

UZAKTAN ALGILAMA VERİLERİNİN ASTRONOMİK GÖZLEMLER AÇISINDAN DEĞERLENDİRİLMESİ

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İÇERİK:

**METEOROLOJİK UYDU VERİLERİNİN
ASTRONOMİK GÖZLEMLER AÇISINDAN DEĞERLENDİRİLMESİNE
YÖNELİK YÖNTEM - KRİTER ÇALIŞMASI VE DOĞU ANADOLU
GÖZLEMEVİ (*DAG*) YERLEŞKESİ İÇİN İLK KEZ UYGULANMASI**

- (TÜBİTAK – 2218 YURT İÇİ DOKTORA SONRASI ARAŞTIRMA BURS PROGRAMI)
- (BAŞLAMA/BİTİŞ: 02-01-2019/02-01-2021 [24 Ay])

ÇALIŞMANIN AMACI:

Farklı dalgaboylarında yapılan gözlemleri belirleyen temel faktörler; gözlem yeri (*yüksek rakım, altyapı, ışık ve toz kirliliğinden uzaklık, kolay ulaşılabilirlik, iletişim vb.*), atmosferik etkiler (*sıcaklık, nem oranı, açık gece sayısı, rüzgar hızı vb.*) ve gözlem araçlarıdır (*teleskop, ayna, alıcılar vb.*).

Bulut kapalılığı; atmosferimiz için açık/kapalı indeksi oluşturmak

Yağışabilir Su buharı (PWV) üretmek.

Atmosferik **O₃, H₂O ve CO₂** gazlarının tespiti ve değişimini araştırmak.

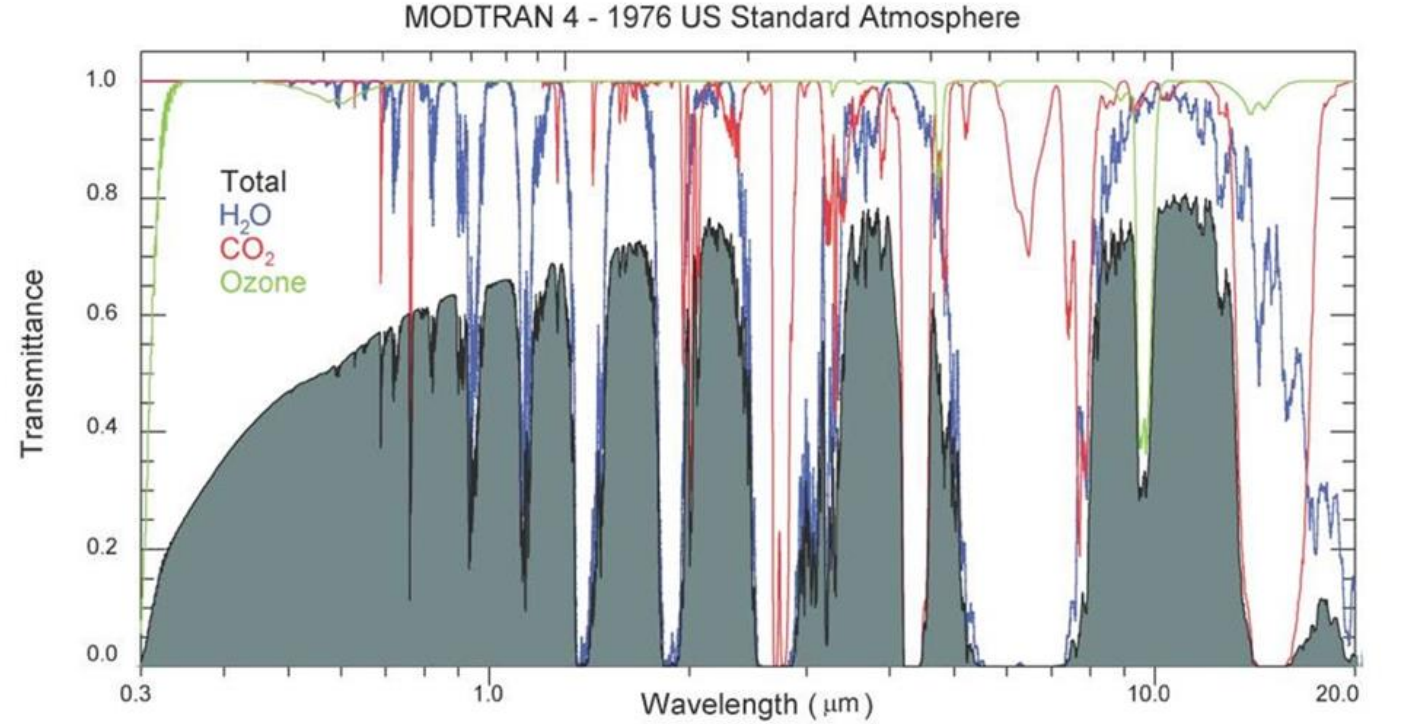
Optik-Kırmızı ötesi gözlem gecelerini belirlemek.

