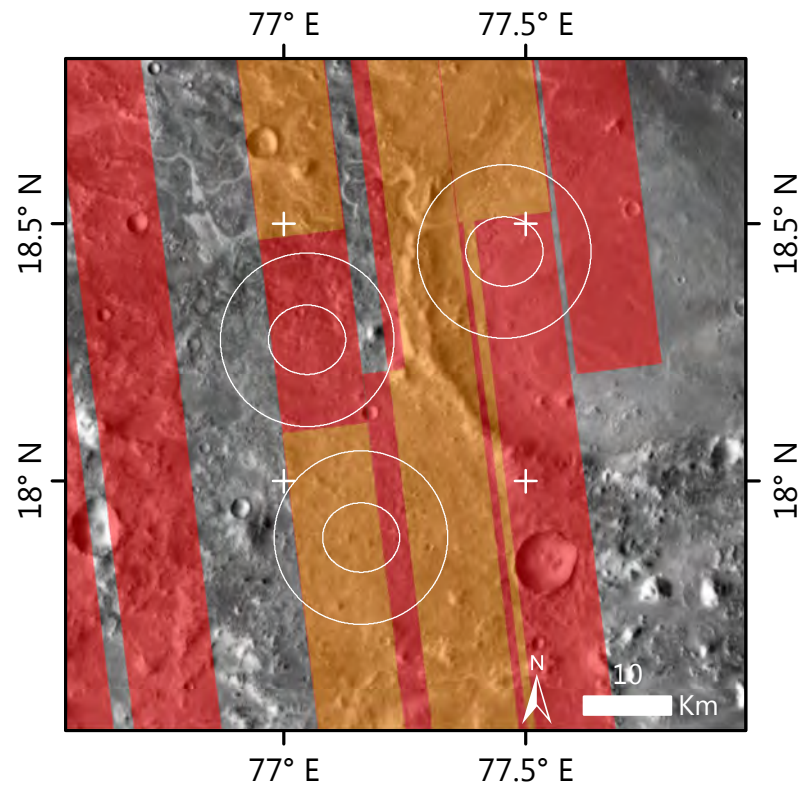


180 m/px IR (MSP, HSP)

Data Density

Number of Overlapping Obs. (Max = 6)

- 1
- 2 – 4
- 5 – 7
- 8 – 10
- >10



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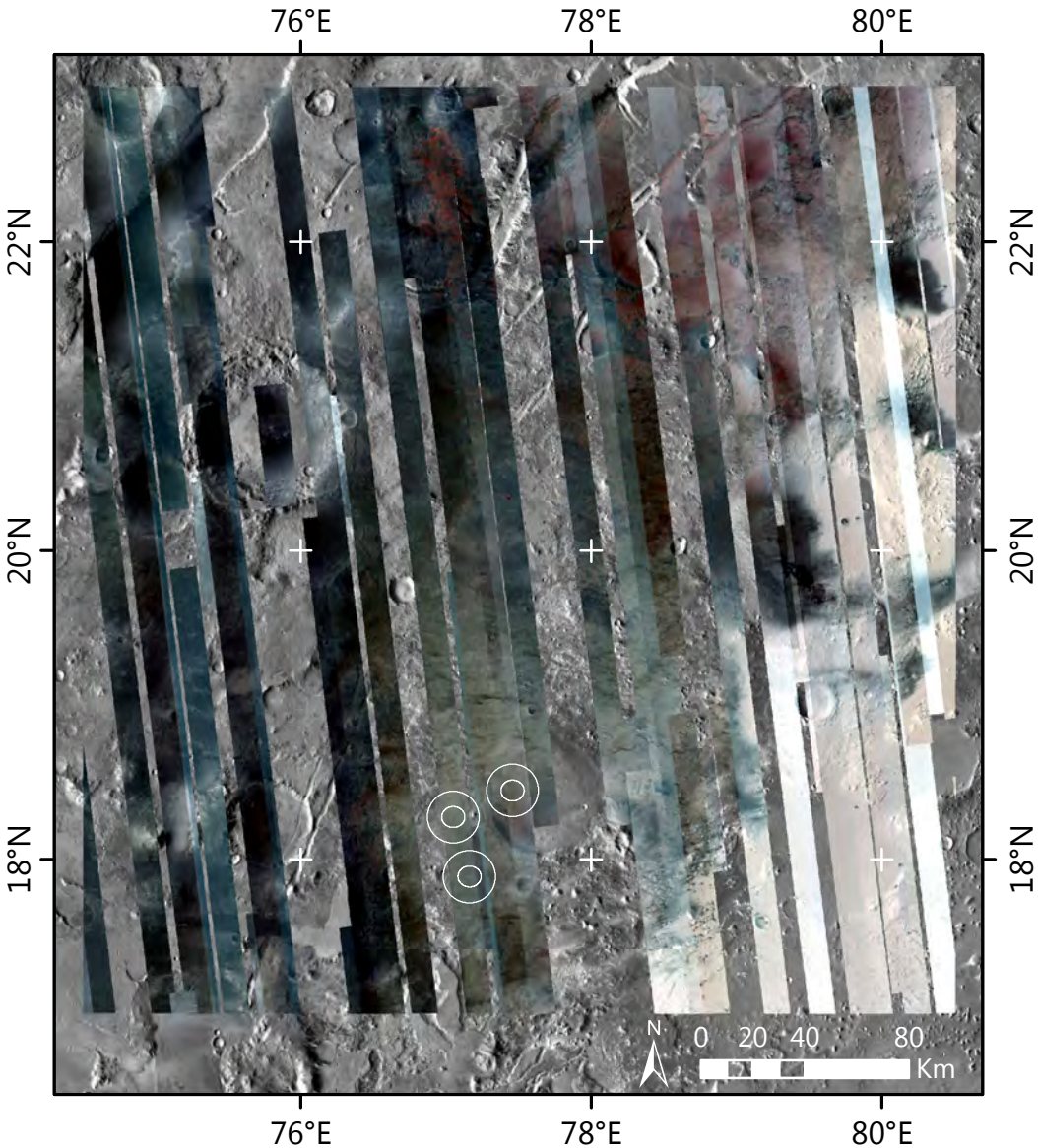


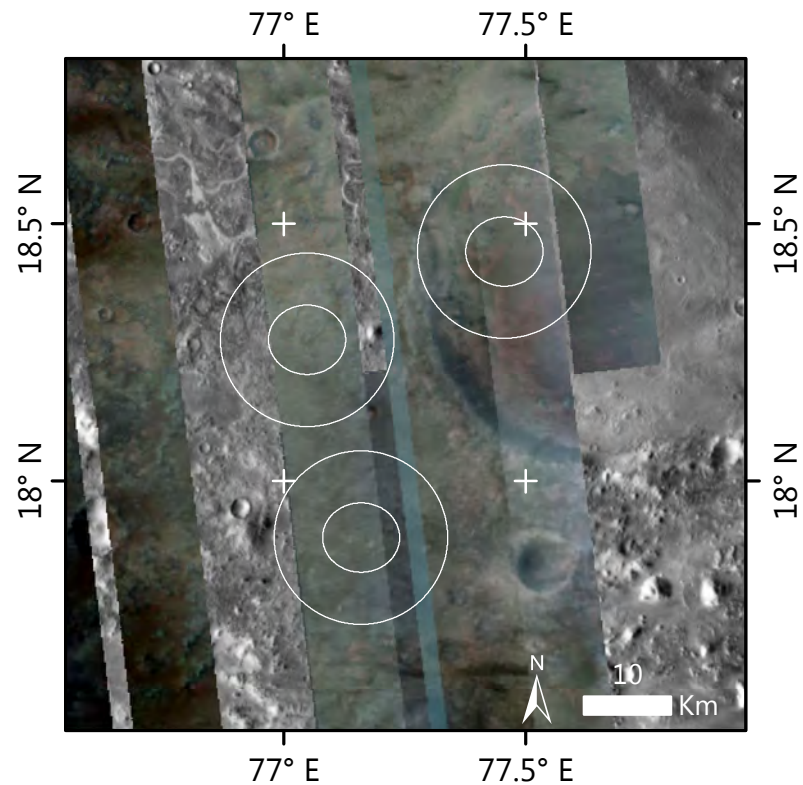
180 m/px IR (MSP, HSP)

Standard Hybrid Processing

Optimization Input

Stretch: linear 2% per band

- 2530 nm
- 1507 nm
- 1078 nm



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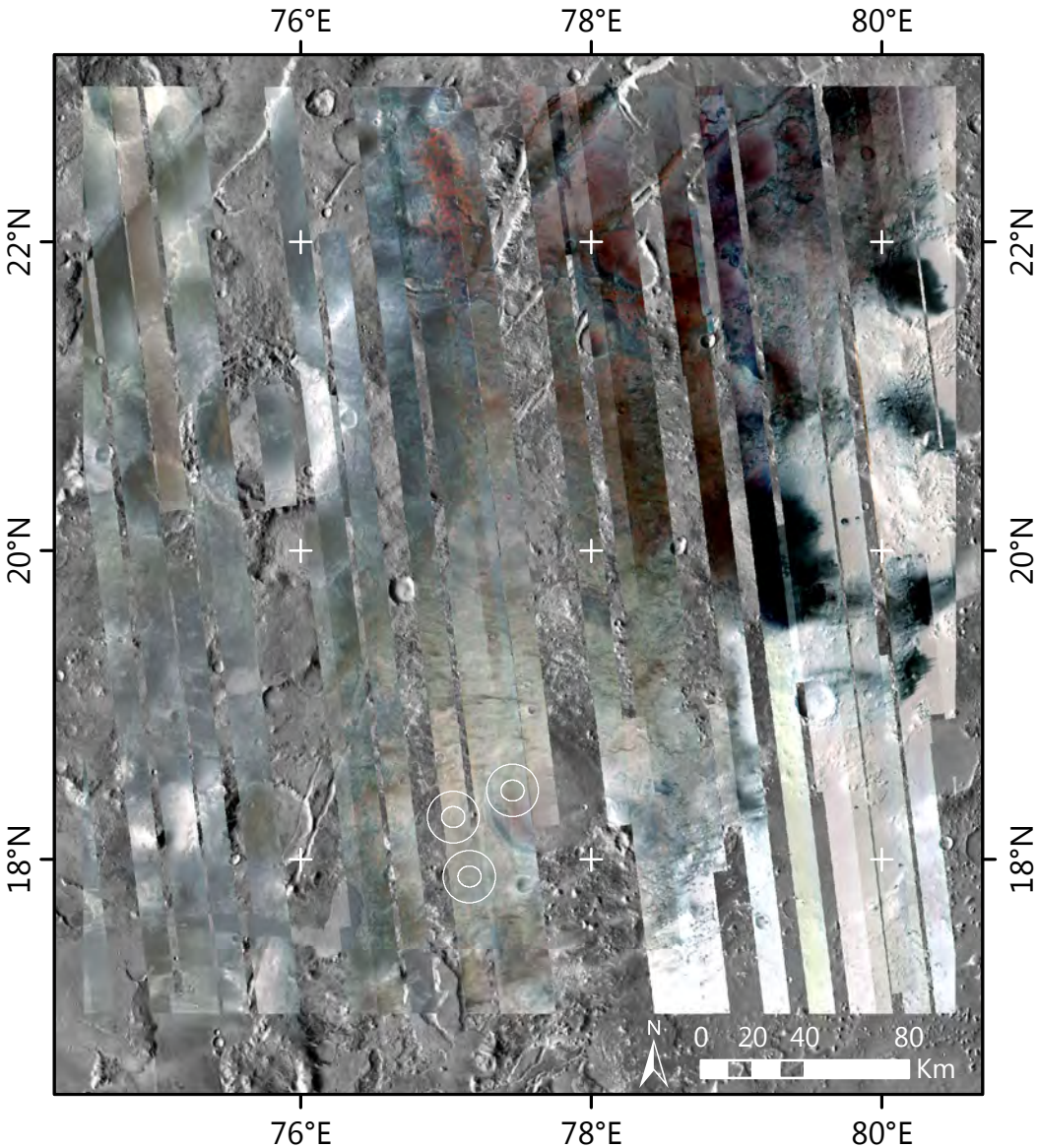
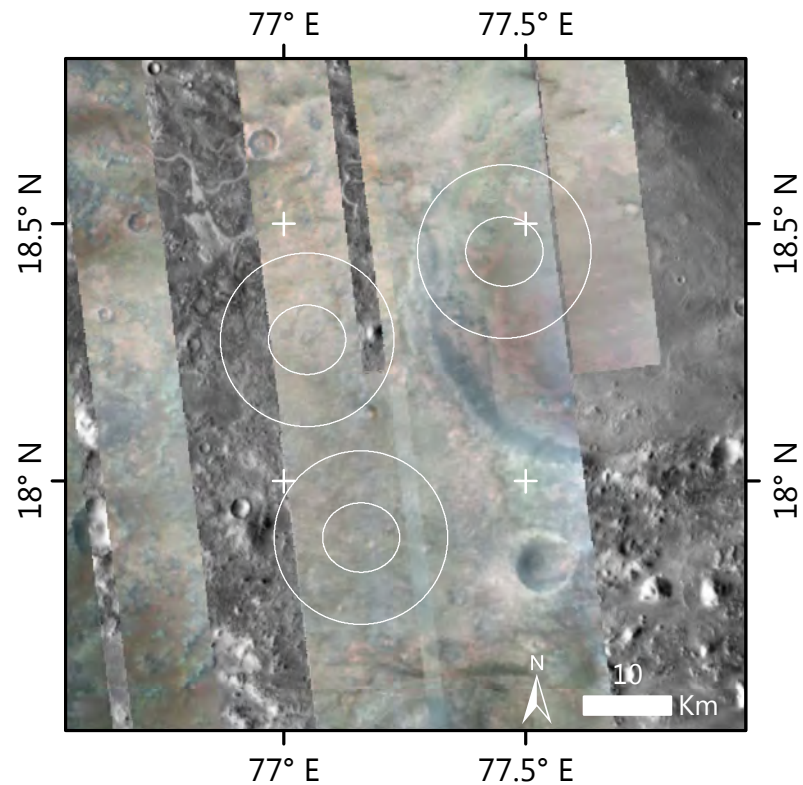


