

Photosynthetically active radiation climatology in Greece for optimal vineyard planning and exploitation

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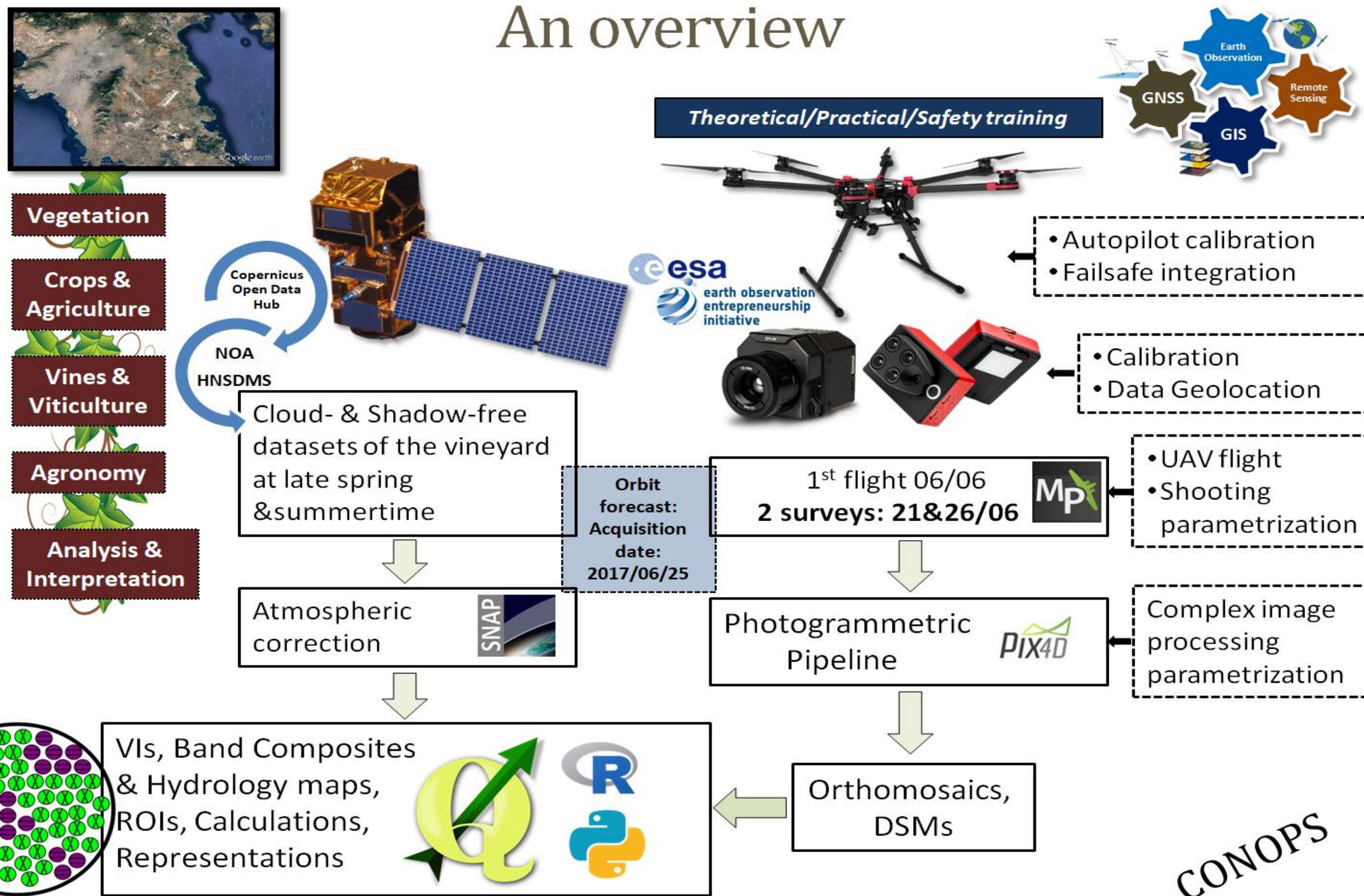
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pmo *wrc*