Atmosferik soğurulmadan sorumlu
başlıca moleküller;

ozon (O₃), su buharı (H₂O), karbondioksit (CO₂), karbonmonoksit (CO), azot (N₂) ve oksijendir (O₂).

DOĞU ANADOLU GÖZLEMEVİ (DAG):

Türkiye'nin en büyük çaplı (4 m)
VIS ve IR; [0.3-3 mikron]
3170 m rakım



VERİLER:

- MODIS:
 - MYD07 (MODIS Atmospheric Profile product)
- METEOSAT
 - SEVIRI (Reflektans, Parlaklık sıcaklığı)
 - NWC SAF (Bulut tipi, Bulut maskesi)
- RAVİNSONDE
 - ERZURUM (Basınç, Sıcaklık, Nem)
- DAG/ATASAM YERİNDE ÖLÇÜMLER:
 - *Seeing Monitor, GNSS-PWV*

MYD07 (MODIS Atmo spheric Profile product)

The screenshot displays the HDFView 3.0 application window. The title bar reads "HDFView 3.0". The menu bar includes "File", "Window", "Tools", and "Help". The "Recent Files" list shows the current file: "C:\Users\zuhai\Desktop\MOD07_L2.A2019001.0000.061.2019001132036.hdf".

The main interface is divided into two panes. The left pane shows a tree view of data fields, including:

- Solar_Azimuth (dimension)
- Sensor_Zenith (dimension)
- Sensor_Azimuth (dimension)
- Brightness_Temperature (dimension)
- Cloud_Mask (dimension)
- Skin_Temperature (dimension)
- Surface_Pressure (dimension)
- Surface_Elevation (dimension)
- Processing_Flag (dimension)
- Tropopause_Height (dimension)
- Guess_Temperature_Profile (dimension)
- Guess_Moisture_Profile (dimension)
- Retrieved_Temperature_Profile (dimension)
- Retrieved_Moisture_Profile (dimension)
- Retrieved_WV_Mixing_Ratio_Profile (dimension)
- Retrieved_Height_Profile (dimension)
- Total_Ozone (dimension)
- Total_Totals (dimension)
- Lifted_Index (dimension)
- K_Index (dimension)
- Water_Vapor (dimension)
- Water_Vapor_Direct (dimension)
- Water_Vapor_Low (dimension)
- Water_Vapor_High (dimension)
- Quality_Assurance (dimension)

The right pane displays "General Object Info" for the selected "Cloud_Mask" field:

- Name: Cloud_Mask (dimension)
- Path: /mod07/Data Fields/
- Type: HDF4 SDS
- Number of Attributes: 11
- Tag, Ref: 720, 28

Below this, the "Dataspace and Datatype" section shows:

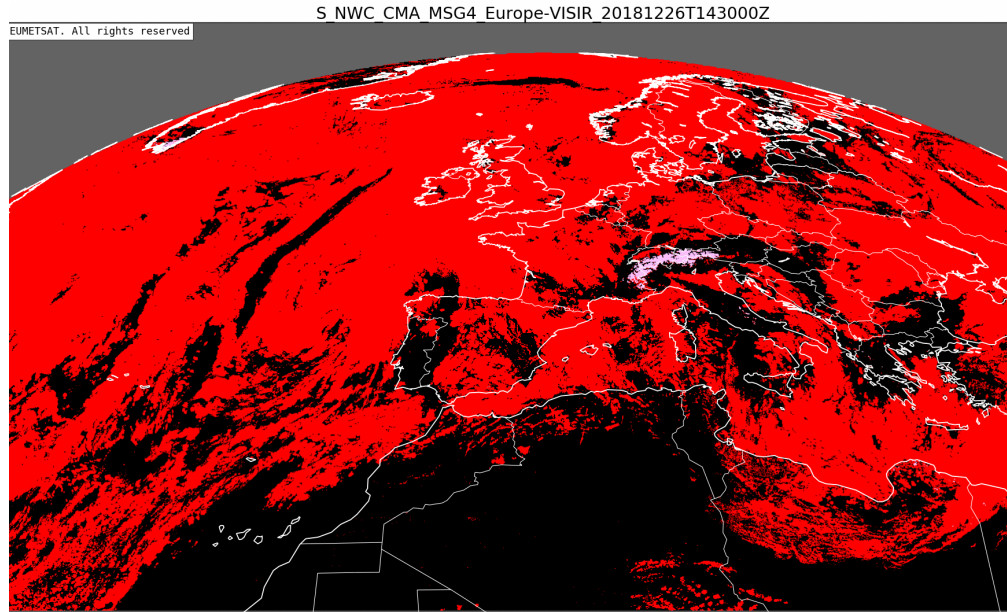
- No. of Dimension(s): 2
- Dimension Size(s): 406 (Cell_Along_Swath:mod07) x 270 (Cell_Across_Swath:mod07)
- Max Dimension Size(s): 406 x 270
- Data Type: 8-bit integer