180 m/px IR (MSP, HSP) Optimization Result

Stretch: linear 2% per band

- 2530 nm
- 1507 nm
- 1078 nm



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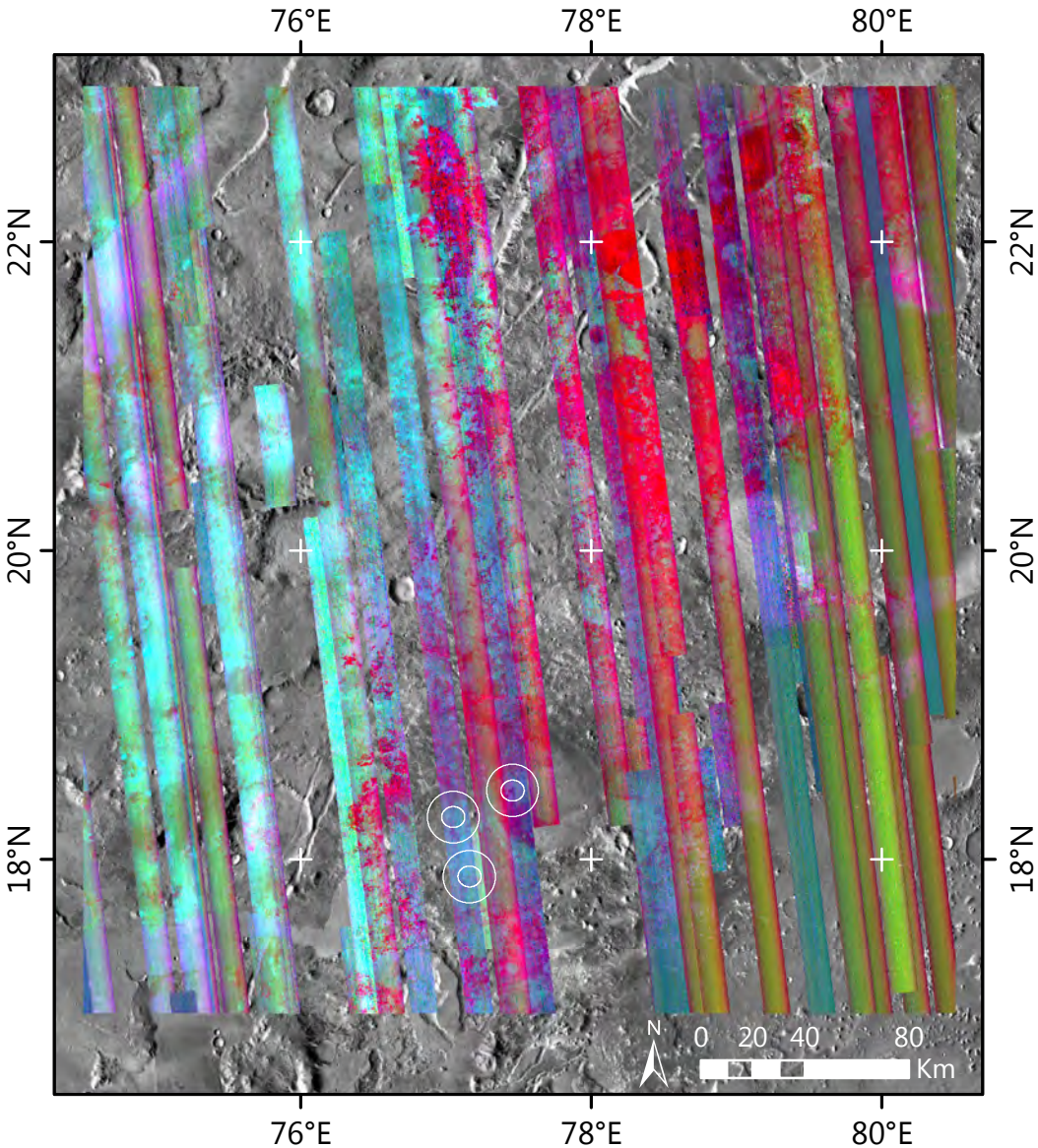


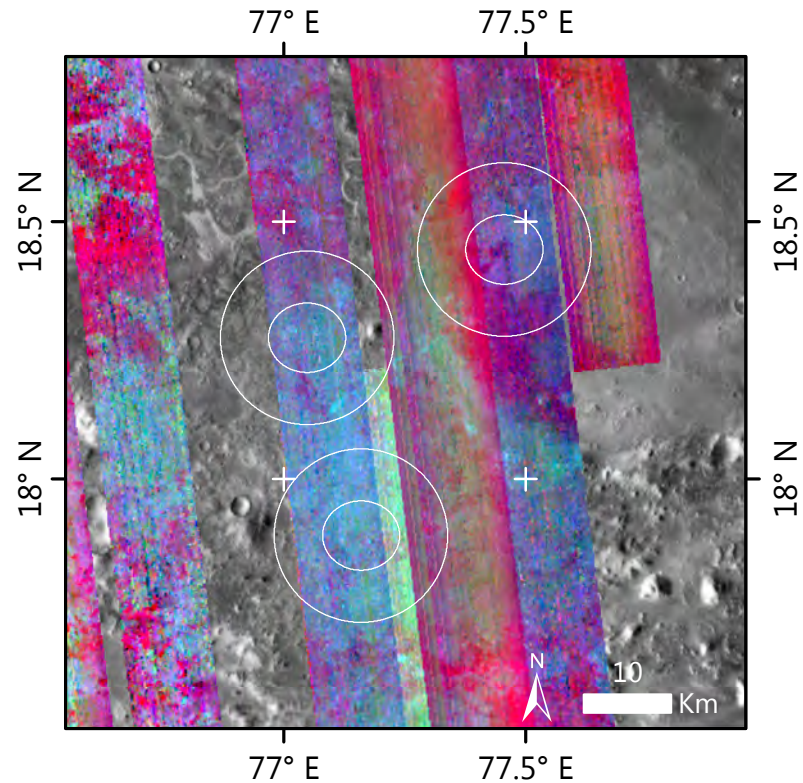
180 m/px IR (MSP, HSP)

Mafic Browse Product (MAF)

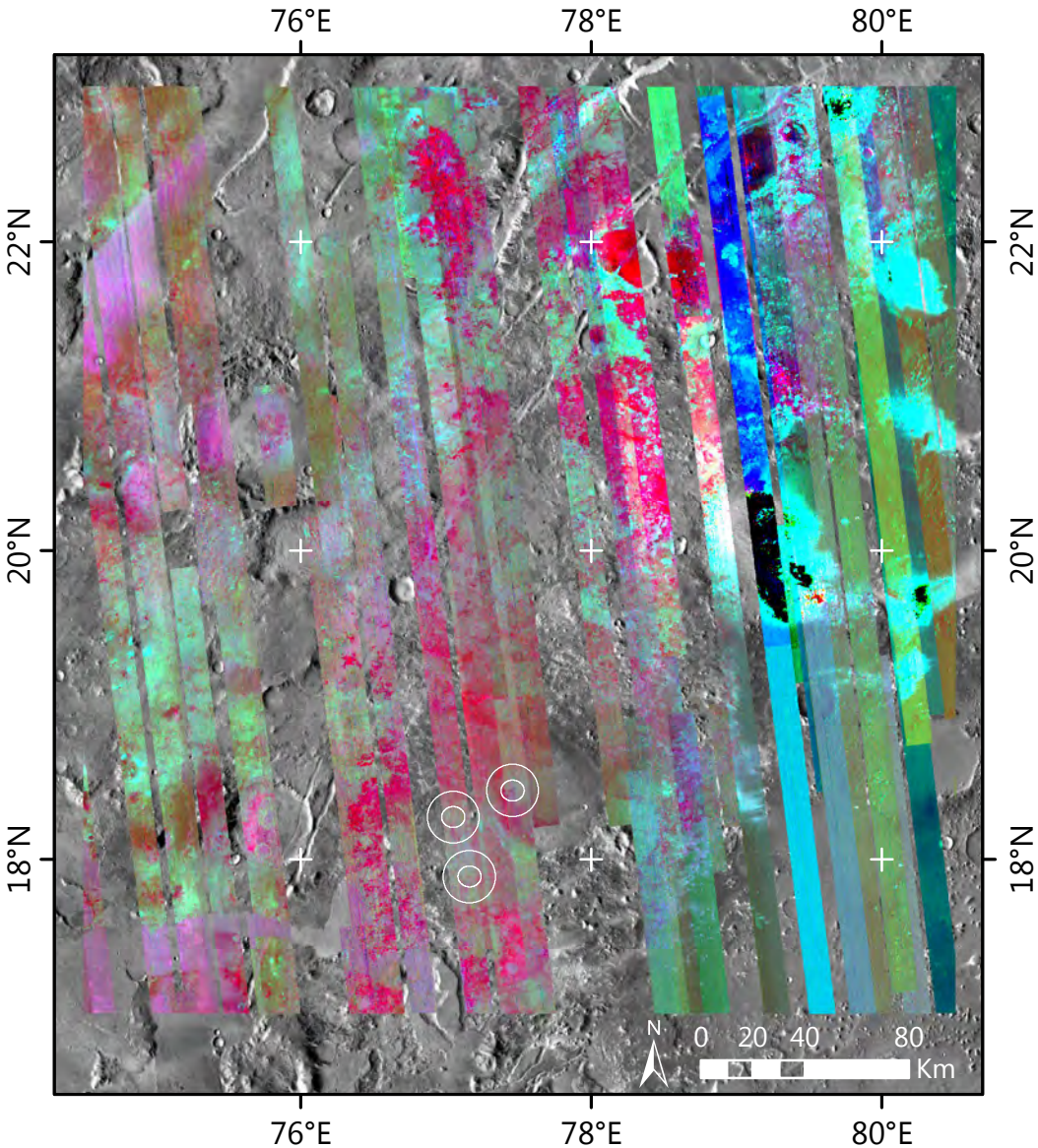
Optimization Input

Stretch: linear interval per band

- olivine (OLINDEX3)
- low-calcium pyroxene (LCPINDEX2)
- high-calcium pyroxene (HCPINDEX2)



CRISM Map Tile T1250



180 m/px IR (MSP, HSP)
Mafic Browse Product (MAF)
Optimization Result

Stretch: linear interval per band

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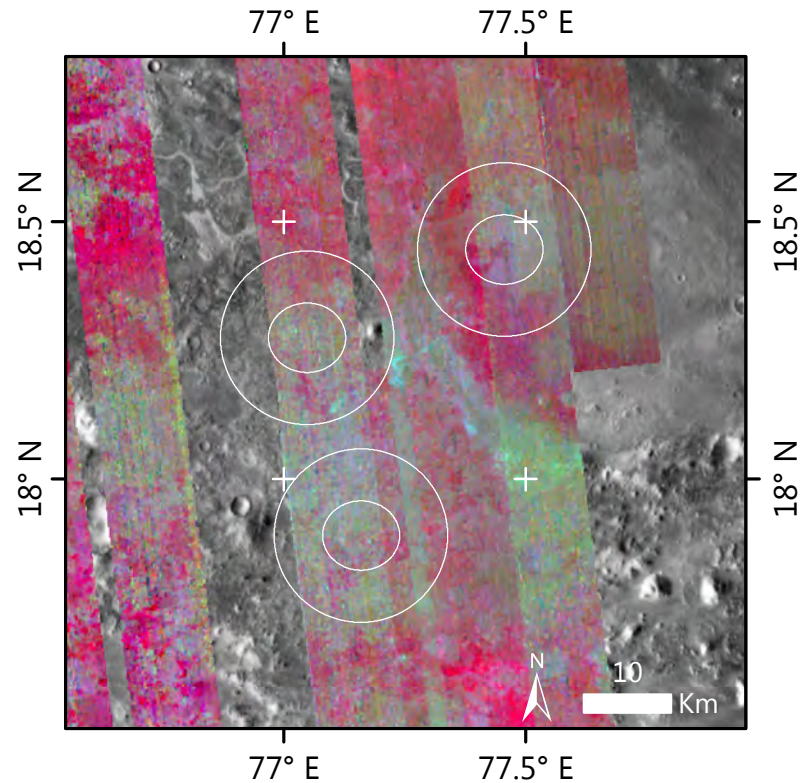
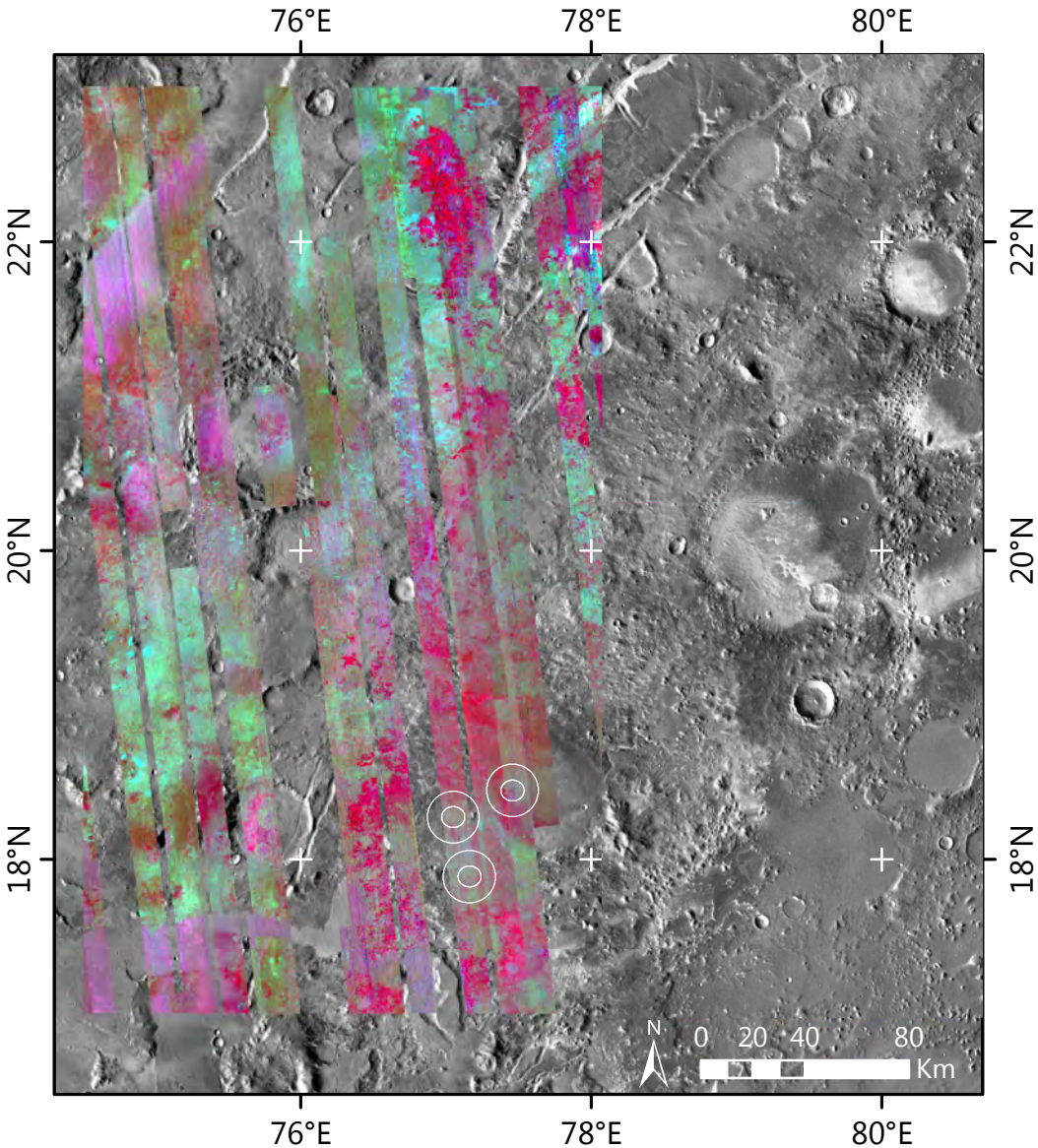