Motivation & Methodology

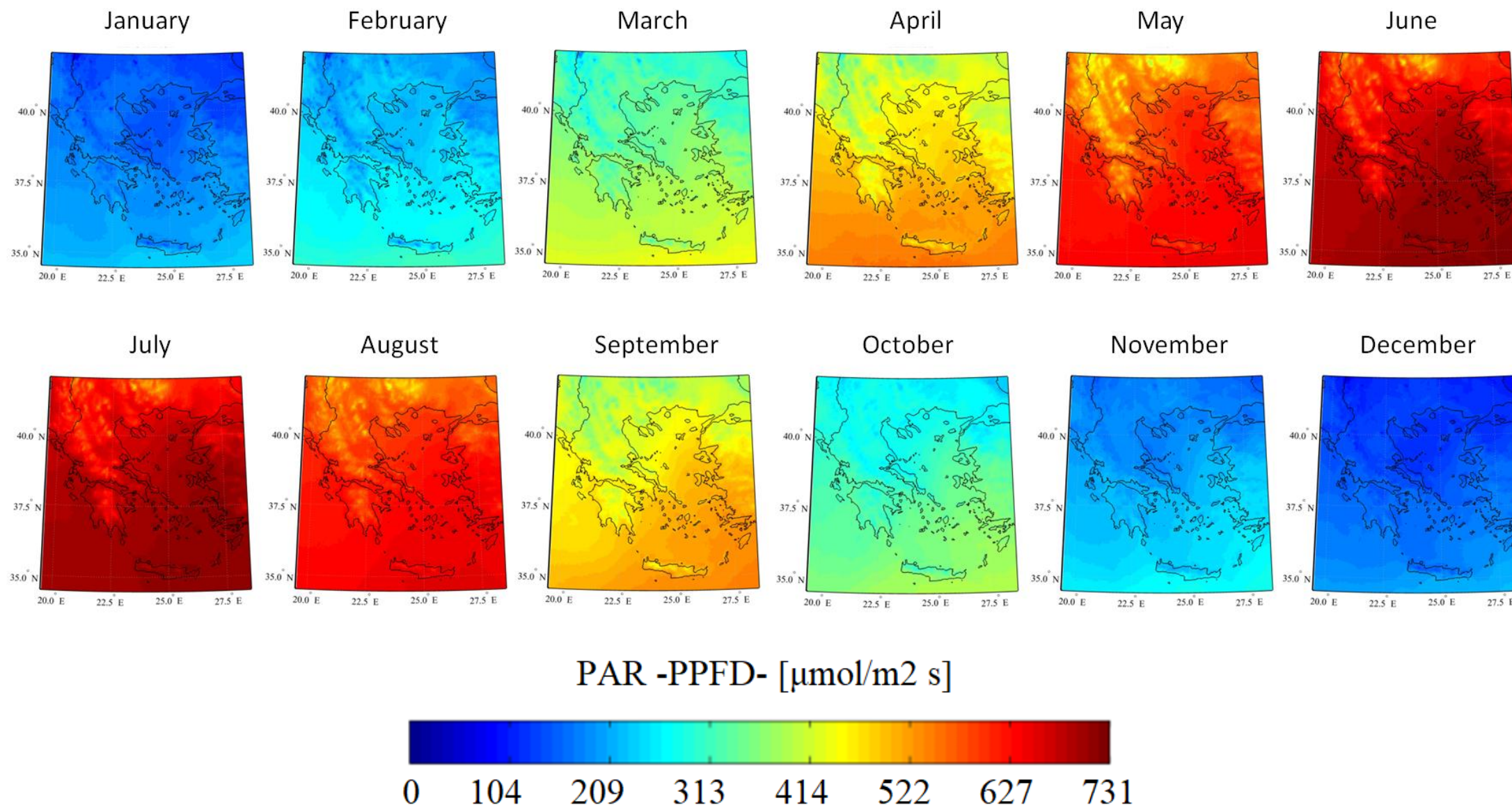
❖ Greece presents unique climatological conditions for wine production from the ancient times. One of the most critical parameters affecting this climate is the Photosynthetically Active Radiation (PAR). PAR provides the energy that supports photosynthesis and primary production by green plants and provokes several effects on grapevine, mainly because of its relation to the ultraviolet band that stimulates the production of important compounds directly involved in yield characteristics. Despite its importance there is a lack of climatological studies about PAR in Greece.