The "Storage Layout" section at the bottom right shows:

- Storage Layout: NONE
- Compression: GZIP(level=4)
- Filters: NONE
- Storage: NONE
- Fill value: 0

The status bar at the bottom of the window indicates the current path: "HDFView root - C:\Users\zuhai\AppData\Local\Apps\HDF_Group\HDFView\3.0.0" and the user property file: "User property file - C:\Users\zuhai\.hdfview3.0". The Windows taskbar at the very bottom shows the system tray with the date "28.01.2019" and time "09:23".

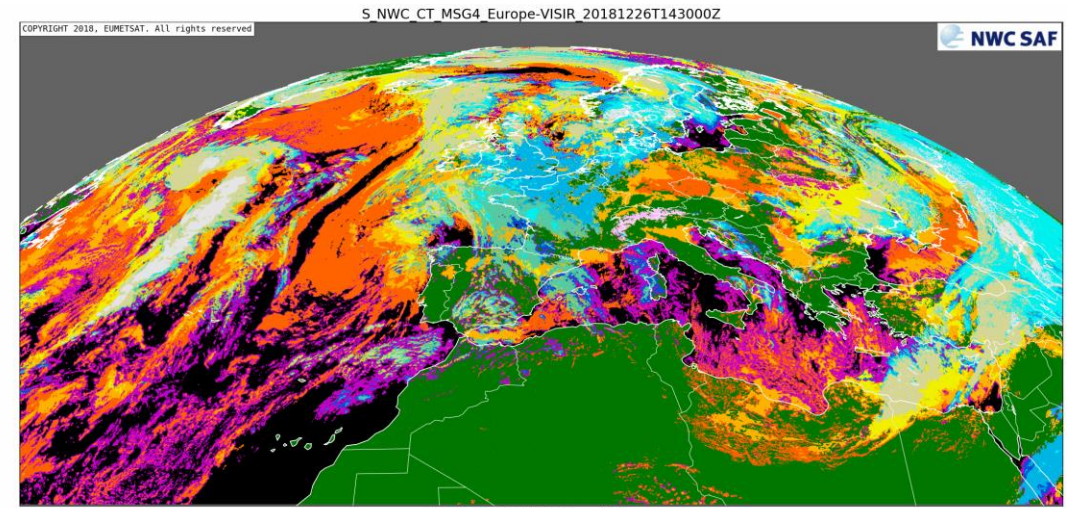
BULUTLULUK



NWC GEO CMA Cloud and Snow Mask



Cloud-free
Cloud except thin ice over snow
Thin ice clouds over snow ice
Snow Ice



NWC GEO CT Cloud Type



Cloud-free land
Cloud-free sea
Snow over land
Sea ice
Very low clouds
Low clouds
Mid-level clouds
High opaque clouds
Very high opaque clouds
Fractional clouds
Transparent thin clouds
Semi-transparent thin clouds
Transparent thick clouds
Semi-transparent thick clouds
Low or medium clouds
Transparent above snow ice

YAĞIŞABİLİR SU BUHARI (PWV)

METEOSAT SEVIRI PWV

RAVİNSONDE PWV

HİBRİT PWV: SEVIRI + RAVİSONDE

- Channel 01: VIS 0.6 μ
- Channel 02: VIS 0.8 μ
- Channel 03: NIR 1.6 μ
- Channel 04: MIR 3.9 μ
- Channel 05: WV 6.2 μ („H₂O“)
- Channel 06: WV 7.3 μ („H₂O“)
- Channel 07: IR 8.7 μ
- Channel 08: IR 9.7 μ („O₃“)
- Channel 09: IR 10.8 μ
- Channel 10: IR 12.0 μ
- Channel 11: IR 13.4 μ („CO₂“)
- Channel 12: HRV (High Resolution Visible)

$$\text{WV1} = a_0 + a_1 \cdot \text{WV062} + a_2 \cdot \text{WV073} + a_3 \cdot \text{IR087} + a_4 \cdot \text{IR097} + a_5 \cdot \text{IR108} + a_6 \cdot \text{IR120} + a_7 \cdot \text{IR134} \quad (1)$$

$$\text{WV2} = a_0 + a_1 \cdot \text{WV062} \cdot (\text{IR108} - \text{IR120}) \quad (2)$$

$$\text{WV3} = a_0 + a_1 \cdot (\text{IR108} - \text{IR120}). \quad (3)$$

(Yves Julien et al., 2015)