CRISM Map Tile T1250



180 m/px IR (MSP, HSP)
Mafic Browse Product (MAF)
Optimization Result

Stretch: linear interval per band

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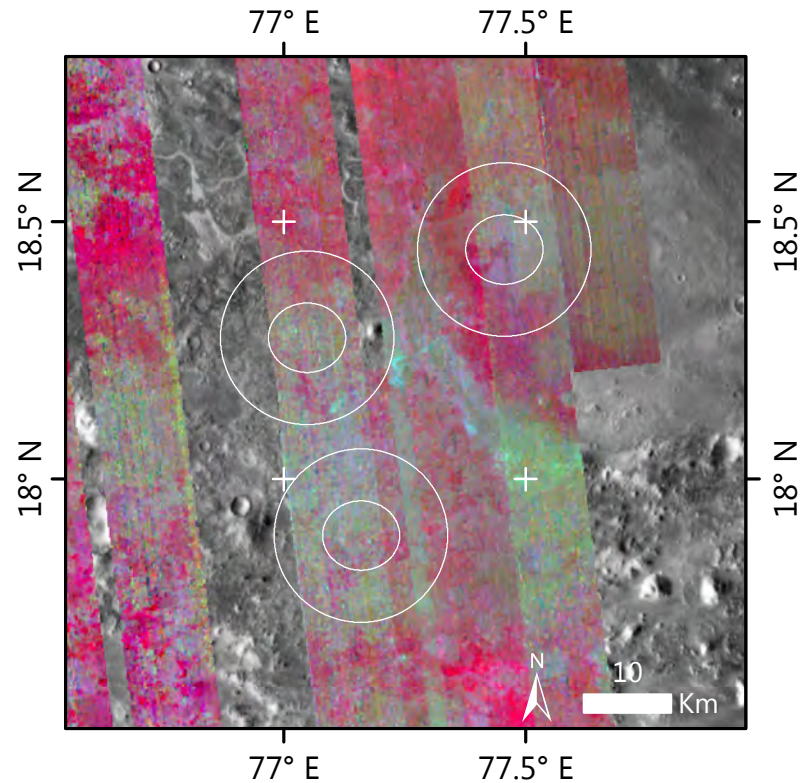
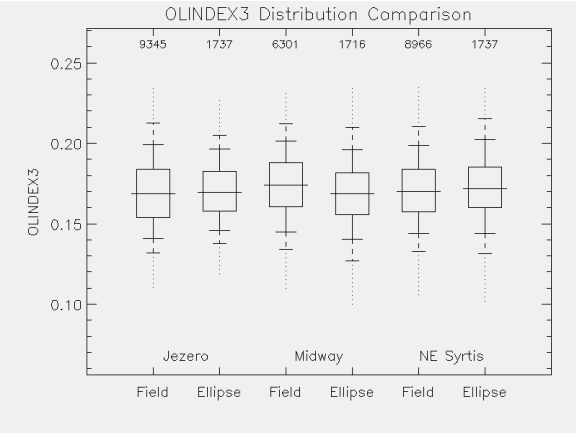
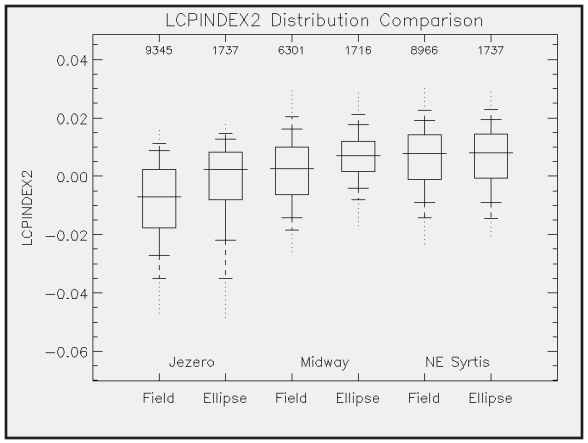
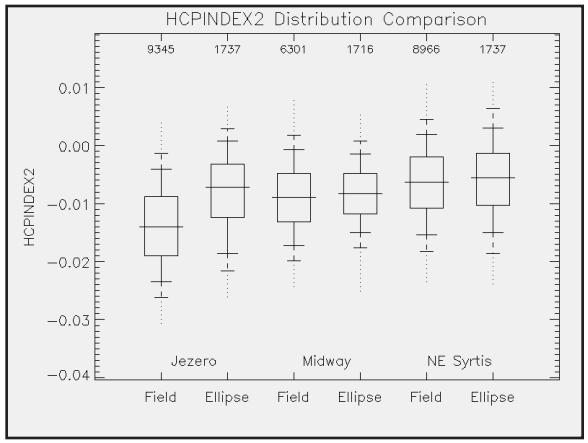
- low-calcium pyroxene (LCPINDEX2)
- high-calcium pyroxene (HCPINDEX2)







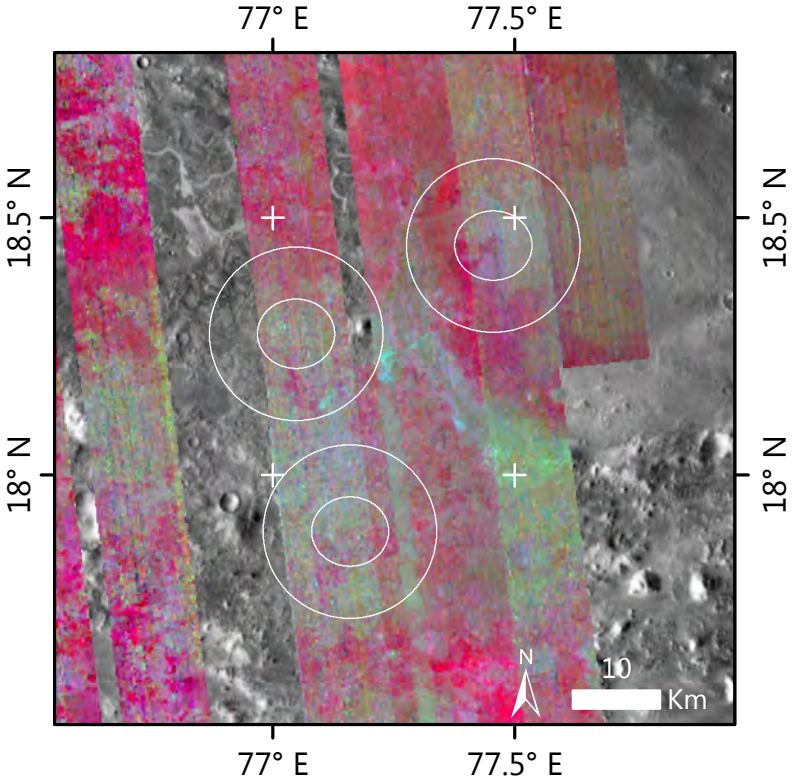


180 m/px IR (MSP, HSP)

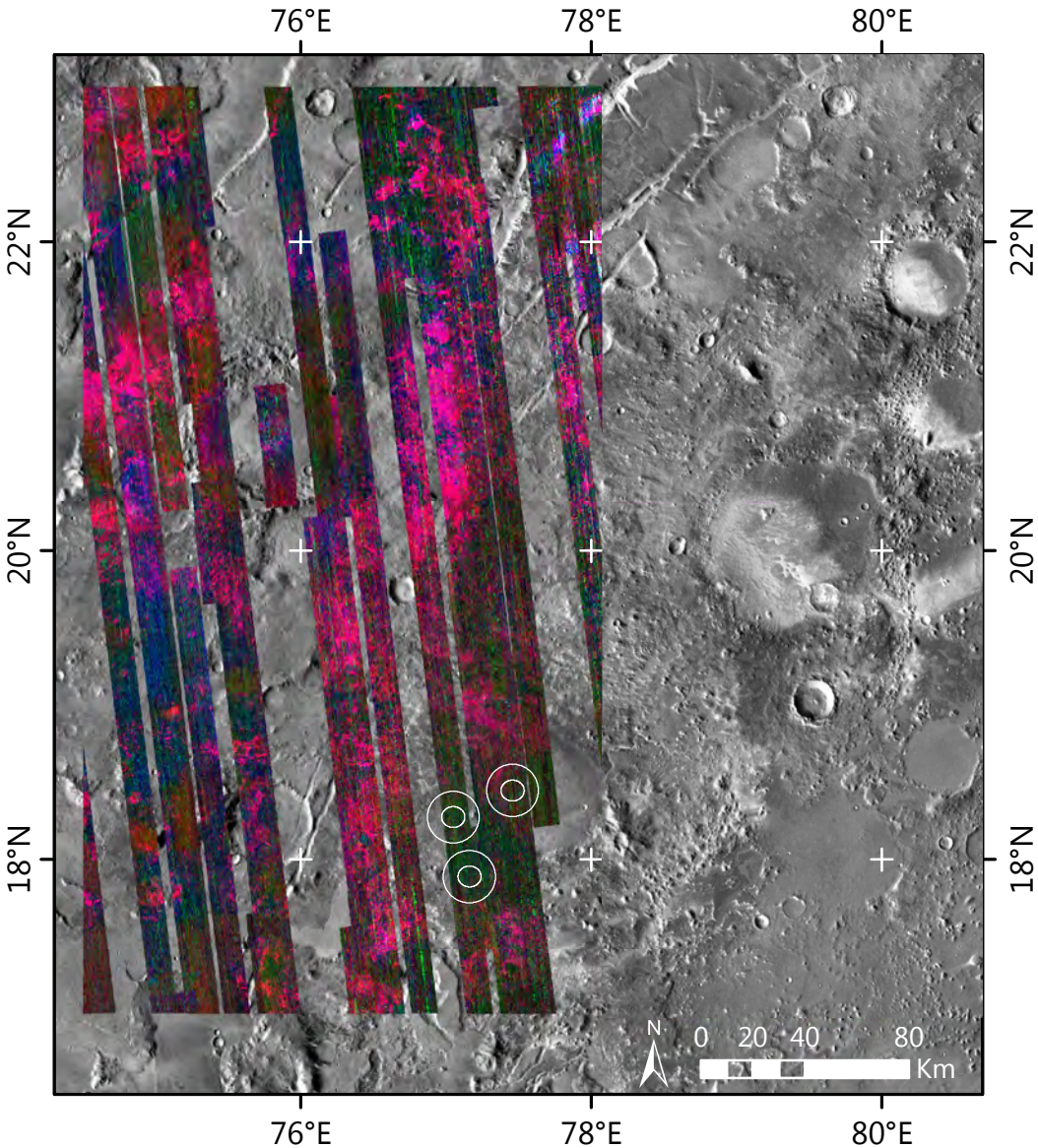
Mafic Browse Product (MAF)

Stretch: linear interval per band

- olivine (OLINDEX3)
- low-calcium pyroxene (LCPINDEX2)
- high-calcium pyroxene (HCPINDEX2)



CRISM Map Tile T1250

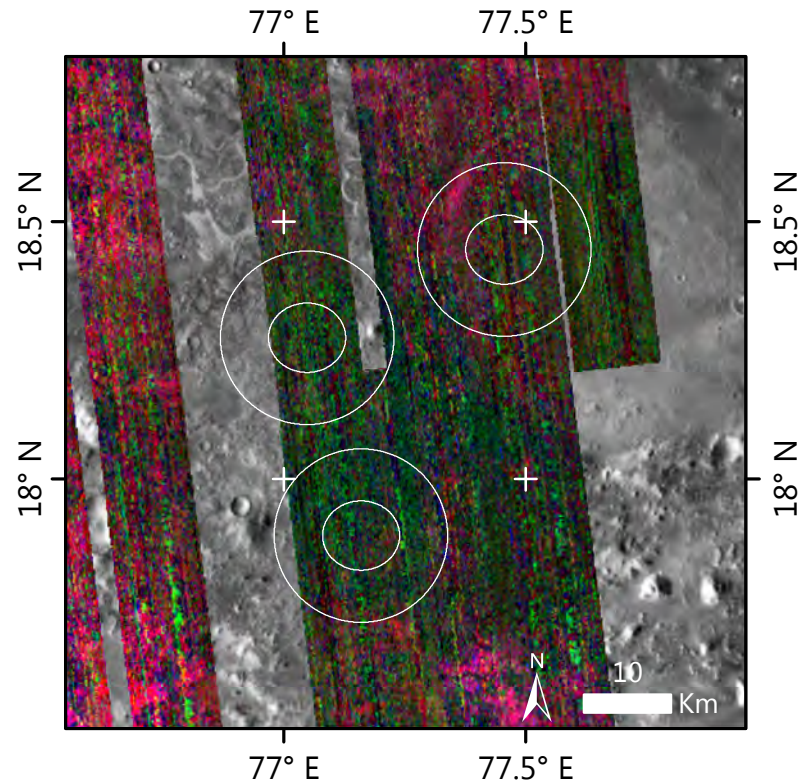


180 m/px IR (MSP, HSP)