➤ In particular, we developed the first tailored Atlas of PAR, in support of the local wine producers and the wider agricultural community. This Atlas, in terms of photosynthetic photon flux density, will provide the necessary background information for "smart" and efficient vineyard programming in Greece.

➤ Simultaneously, by using airborne and space-borne remote sensing techniques (e.g. Unmanned Aircraft Systems, Sentinel-2) and for a specific pilot vineyard at Spata (Attica), we report on additional stress factors, irrigation issues, crop vigor, hydrological behavior etc, in order to optimize the cultivation practices.

PAR Climatology & Applications



➤ The climatology of PAR is based on a 15-year climatology from the solar radiation databases and products of the EUMETSAT's Satellite Application Facility on Climate Monitoring (CM SAF), taking into account the clouds and aerosols impact on PAR, while the spatial resolution is almost 3 km at nadir, maximizing the exploitative value of the solar energy technologies.

➤ PAR was calculated by using the spectral global horizontal irradiance information in the region 400-700 nm and this techniques was applied for various scientific purposes (Dimitropoulou et al., 2018).

The PAR is available in terms of power (W/m²) and photosynthetic photon flux density (PPFD) in μmol/m² s.



Step 1: Select Country

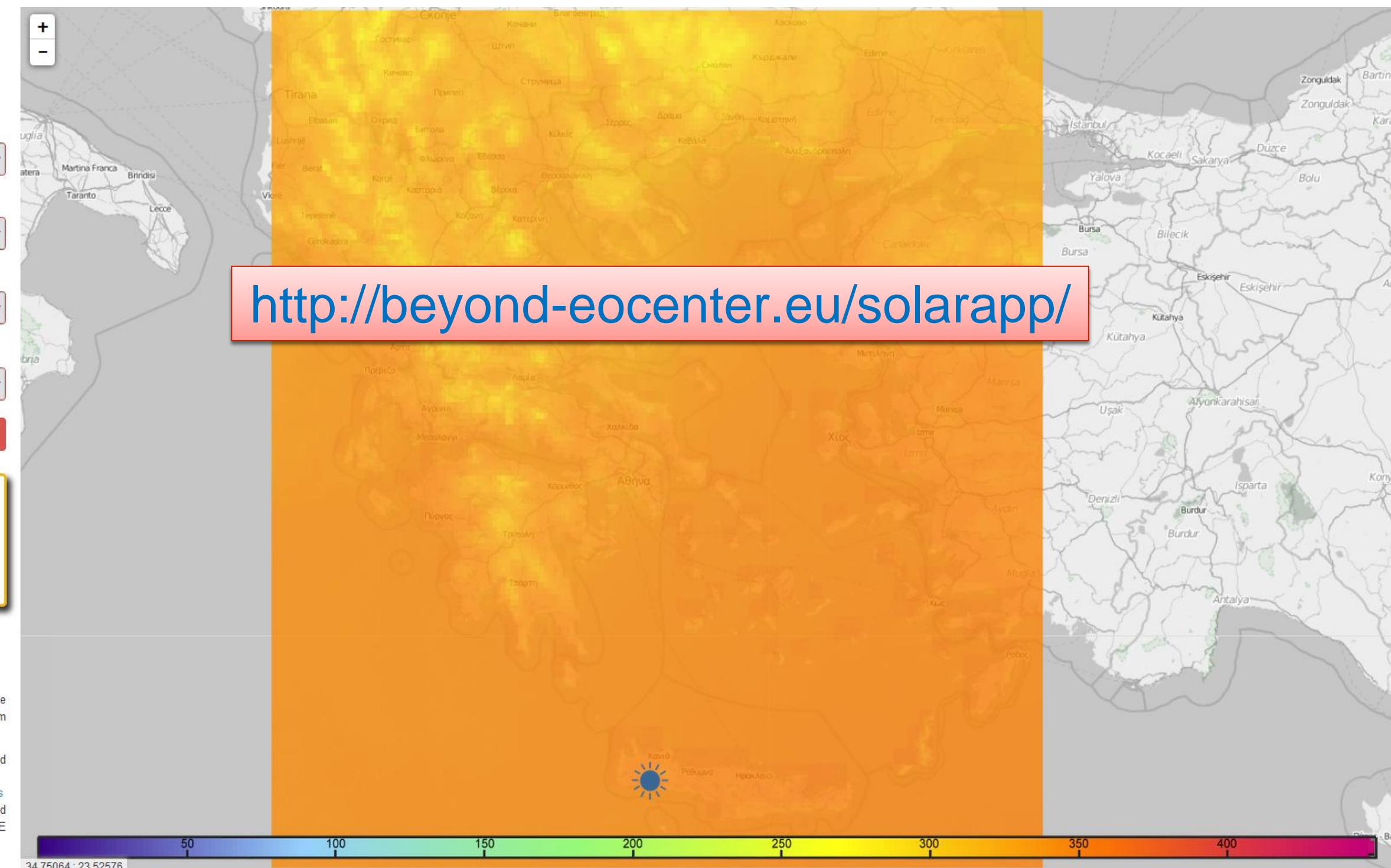
Step 2: Select Year

Step 3: Select Month

Step 4: Select Type of Data

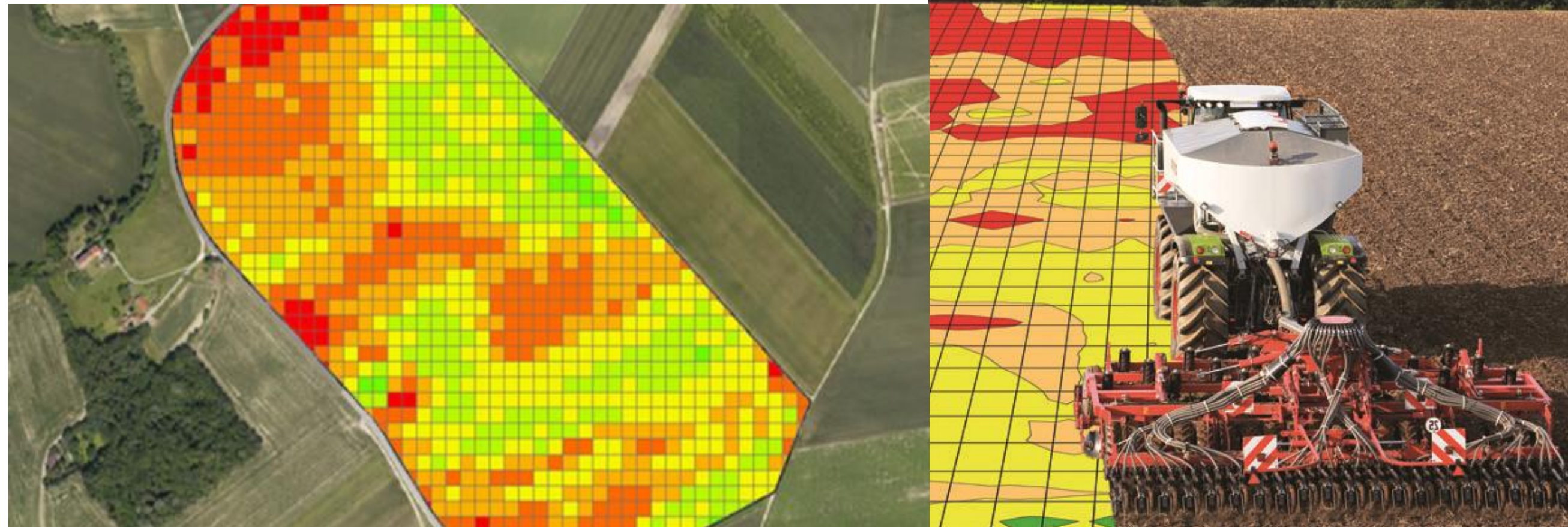
Power: 159.49 W/m²
Mean Power: 101.11 W/m²
PPFD: 211.17 μmol/m² s
Mean PPFD: 462.08 μmol/m² s
[Download Selected Area Data](#)

This service has been implemented in the framework of Solar Energy Nowcasting SystEm (SENSE) pilot of the GEO-CRADLE project.
 The initial solar radiation database was retrieved by the EUMETSAT's CM SAF.
 For more information please contact Stelios Kazadzis (PI of SENSE from PMOD/WRC) and Panagiotis Kosmopoulos (Developer of SENSE from NOA).