ATMOSFERİK GAZLAR (O3, H2O ve CO2)

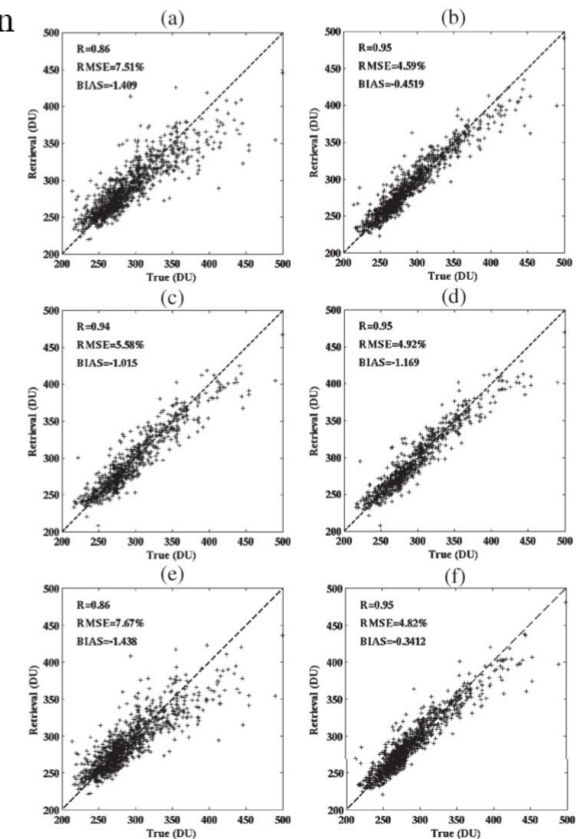
- Channel 01: VIS 0.6 μ
- Channel 02: VIS 0.8 μ
- Channel 03: NIR 1.6 μ
- Channel 04: MIR 3.9 μ
- Channel 05: WV 6.2 μ („H₂O“)
- Channel 06: WV 7.3 μ („H₂O“)
- Channel 07: IR 8.7 μ
- Channel 08: IR 9.7 μ („O₃“)
- Channel 09: IR 10.8 μ
- Channel 10: IR 12.0 μ
- Channel 11: IR 13.4 μ („CO₂“)
- Channel 12: HRV (High Resolution)

OZON (O3):

$$TOZ = A_0 + \sum_{j=1}^n A_j T b_j + \sum_{j=1}^n A'_j T b_j^2 + \sum_{l=1}^{101} B_l T a_l + C_1 p_s + C_2 \sec \theta + C_3 \cos \left(\frac{M-6}{12} \pi \right) + C_4 \cos(LAT). \quad (2)$$

Here, *TOZ* is the total ozone value in Dobson units (DU); *A*, *A'*, *B*, and *C* are the regression coefficients; *Tb* and *Ta* are IR BTs and atmospheric temperatures, respectively; θ is the local zenith angle (LZA) of the satellite field of view (FOV); *M* is the month (1, 2, ..., 12); *LAT* is the latitude of the satellite pixel; *j* is the satellite band index; *n* is the number of IR channels applied in the algorithm; and *l* is the layer index of the temperature profile.

(Xin Jin et al., 2018)



ATMOSFERİK GAZLAR: O₃, H₂O ve CO₂

- Channel 01: VIS 0.6 μ
- Channel 02: VIS 0.8 μ
- Channel 03: NIR 1.6 μ
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- Channel 05: WV 6.2 μ („H₂O“)
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$$\text{WV1} = a_0 + a_1 \cdot \text{WV062} + a_2 \cdot \text{WV073} + a_3 \cdot \text{IR087} + a_4 \cdot \text{IR097} + a_5 \cdot \text{IR108} + a_6 \cdot \text{IR120} + a_7 \cdot \text{IR134} \quad (1)$$

$$\text{WV2} = a_0 + a_1 \cdot \text{WV062} \cdot (\text{IR108} - \text{IR120}) \quad (2)$$

$$\text{WV3} = a_0 + a_1 \cdot (\text{IR108} - \text{IR120}). \quad (3)$$

H₂O:

TABLE I
WV COEFFICIENTS FOR THE ALGORITHM GIVEN BY (1)–(3).
COEFFICIENT OF DETERMINATION (R^2), STANDARD ERROR
OF ESTIMATION (σ), AND TOTAL ERROR e_{WV} OBTAINED
IN THE SENSITIVITY ANALYSIS ARE ALSO GIVEN

Coef	WV1	WV2	WV3
a ₀	-70.7±1.0	1.400±0.014	1.403±0.014
a ₁	-0.011±0.004	0.00692±0.00004	1.657±0.011
a ₂	0.033±0.006		
a ₃	-0.134±0.005		
a ₄	0.083±0.002		
a ₅	1.273±0.018		
a ₆	-1.66±0.02		
a ₇	0.725±0.015		
R ²	0.93	0.78	0.78
σ (g/cm ²)	0.5	0.8	0.8
e _{WV} (g/cm ²)	0.6	0.9	0.9

ATMOSFERİK GAZLAR (O₃, H₂O ve CO₂)

- Channel 01: VIS 0.6 μ
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- Channel 12: HRV (High Resolution Visible)

CO₂:

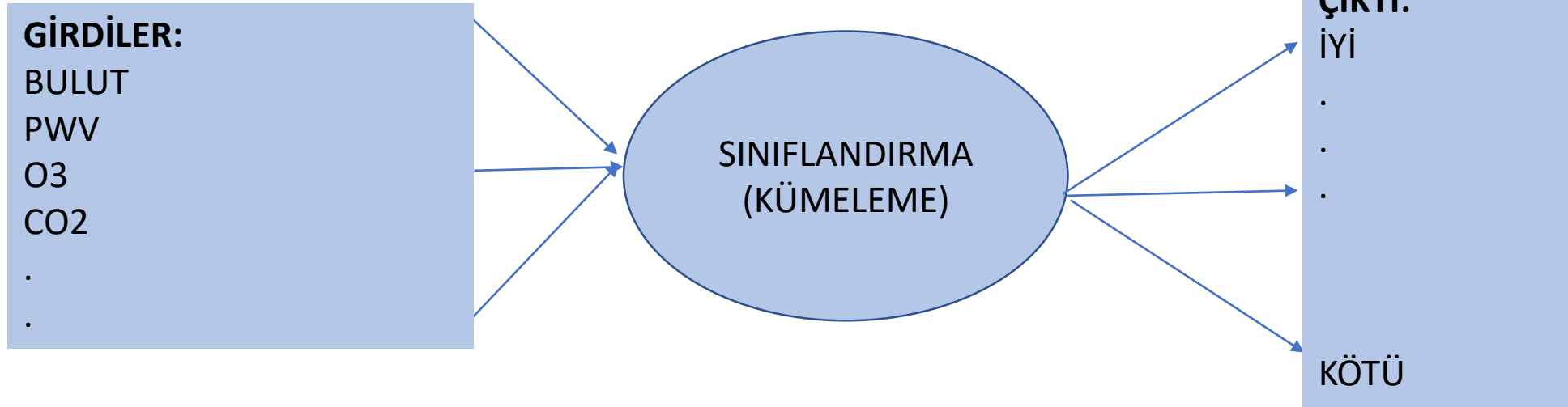
The 10.8 and 13.4-μm channels brightness temperatures ($T_{10.8}$ and $T_{13.4}$ respectively) were used to estimate the upward transmission of radiation above the cloud at the 13.4-μm channel ($t'_{13.4}$):

$$t'_{13.4} = \left(\frac{T_{13.4}}{T_{10.8}} \right)^4, \quad (10)$$

The absorption at the 13.4-μm channel is:

$$a'_{13.4} = 1 - t'_{13.4}$$

(Meteosat Docs)



ÖZETLE

CM ve CT görüntülerinden atmosferimiz için açık/kapalı indeksi oluşturulacaktır.

METEOSAT termal kanal verilerinden ve Ravinsonde rasatlarından PWV üretilecektir.

O₃, H₂O ve CO₂ uydu verilerinden (SEVIRI) tespiti yapılarak bu moleküllerin atmosferdeki alansal ve zamansal değişimi ile AGK'ne etkisi belirlenecektir.

IR gözlem gecelerine yönelik ilk tespitler yapılacaktır.

Anlık AGK belirlenecek.

TEŞEKKÜRLER..

YORUM/KATKI/soru