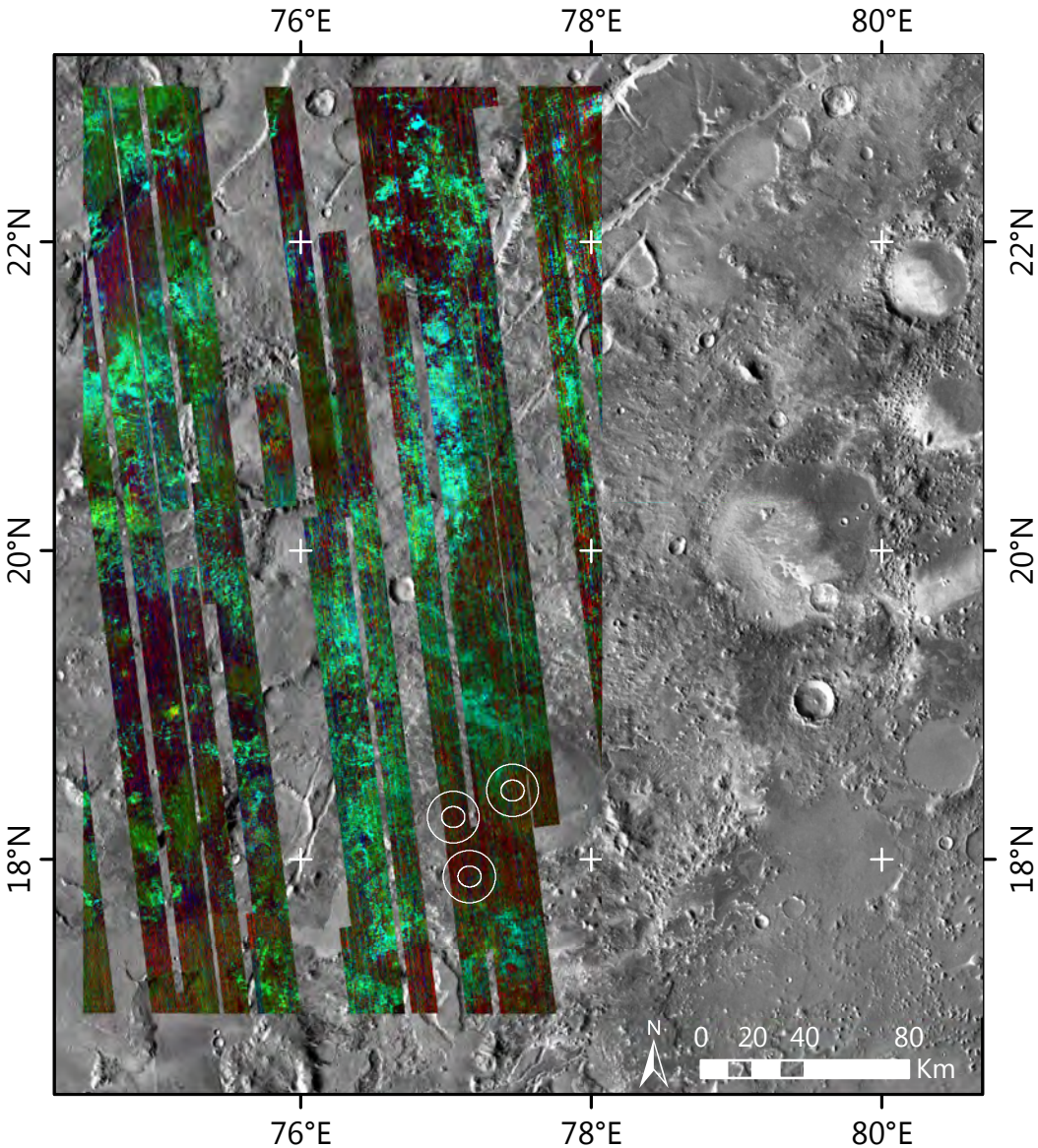
Phyllosilicates Browse Product (PHY)

Stretch: linear interval per band

- Fe/Mg-OH; Mg-Carbonate (D2300)
- Al-OH minerals (D2210_2)
- H_2O (BD1900_2)



CRISM Map Tile T1250

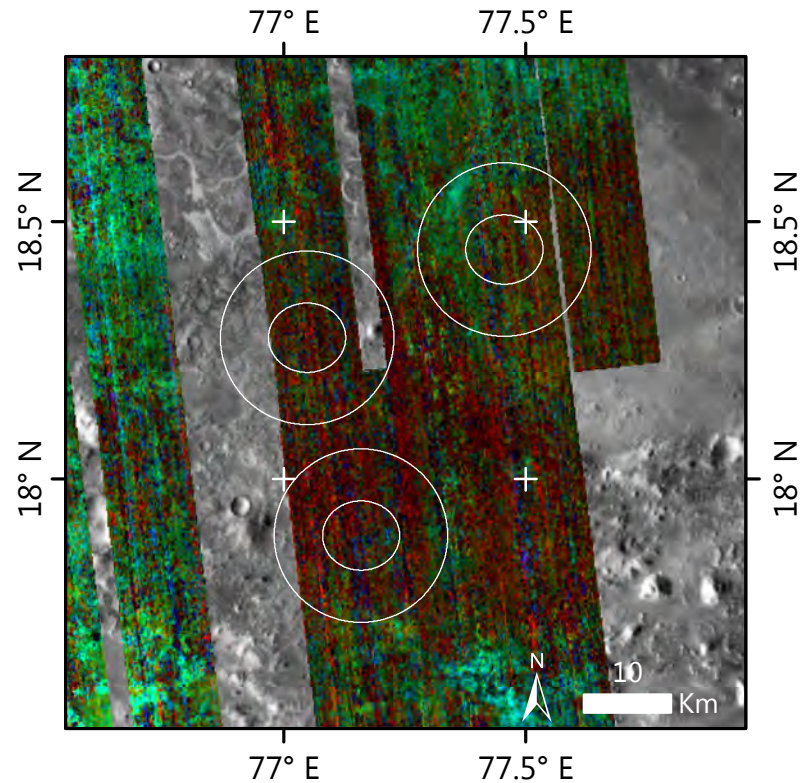


180 m/px IR (MSP, HSP)

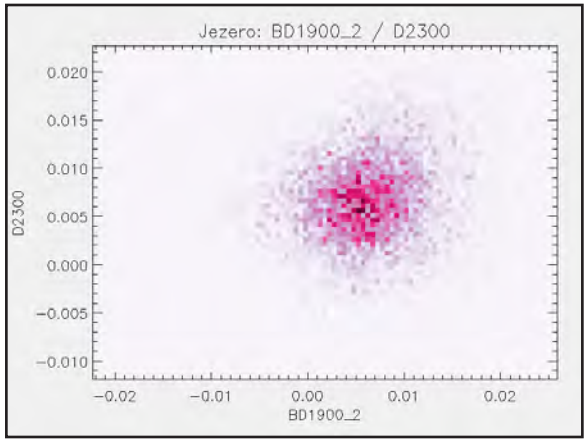
Fe/Mg Phyllosilicates Browse Product (PFM)

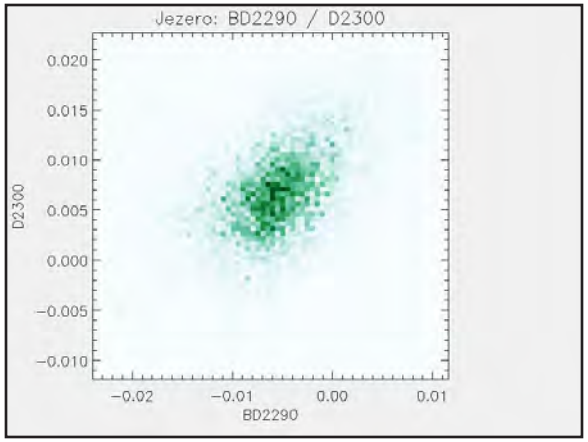
Stretch: linear interval per band

- Chlorite (BD2355)
- Fe/Mg-OH; Mg-Carbonate (D2300)
- Mg/Fe-OH minerals (BD2290)

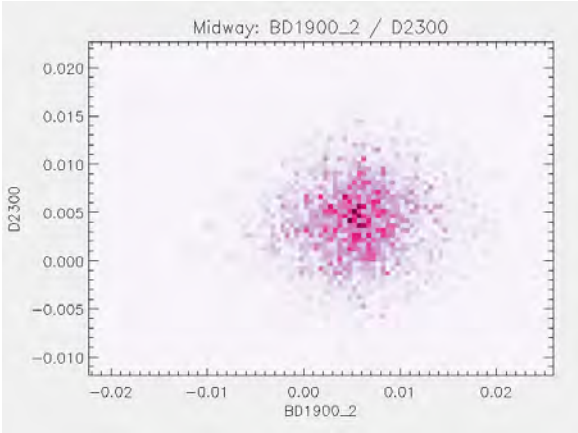


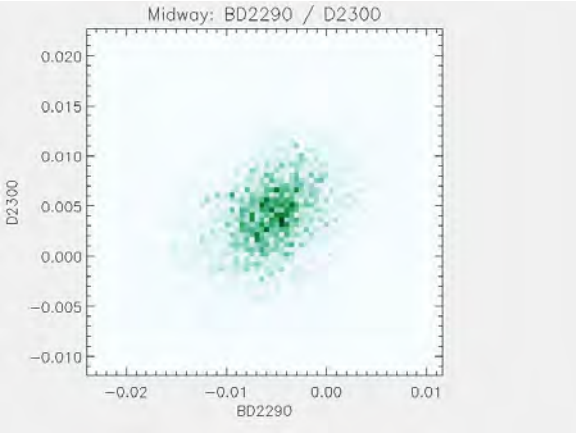
Jezero



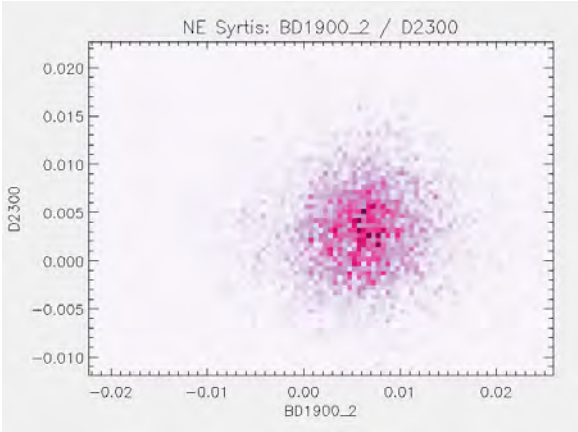


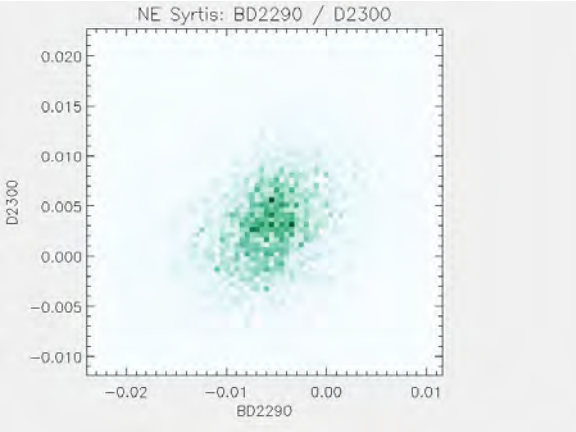
Midway





NE Syrtis





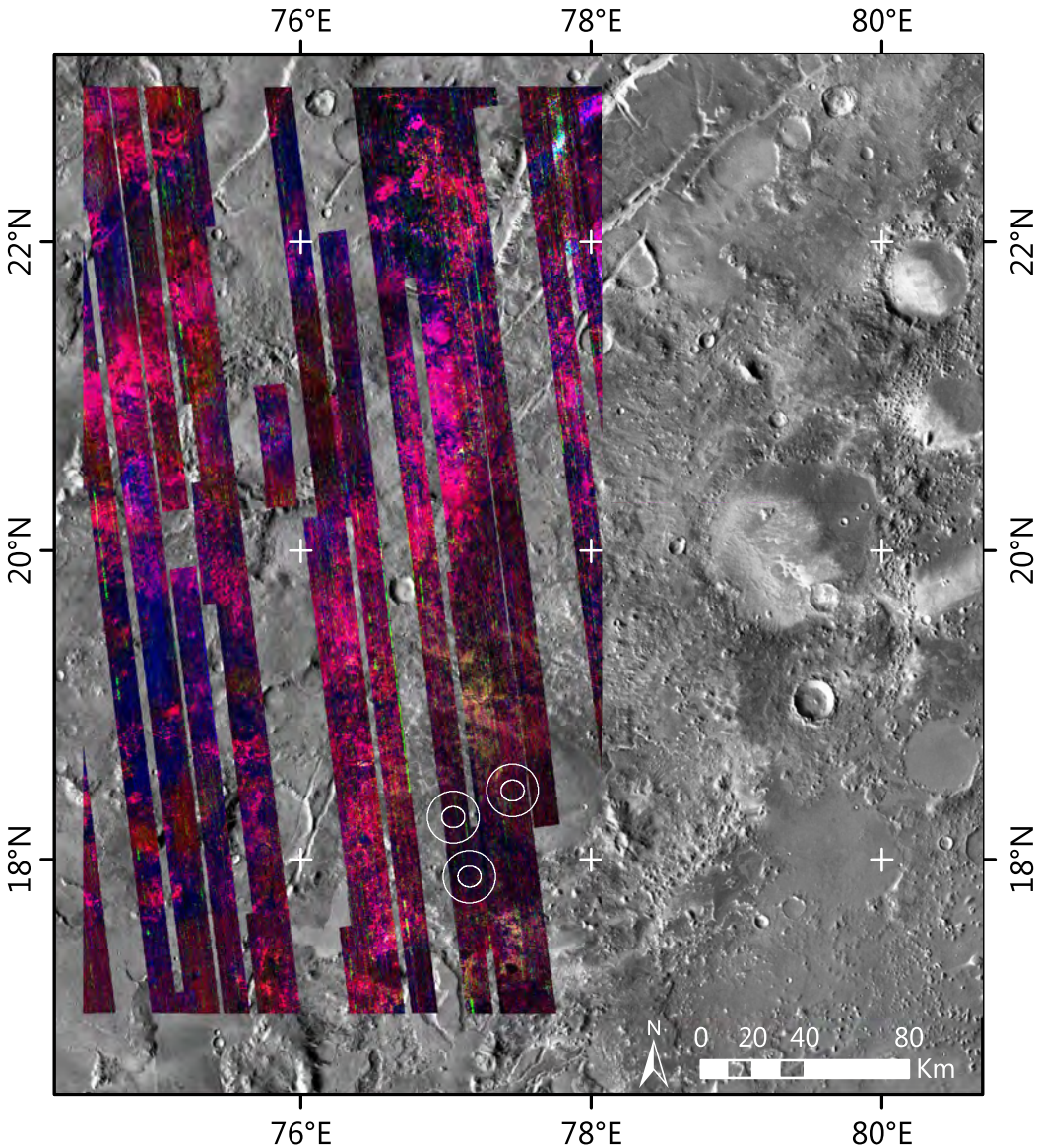
180 m/px IR (MSP, HSP)

Phyllosilicates Browse Product (PHY)

Fe/Mg Phyllosilicates Browse Product (PFM)