Remote Sensing for agriculture is a solution looking for a problem

- Continuous monitoring and background
- Efficient and fully interactive cultivation



Photosynthetically Active Radiation Climatology In Greece For Optimal Vineyard Planning And Exploitation

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²Physical and Meteorological Observatory of Davos, World Radiation Center, Switzerland

Motivation & Methodology

Greece presents unique climatological conditions for wine production from the ancient times. One of the most critical parameters affecting this climate is the Photosynthetically Active Radiation (PAR). PAR provides the energy that supports photosynthesis and primary production by green plants and provides several effects on grapevine, mainly because of its relation to the ultraviolet band that stimulates the production of important compounds directly involved in yield characteristics. Despite its importance there is a lack of climatological studies about PAR. Simultaneously, by using airborne and space-borne remote sensing techniques (Unmanned Aircraft Systems, Sentinel-2) and for a specific pilot vineyard in Spata (Attika), we report on additional stress factors, irrigation issues, crop vigor, hydrological behavior etc. in order to optimize the cultivation practices. With this study, we propose the synergistic use of remote sensing and modeling techniques as a promising tool for effective vineyard planning and exploitation, and the selection of the pilot location, will enable further investigation of the effects of the urban conditions on the vineyards, both directly (e.g. air quality) and indirectly (e.g. impacts on PAR).

In this study, we present different EO techniques and smart technologies combined within the SMURBS/TRA-PLANET project, in order to explore the benefits from the synergy of different observational platforms developed under the smart city approaches on parallel activities like agriculture.

In particular, we will develop the first tailored Atlas of PAR, in support of the local wine producers and the wider agricultural community. This Atlas, in terms of photosynthetic photon flux density, will provide the necessary background information for "smart" and efficient vineyard programming in Greece, focusing also on a specific pilot vineyard at Spata, which is a peri-urban field in the region of Attika, during the cultivation period of summer.

Precision

Modeling cultural practices as a function of spatial and temporal variabilities within agricultural fields

Precision farming, training and variability sensing
Precision Agriculture for the Agricultural sector

Absorption

Photosynthesis
Organic matter composition

Reflectance

Spectral signature

Vines should be monitored Spatially, in the context of the field they are planted in Temporally, through time series of status monitoring

PAR was calculated by using the spectral global horizontal irradiation information in the region 400-700 nm and this technique was applied for various scientific purposes (Dontropoulos et al., 2018).

PAR Climatology & Applications

Pilot Vineyard & Remote Interpretation

Cloud & Shadow Free Retrieval of the vineyard at late spring/Summer time

17 Flights (06/16, 27/06/16, 04/07/16, 11/07/16, 18/07/16, 25/07/16, 01/08/16, 08/08/16, 15/08/16, 22/08/16, 29/08/16, 05/09/16, 12/09/16, 19/09/16, 26/09/16, 03/10/16)