Selected Parameter Joint Distributions

CRISM Map Tile T1250

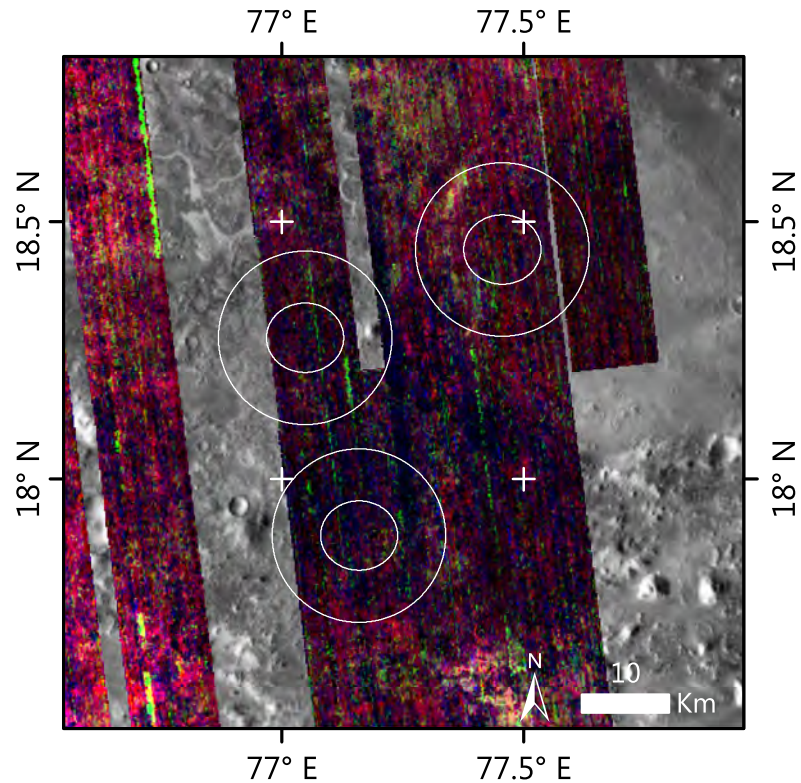


180 m/px IR (MSP, HSP)

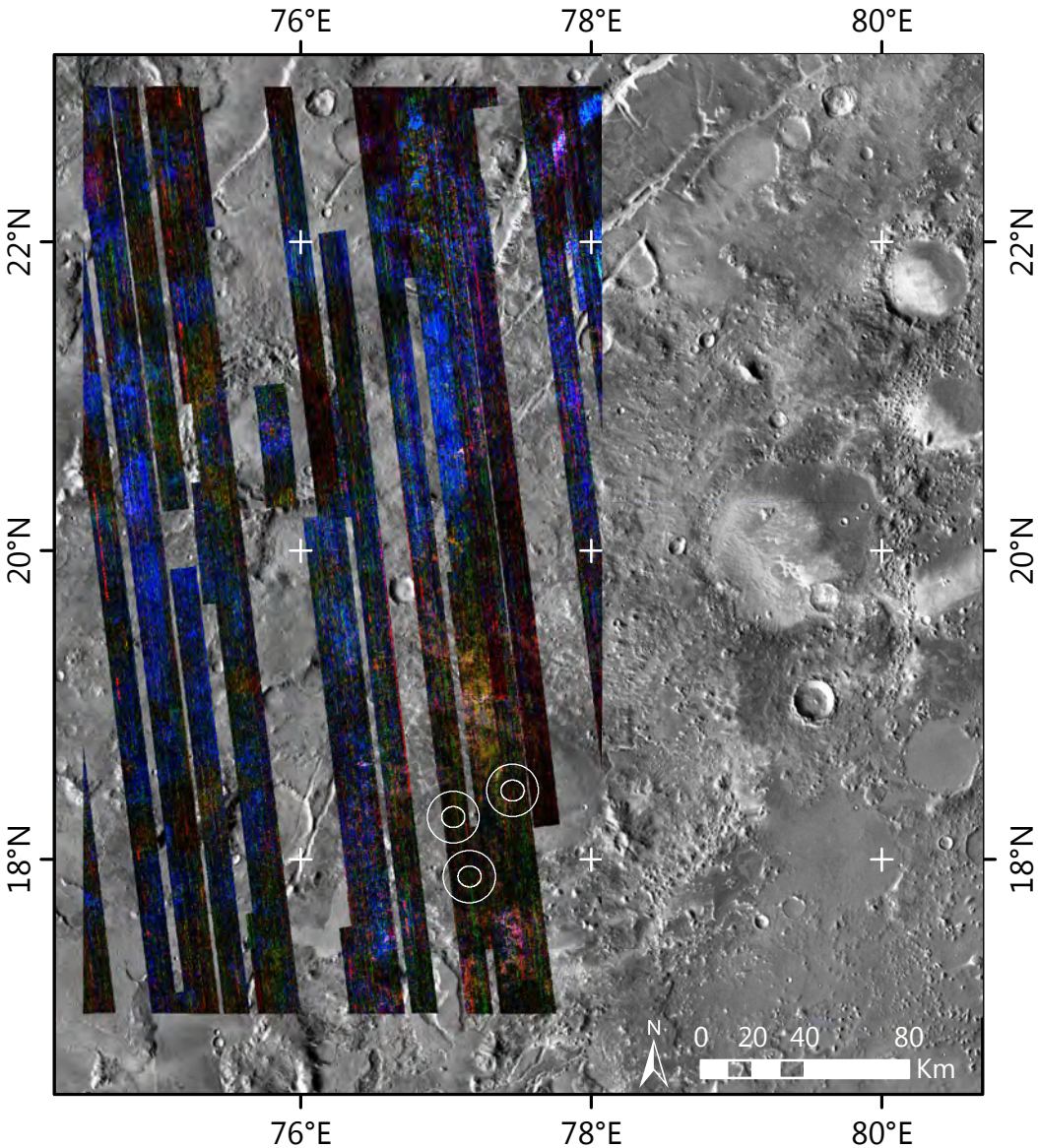
Carbonates Browse Product (CAR)

Stretch: linear interval per band

- Fe/Mg silicates (D2300)
- Mg carbonates (BD2500_2)
- bound molecular H_2O (BD1900_2)



CRISM Map Tile T1250

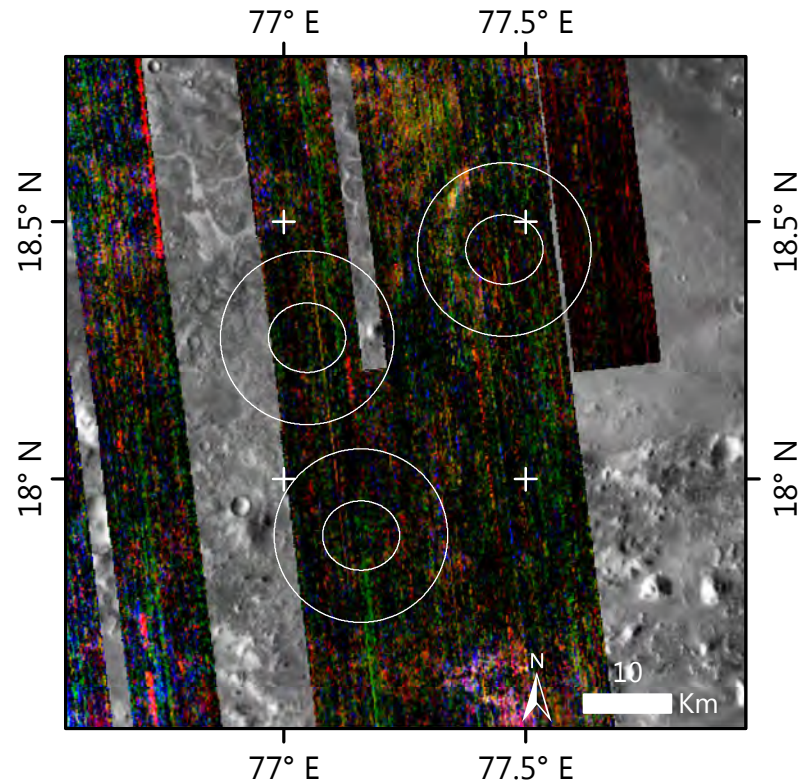


180 m/px IR (MSP, HSP)

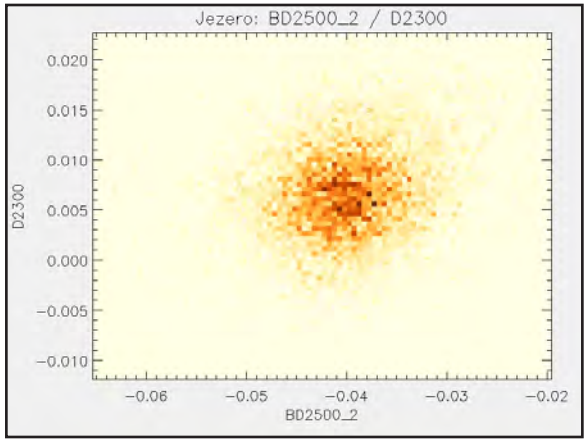
Custom Carbonates Browse Product

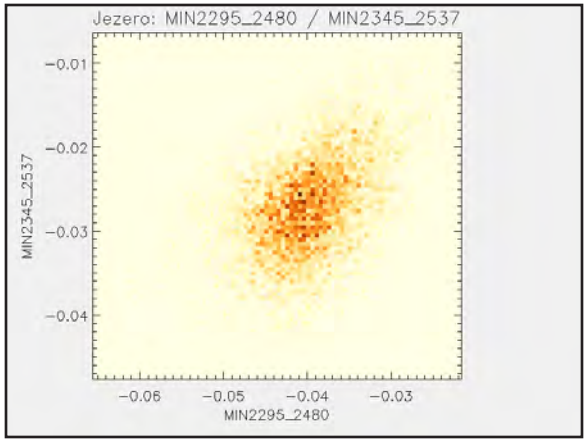
Stretch: linear interval per band

- Mg carbonates (MIN2295_2480)
- Ca/Fe carbonates (MIN2345_2537)
- bound molecular H_2O (BD1900_2)



Jezero



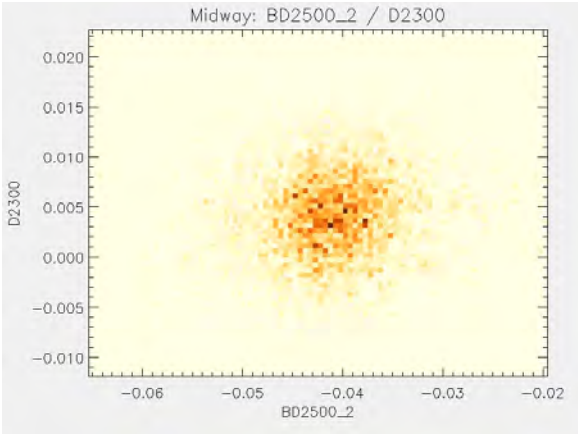


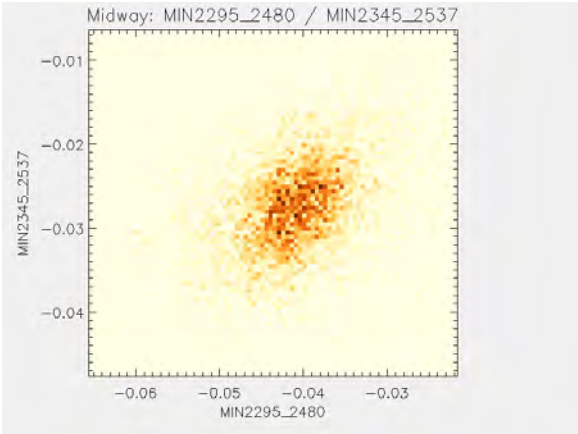
180 m/px IR (MSP, HSP)

Carbonates Browse Product (CAR)

Custom Carbonates Browse Product

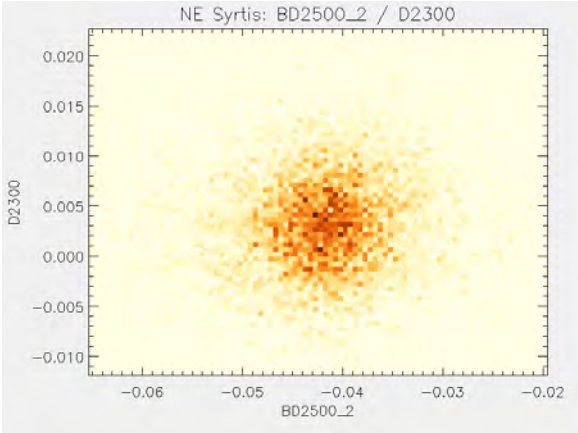
Midway

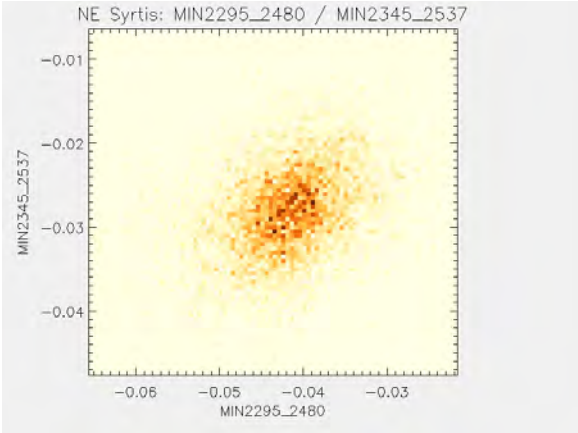


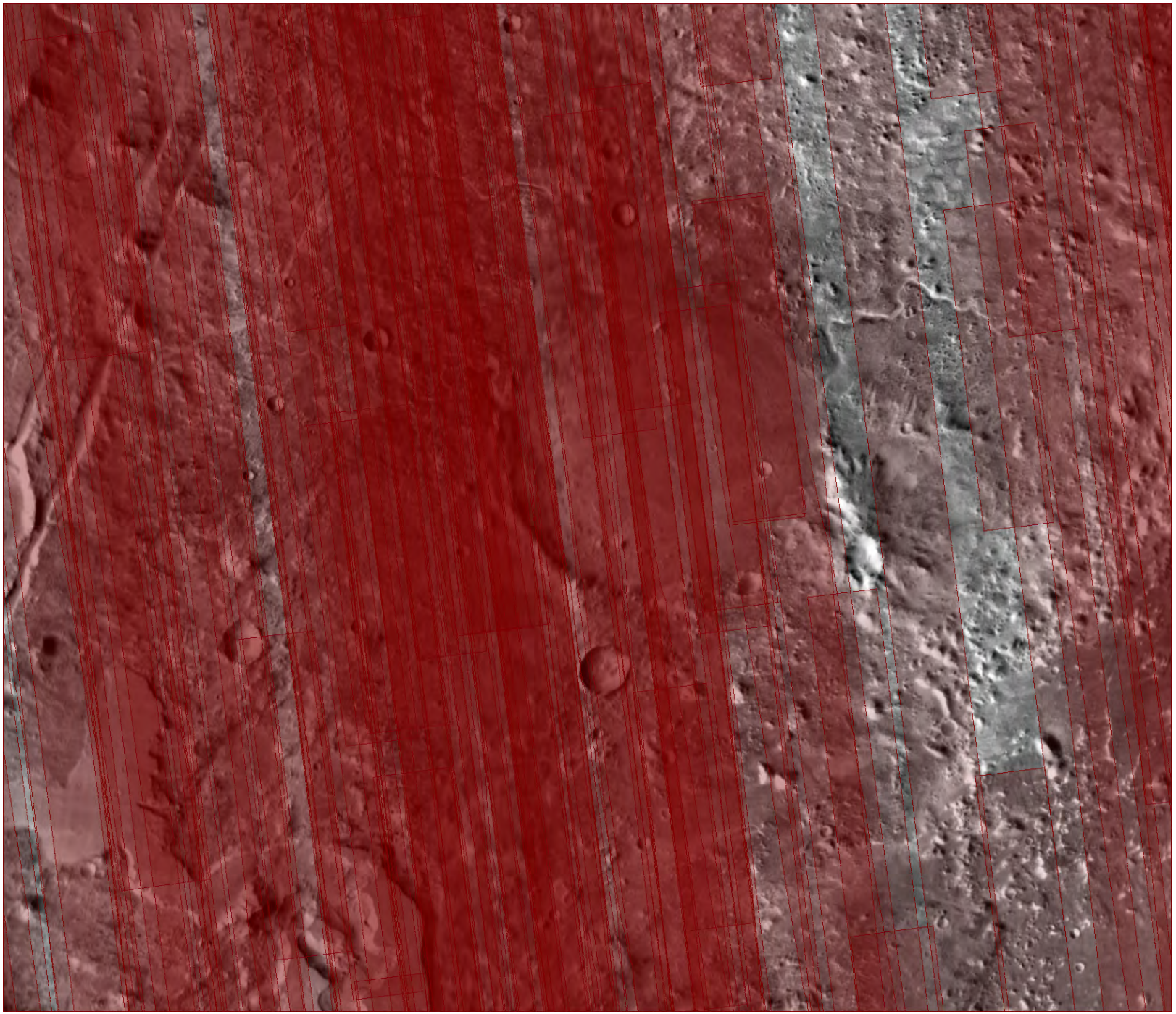


Selected Parameter Joint Distributions

NE Syrtis

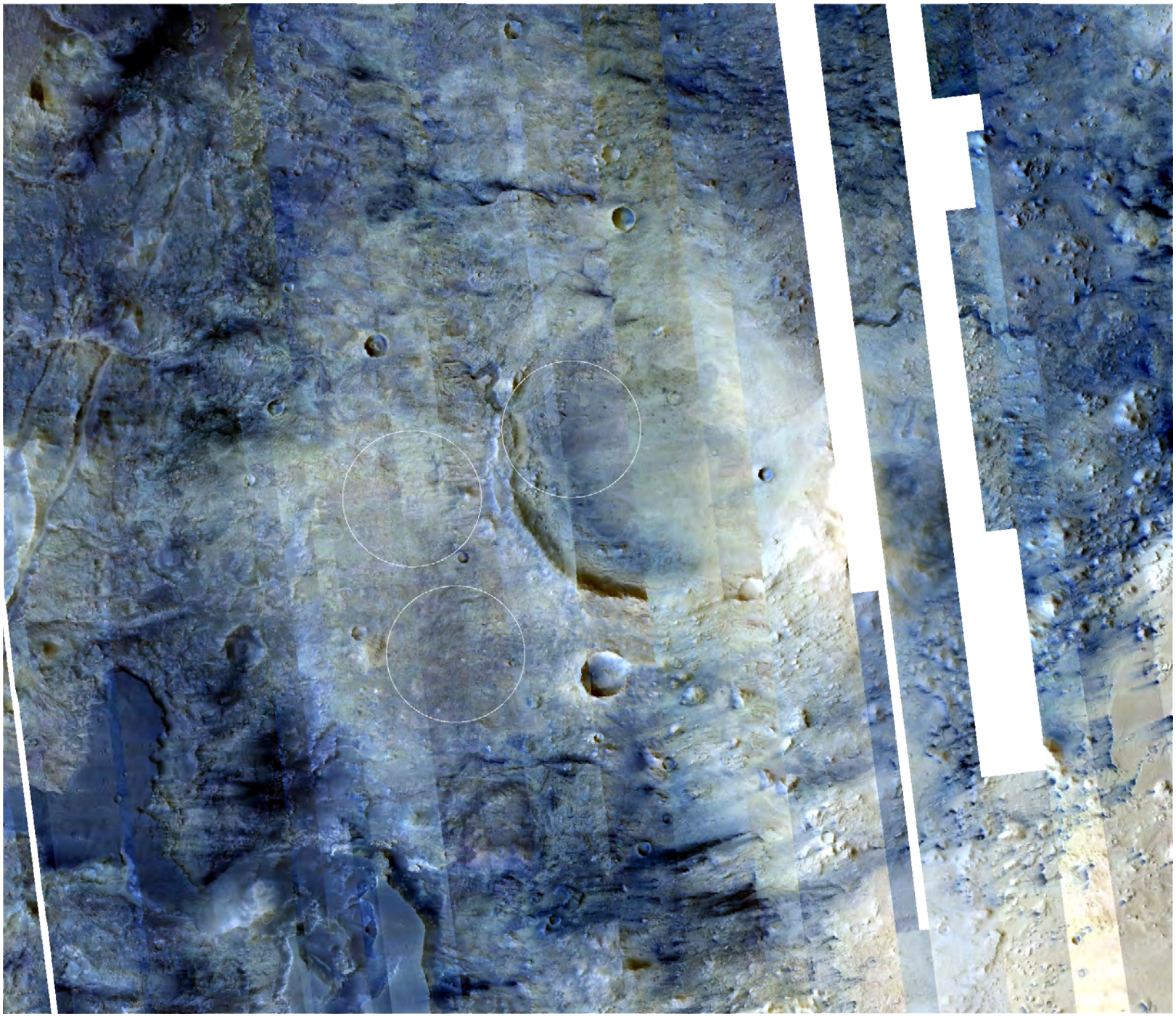






MSV - 90 m/px
VNIR
Hyperspectral

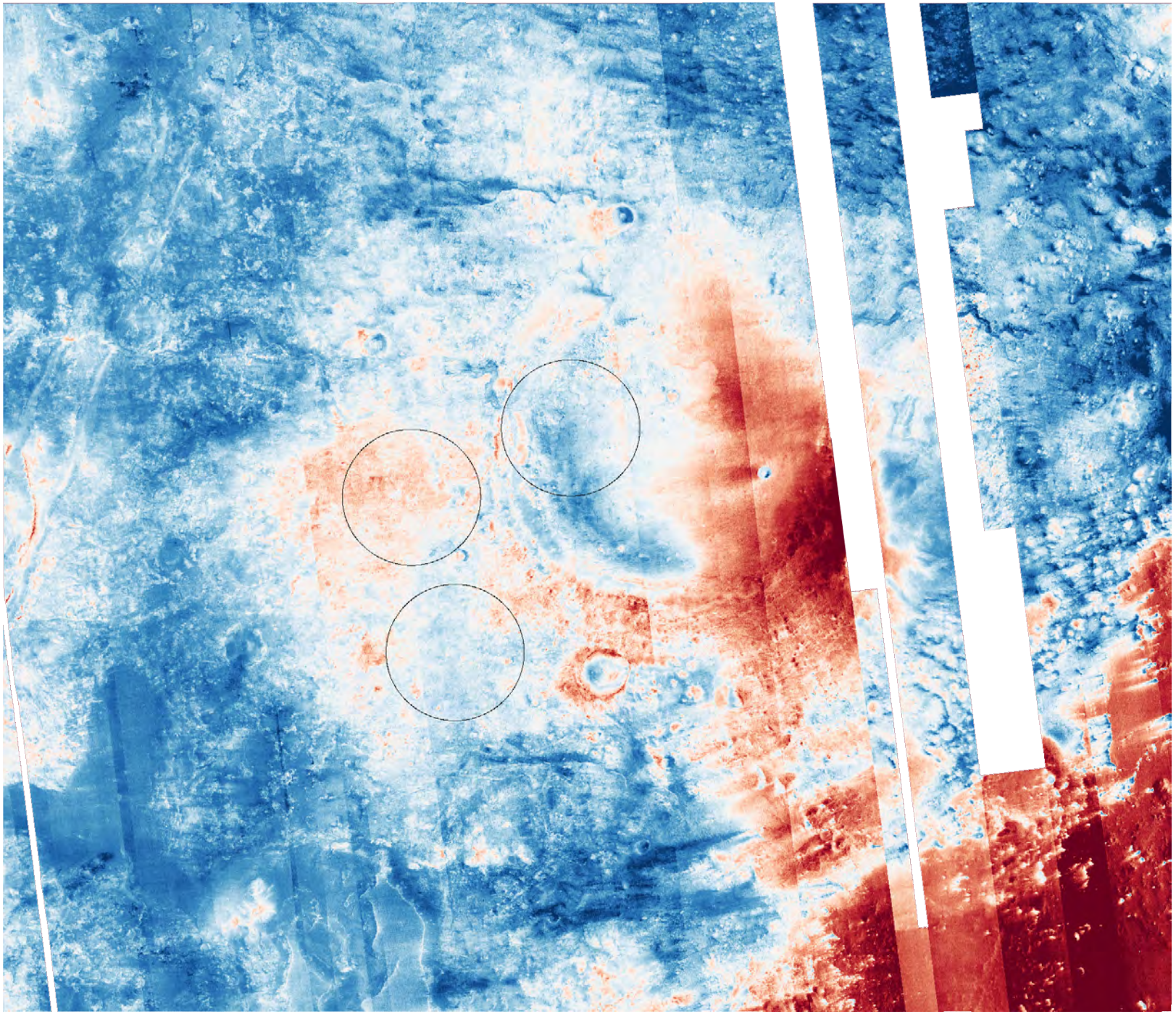
Coverage / Density



MSV - 90 m/px
VNIR
Hyperspectral

R: 770 nm
G: 600 nm
B: 530 nm

Optimized RGB Composite

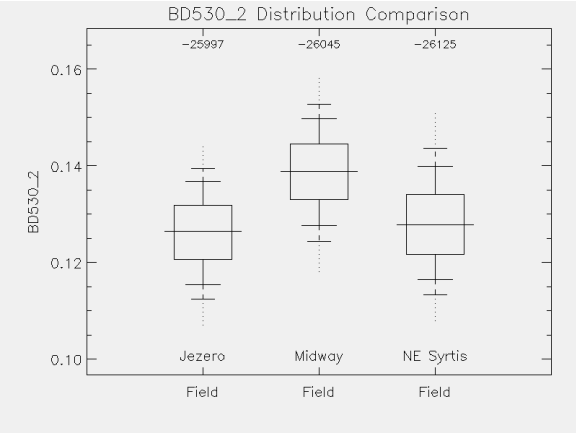


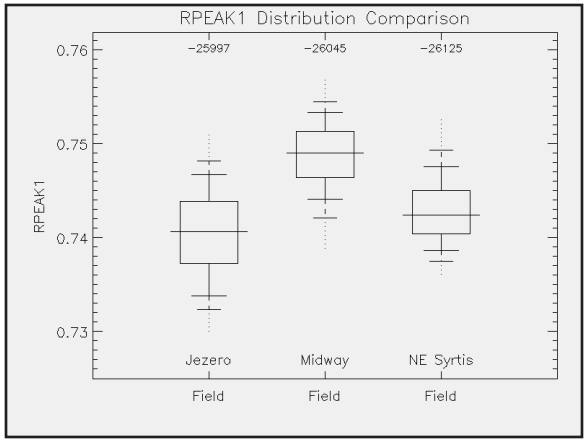
MSV - 90 m/px
VNIR
Hyperspectral

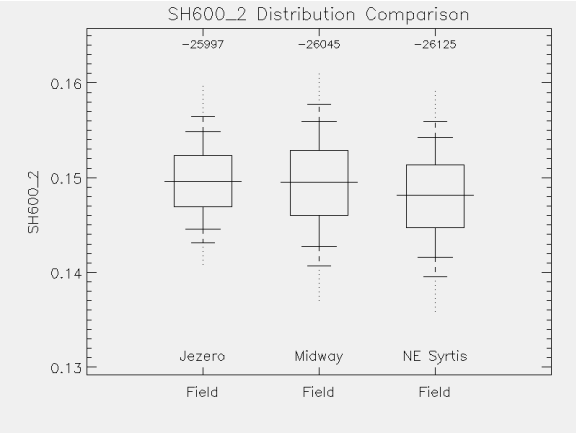
Linear Stretch
[718-774] nm

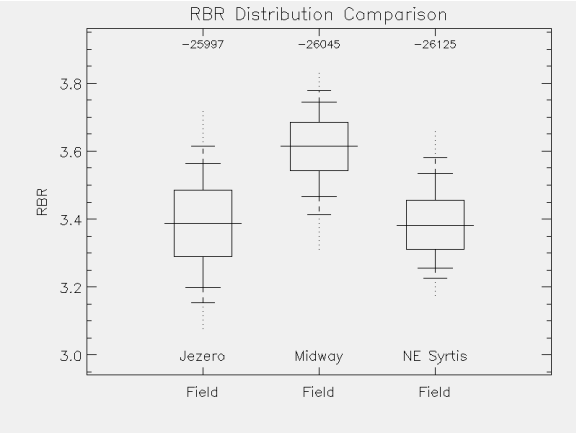
RPEAK1

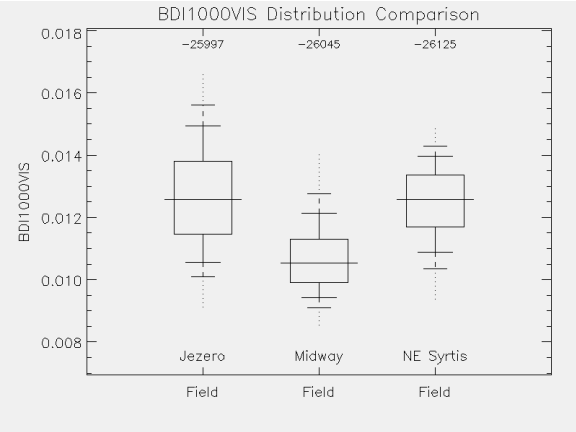
90 m/px VNIR (MSV) Hyperspectral Parameter Distributions