Photogrammetric Pipeline PAR

Orthorectified, DSMs

Legend

Color	Value
Blue	4.404
Green	4.407
Yellow	4.411
Orange	4.414
Red	4.417
Purple	4.420
Dark Blue	4.423
Dark Green	4.426
Dark Orange	4.429
Dark Red	4.432
Dark Purple	4.435
Dark Blue-Green	4.438
Dark Yellow	4.441
Dark Orange-Red	4.444
Dark Red-Purple	4.447
Dark Purple-Blue	4.450
Dark Blue-Orange	4.453
Dark Orange-Green	4.456
Dark Green-Red	4.459
Dark Red-Blue	4.462
Dark Blue-Green	4.465
Dark Green-Orange	4.468
Dark Orange-Red	4.471
Dark Red-Blue	4.474
Dark Blue-Green	4.477
Dark Green-Orange	4.480
Dark Orange-Red	4.483
Dark Red-Blue	4.486
Dark Blue-Green	4.489
Dark Green-Orange	4.492
Dark Orange-Red	4.495
Dark Red-Blue	4.498
Dark Blue-Green	4.501
Dark Green-Orange	4.504
Dark Orange-Red	4.507
Dark Red-Blue	4.510
Dark Blue-Green	4.513
Dark Green-Orange	4.516
Dark Orange-Red	4.519
Dark Red-Blue	4.522
Dark Blue-Green	4.525
Dark Green-Orange	4.528
Dark Orange-Red	4.531
Dark Red-Blue	4.534
Dark Blue-Green	4.537
Dark Green-Orange	4.540
Dark Orange-Red	4.543
Dark Red-Blue	4.546
Dark Blue-Green	4.549
Dark Green-Orange	4.552
Dark Orange-Red	4.555
Dark Red-Blue	4.558
Dark Blue-Green	4.561
Dark Green-Orange	4.564
Dark Orange-Red	4.567
Dark Red-Blue	4.570
Dark Blue-Green	4.573
Dark Green-Orange	4.576
Dark Orange-Red	4.579
Dark Red-Blue	4.582
Dark Blue-Green	4.585
Dark Green-Orange	4.588
Dark Orange-Red	4.591
Dark Red-Blue	4.594
Dark Blue-Green	4.597
Dark Green-Orange	4.600
Dark Orange-Red	4.603
Dark Red-Blue	4.606
Dark Blue-Green	4.609
Dark Green-Orange	4.612
Dark Orange-Red	4.615
Dark Red-Blue	4.618
Dark Blue-Green	4.621
Dark Green-Orange	4.624
Dark Orange-Red	4.627
Dark Red-Blue	4.630
Dark Blue-Green	4.633
Dark Green-Orange	4.636
Dark Orange-Red	4.639
Dark Red-Blue	4.642
Dark Blue-Green	4.645
Dark Green-Orange	4.648
Dark Orange-Red	4.651
Dark Red-Blue	4.654
Dark Blue-Green	4.657
Dark Green-Orange	4.660
Dark Orange-Red	4.663
Dark Red-Blue	4.666
Dark Blue-Green	4.669
Dark Green-Orange	4.672
Dark Orange-Red	4.675
Dark Red-Blue	4.678
Dark Blue-Green	4.681
Dark Green-Orange	4.684
Dark Orange-Red	4.687
Dark Red-Blue	4.690
Dark Blue-Green	4.693
Dark Green-Orange	4.696
Dark Orange-Red	4.699
Dark Red-Blue	4.702
Dark Blue-Green	4.705
Dark Green-Orange	4.708
Dark Orange-Red	4.711
Dark Red-Blue	4.714
Dark Blue-Green	4.717
Dark Green-Orange	4.720
Dark Orange-Red	4.723
Dark Red-Blue	4.726
Dark Blue-Green	4.729
Dark Green-Orange	4.732
Dark Orange-Red	4.735
Dark Red-Blue	4.738
Dark Blue-Green	4.741
Dark Green-Orange	4.744
Dark Orange-Red	4.747
Dark Red-Blue	4.750
Dark Blue-Green	4.753
Dark Green-Orange	4.756
Dark Orange-Red	4.759
Dark Red-Blue	4.762
Dark Blue-Green	4.765
Dark Green-Orange	4.768
Dark Orange-Red	4.771
Dark Red-Blue	4.774
Dark Blue-Green	4.777
Dark Green-Orange	4.780
Dark Orange-Red	4.783
Dark Red-Blue	4.786
Dark Blue-Green	4.789
Dark Green-Orange	4.792
Dark Orange-Red	4.795
Dark Red-Blue	4.798
Dark Blue-Green	4.801
Dark Green-Orange	4.804
Dark Orange-Red	4.807
Dark Red-Blue	4.810
Dark Blue-Green	4.813
Dark Green-Orange	4.816
Dark Orange-Red	4.819
Dark Red-Blue	4.822
Dark Blue-Green	4.825
Dark Green-Orange	4.828
Dark Orange-Red	4.831
Dark Red-Blue	4.834
Dark Blue-Green	4.837
Dark Green-Orange	4.840
Dark Orange-Red	4.843
Dark Red-Blue	4.846
Dark Blue-Green	4.849
Dark Green-Orange	4.852
Dark Orange-Red	4.855
Dark Red-Blue	4.858
Dark Blue-Green	4.861
Dark Green-Orange	4.864
Dark Orange-Red	4.867
Dark Red-Blue	4.870
Dark Blue-Green	4.873
Dark Green-Orange	4.876
Dark Orange-Red	4.879
Dark Red-Blue	4.882
Dark Blue-Green	4.885
Dark Green-Orange	4.888
Dark Orange-Red	4.891
Dark Red-Blue	4.894
Dark Blue-Green	4.897
Dark Green-Orange	4.900
Dark Orange-Red	4.903
Dark Red-Blue	4.906
Dark Blue-Green	4.909
Dark Green-Orange	4.912
Dark Orange-Red	4.915
Dark Red-Blue	4.918
Dark Blue-Green	4.921
Dark Green-Orange	4.924
Dark Orange-Red	4.927
Dark Red-Blue	4.930
Dark Blue-Green	4.933
Dark Green-Orange	4.936
Dark Orange-Red	4.939
Dark Red-Blue	4.942
Dark Blue-Green	4.945
Dark Green-Orange	4.948
Dark Orange-Red	4.951
Dark Red-Blue	4.954
Dark Blue-Green	4.957
Dark Green-Orange	4.960
Dark Orange-Red	4.963
Dark Red-Blue	4.966
Dark Blue-Green	4.969
Dark Green-Orange	4.972
Dark Orange-Red	4.975
Dark Red-Blue	4.978
Dark Blue-Green	4.981
Dark Green-Orange	4.984
Dark Orange-Red	4.987
Dark Red-Blue	4.990
Dark Blue-Green	4.993
Dark Green-Orange	4.996
Dark Orange-Red	4.999
Dark Red-Blue	5.002
Dark Blue-Green	5.005
Dark Green-Orange	5.008
Dark Orange-Red	5.011
Dark Red-Blue	5.014
Dark Blue-Green	5.017
Dark Green-Orange	5.020
Dark Orange-Red	5.023
Dark Red-Blue	5.026
Dark Blue-Green	5.029
Dark Green-Orange	5.032
Dark Orange-Red	5.035
Dark Red-Blue	5.038
Dark Blue-Green	5.041
Dark Green-Orange	5.044
Dark Orange-Red	5.047
Dark Red-Blue	5.050
Dark Blue-Green	5.053
Dark Green-Orange	5.056
Dark Orange-Red	5.059
Dark Red-Blue	5.062
Dark Blue-Green	5.065
Dark Green-Orange	5.068
Dark Orange-Red	5.071
Dark Red-Blue	5.074
Dark Blue-Green	5.077
Dark Green-Orange	5.080
Dark Orange-Red	5.083
Dark Red-Blue	5.086
Dark Blue-Green	5.089
Dark Green-Orange	5.092
Dark Orange-Red	5.095
Dark Red-Blue	5.098
Dark Blue-Green	5.101
Dark Green-Orange	5.104
Dark Orange-Red	5.107
Dark Red-Blue	5.110
Dark Blue-Green	5.113
Dark Green-Orange	5.116
Dark Orange-Red	5.119
Dark Red-Blue	5.122
Dark Blue-Green	5.125
Dark Green-Orange	5.128
Dark Orange-Red	5.131
Dark Red-Blue	5.134
Dark Blue-Green	5.137
Dark Green-Orange	5.140
Dark Orange-Red	5.143
Dark Red-Blue	5.146
Dark Blue-Green	5.149
Dark Green-Orange	5.152
Dark Orange-Red	5.155
Dark Red-Blue	5.158
Dark Blue-Green	5.161
Dark Green-Orange	5.164
Dark Orange-Red	5.167
Dark Red-Blue	5.170
Dark Blue-Green	5.173
Dark Green-Orange	5.176
Dark Orange-Red	5.179
Dark Red-Blue	5.182
Dark Blue-Green	5.185
Dark Green-Orange	5.188