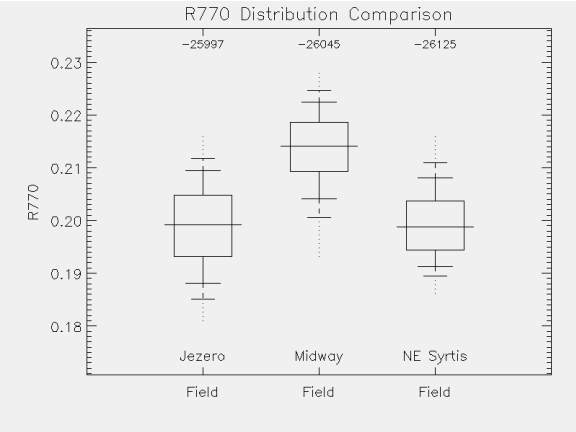


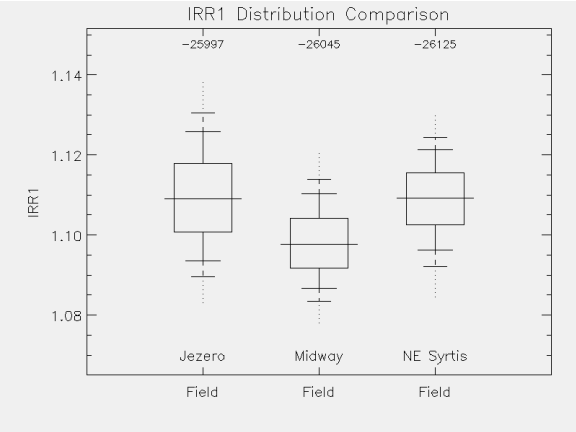








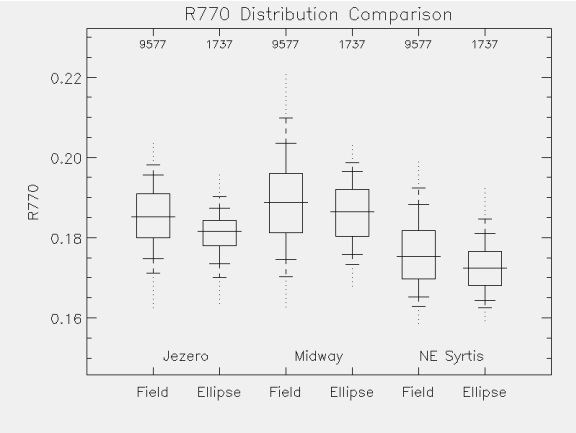


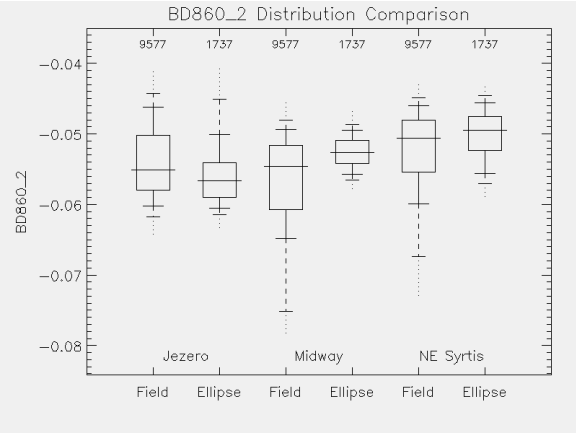


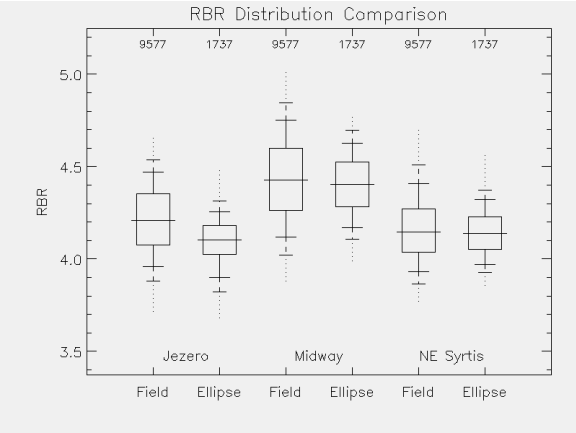
- Three T1250 Mapping Data Splits
  - ~180 m/pxl, 19 channel VNIR; 199 observations
    - MSP, HSP, HSV
    - Band composite and parameter composite optimizaon
      - 1D landing ellipse and field area parameter stats comparison
  - ~180 m/pxl, 55 channel IR; 91 observations
    - MSP, HSP
    - Band composite and parameter composite optimization
      - 1D ellipse and field area parameter stats comparison
    - Selected additional browse / parameter composites
      - 2D field area joint parameter distribution comparison
  - ~90 m/pxl, 90 channel VNIR; 107 observations (landing site local area)
    - MSV
    - Example optimized band and parameter composite
      - 1D field area parameter stats comparison

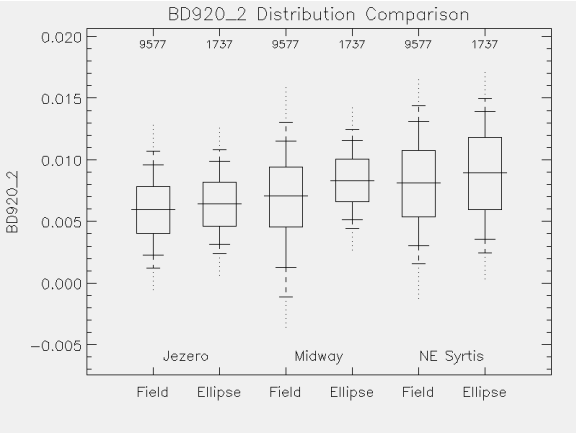
Additional Material

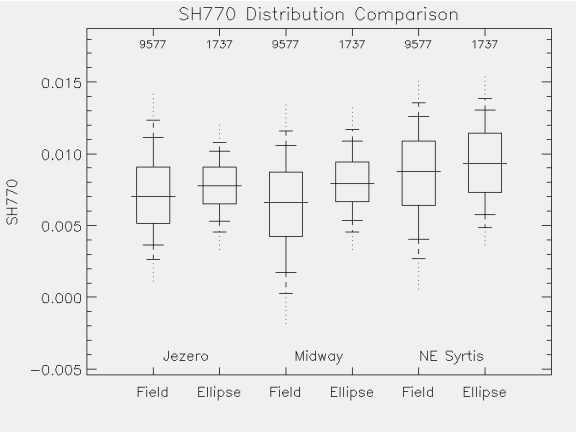
180 m/px VNIR (MSP, HSP, HSV) Multispectral Parameter Distributions

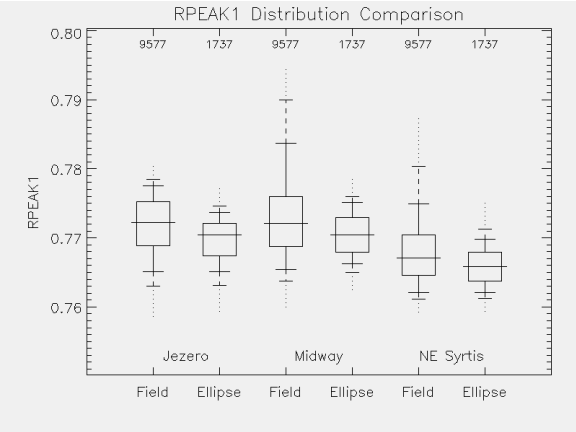


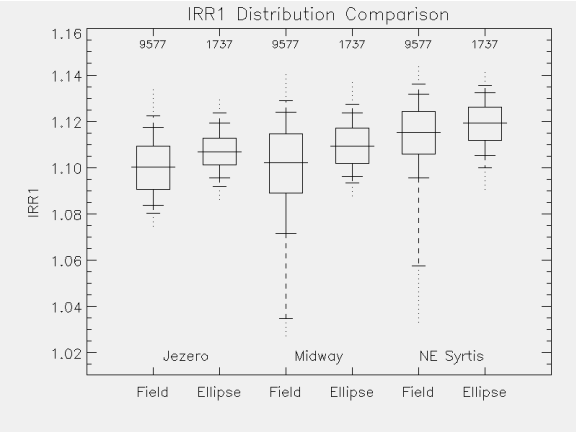




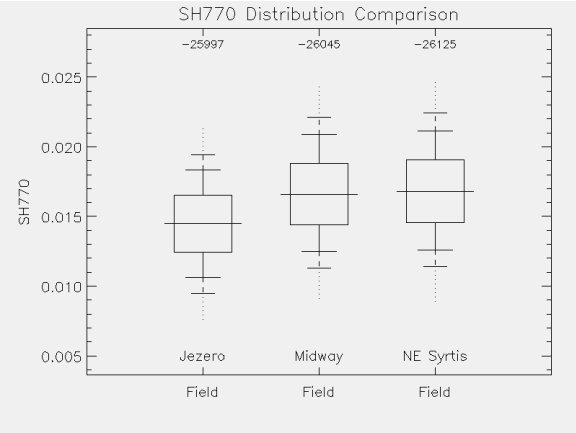


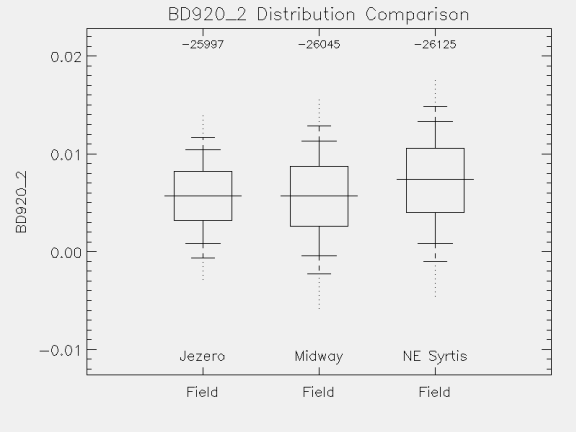


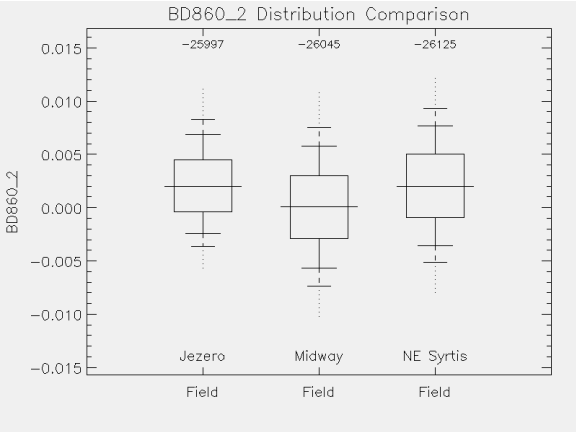




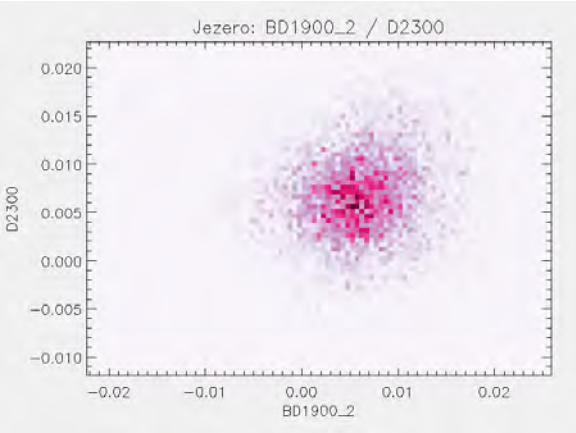
90 m/px VNIR (MSV) Hyperspectral Parameter Distributions

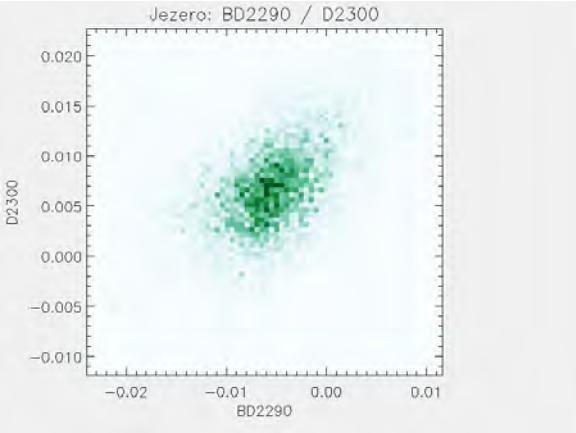






Jezero


Jezero: BD1900_2 / D2300
D2300
BD1900_2
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.02
−0.01
0.00
0.01
0.02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D2300
BD2290
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0.005
0.000
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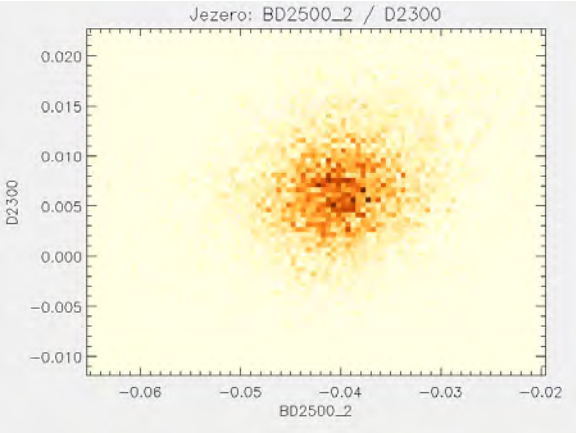
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D2300
BD2500_2
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0.015
0.010
0.005
0.000
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−0.06
−0.05
−0.04
−0.03
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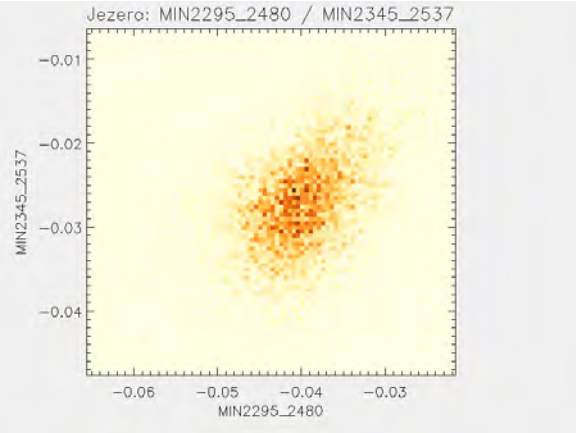
Jezero: MIN2295_2480 / MIN2345_2537
MIN2345_2537
MIN2295_2480
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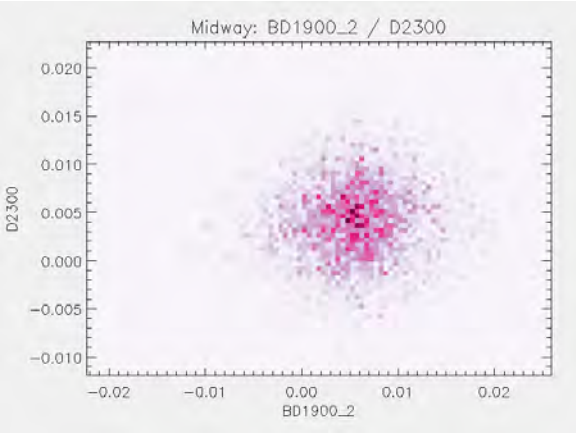
−0.02
−0.03
−0.04
−0.06
−0.05
−0.04
−0.03

Midway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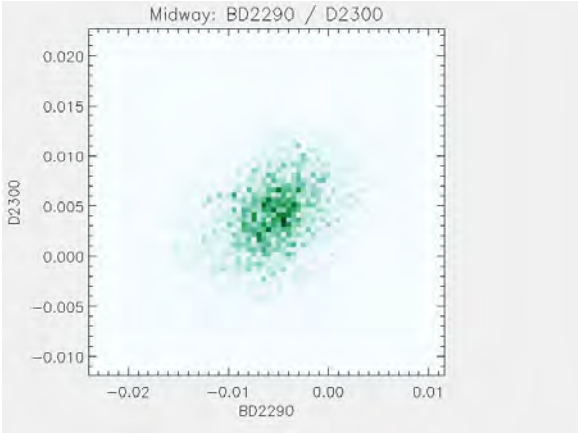
D2300
BD1900_2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D2300
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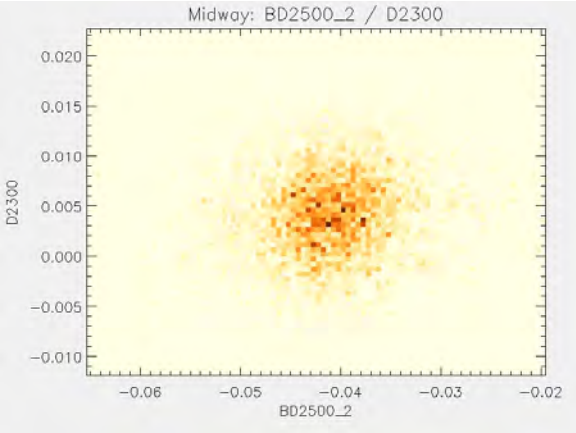
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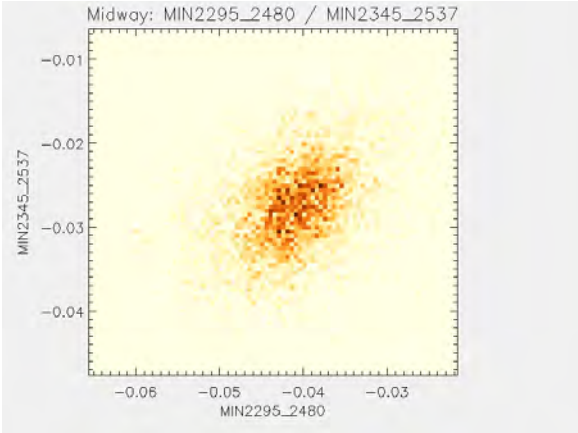
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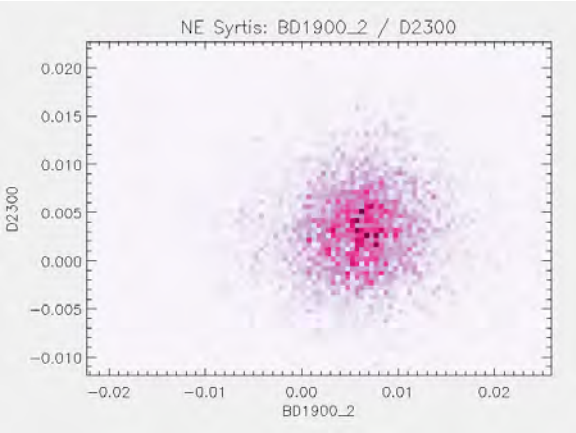
NE Syrtis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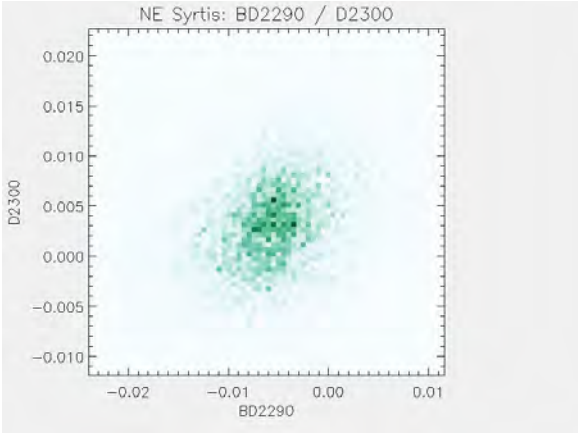
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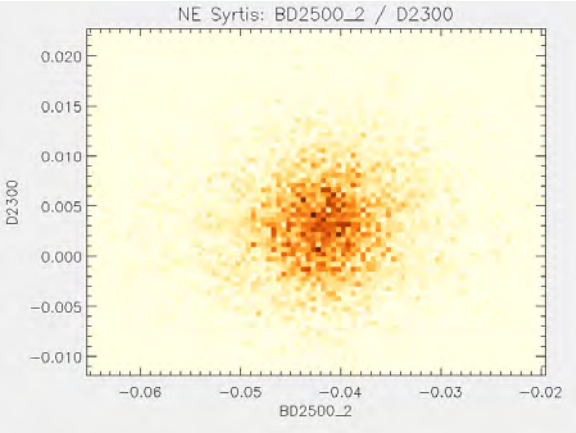
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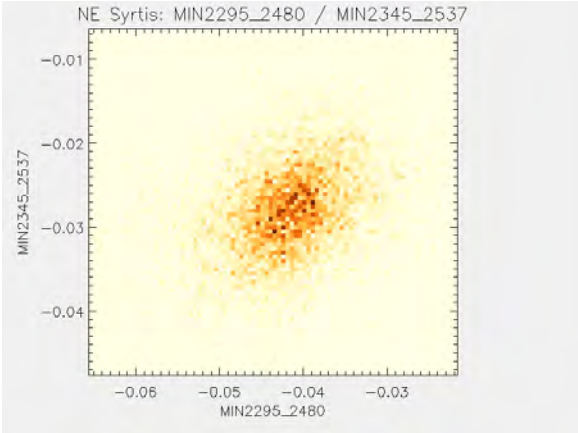
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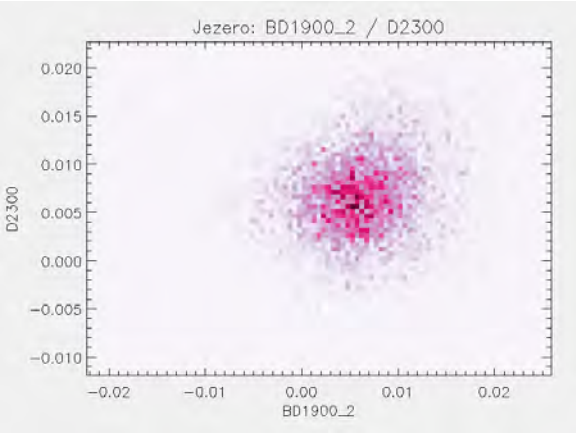
MIN2345_2537
MIN2295_2480

Jezero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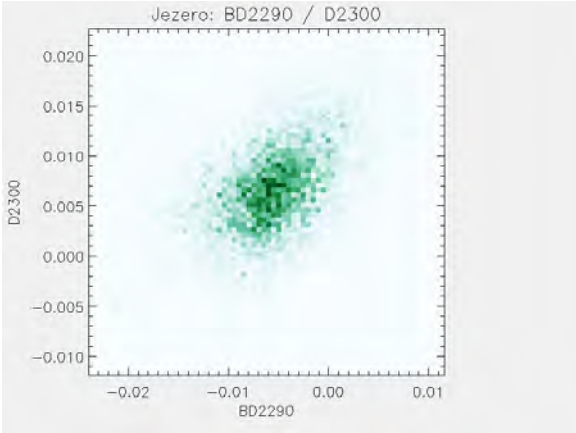
D2300
BD1900_2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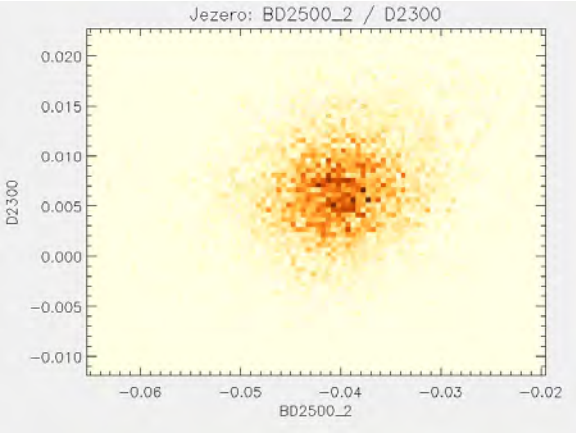
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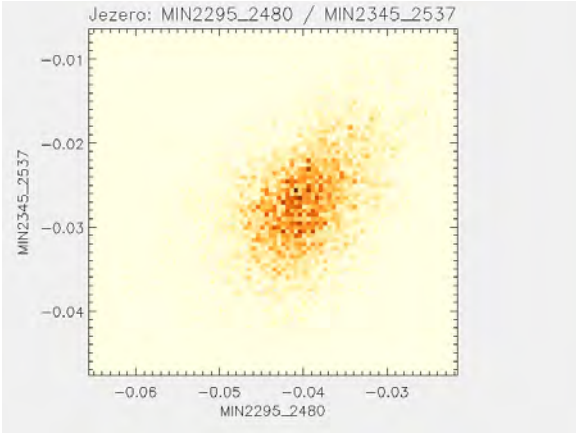
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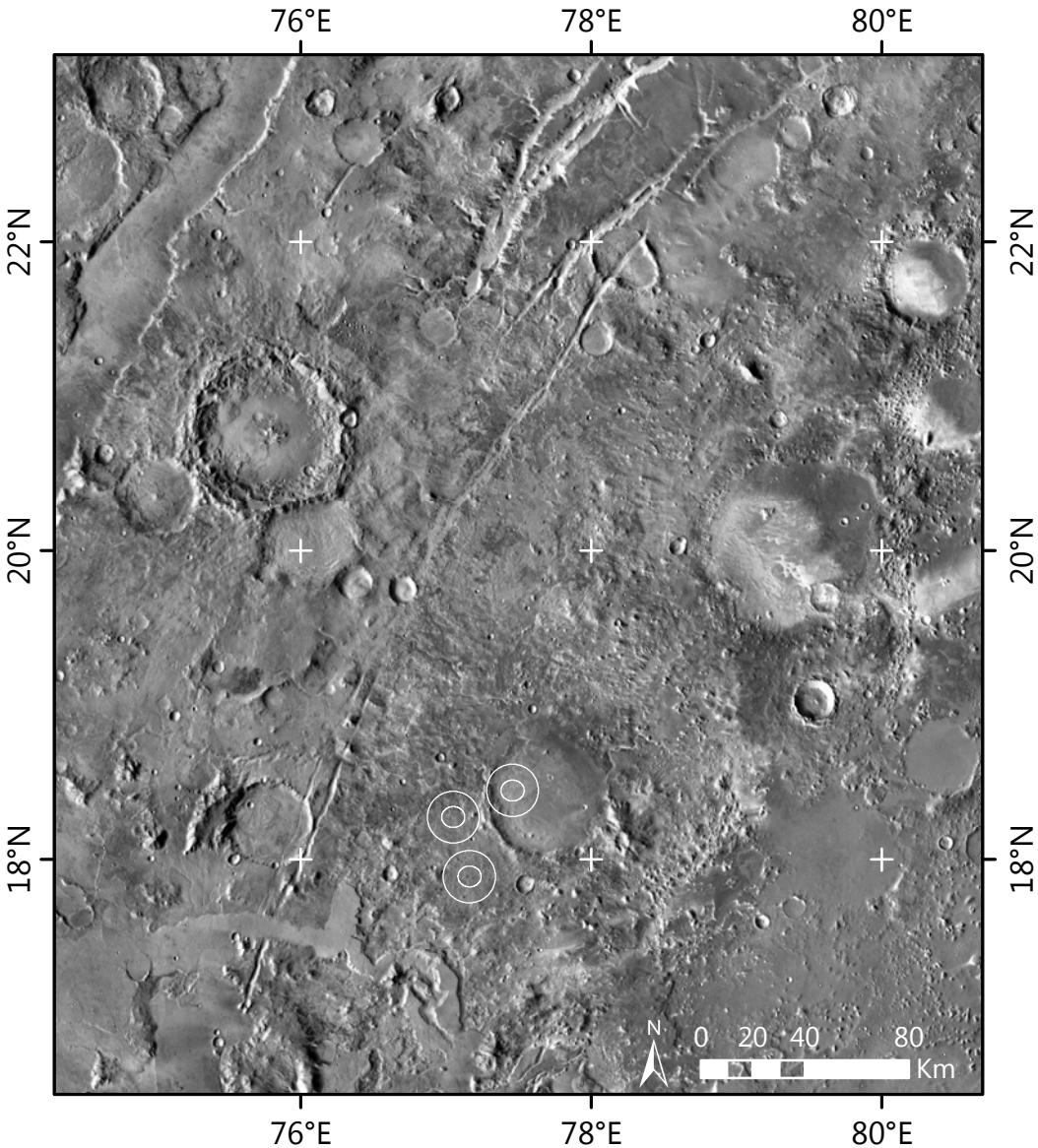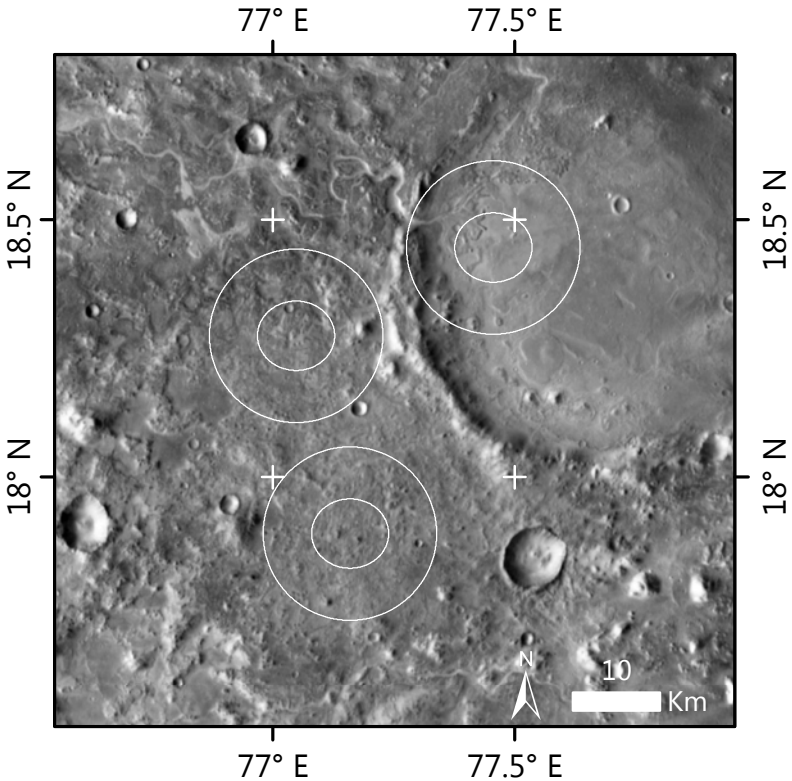
CRISM Map Tile T1250