Dark Orange-Red	5.191
Dark Red-Blue	5.194
Dark Blue-Green	5.197
Dark Green-Orange	5.200
Dark Orange-Red	5.203
Dark Red-Blue	5.206
Dark Blue-Green	5.209
Dark Green-Orange	5.212
Dark Orange-Red	5.215
Dark Red-Blue	5.218
Dark Blue-Green	5.221
Dark Green-Orange	5.224
Dark Orange-Red	5.227
Dark Red-Blue	5.230
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Dark Green-Orange	5.236
Dark Orange-Red	5.239
Dark Red-Blue	5.242
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Dark Red-Blue	5.254
Dark Blue-Green	5.257
Dark Green-Orange	5.260
Dark Orange-Red	5.263
Dark Red-Blue	5.266
Dark Blue-Green	5.269
Dark Green-Orange	5.272
Dark Orange-Red	5.275
Dark Red-Blue	5.278
Dark Blue-Green	5.281
Dark Green-Orange	5.284
Dark Orange-Red	5.287
Dark Red-Blue	5.290
Dark Blue-Green	5.293
Dark Green-Orange	5.296
Dark Orange-Red	5.299
Dark Red-Blue	5.302
Dark Blue-Green	5.305
Dark Green-Orange	5.308
Dark Orange-Red	5.311
Dark Red-Blue	5.314
Dark Blue-Green	5.317
Dark Green-Orange	5.320
Dark Orange-Red	5.323
Dark Red-Blue	5.326
Dark Blue-Green	5.329
Dark Green-Orange	5.332
Dark Orange-Red	5.335
Dark Red-Blue	5.338
Dark Blue-Green	5.341
Dark Green-Orange	5.344
Dark Orange-Red	5.347
Dark Red-Blue	5.350
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Dark Orange-Red	5.359
Dark Red-Blue	5.362
Dark Blue-Green	5.365
Dark Green-Orange	5.368
Dark Orange-Red	5.371
Dark Red-Blue	5.374
Dark Blue-Green	5.377
Dark Green-Orange	5.380
Dark Orange-Red	5.383
Dark Red-Blue	5.386
Dark Blue-Green	5.389
Dark Green-Orange	5.392
Dark Orange-Red	5.395
Dark Red-Blue	5.398
Dark Blue-Green	5.401
Dark Green-Orange	5.404
Dark Orange-Red	5.407
Dark Red-Blue	5.410
Dark Blue-Green	5.413
Dark Green-Orange	5.416
Dark Orange-Red	5.419
Dark Red-Blue	5.422
Dark Blue-Green	5.425
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Dark Orange-Red	5.431
Dark Red-Blue	5.434
Dark Blue-Green	5.437
Dark Green-Orange	5.440
Dark Orange-Red	5.443
Dark Red-Blue	5.446
Dark Blue-Green	5.449
Dark Green-Orange	5.452
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Dark Red-Blue	5.470
Dark Blue-Green	5.473
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Dark Orange-Red	5.479
Dark Red-Blue	5.482
Dark Blue-Green	5.485
Dark Green-Orange	5.488
Dark Orange-Red	5.491
Dark Red-Blue	5.494
Dark Blue-Green	5.497
Dark Green-Orange	5.500
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Dark Red-Blue	5.506
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Dark Green-Orange	5.512
Dark Orange-Red	5.515
Dark Red-Blue	5.518
Dark Blue-Green	5.521
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Dark Orange-Red	5.527
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Dark Red-Blue	5.542
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Dark Orange-Red	5.551
Dark Red-Blue	5.554
Dark Blue-Green	5.557
Dark Green-Orange	5.560
Dark Orange-Red	5.563
Dark Red-Blue	5.566
Dark Blue-Green	