An intercomparison of burnt area estimates from key operational products: results from the analysis of Greek wildland fires

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f the most threatening disturbance factors, for properties, infrastructures as well as
, fire has been a major ecological factor with a long and important impact for mil-
d mapping of burnt areas shortly after fire suppression, among others is of key im-
mospheric and climatic impacts of burnt biomass, as well as in estimating the total

emote sensing, today's societies are able to map and analyze wildland fires at large
 a cost-effective, repetitive and systematic way. Nowadays, a wide variety of re-
e, including also a number of relevant operational products. Particularly with re-
y used operational products consist of the **MODIS** burnt area product and the Euro-
ted by NASA and the European Union respectively.

ertake a comparative study of the **MODIS** and **EFFIS** burnt area operational prod-
f the conducted analysis, an investigation of the main findings was performed with
ase/ cover.

more specifically the mainland and the
ly projected to the Hellenic Geodetic

ns were made for the two operational
tive analysis was conducted for three
products.

re 2), 2005 (WWW1, Boschetti et al.,

ure 3), 2005 (WWW3)

igure 4) (WWW2)

Figure 1: Study area

3. METHODS

ENVI
MCD45 products were imported to ENVI software in order to create a re-
cord for each year containing all the burnt areas in one vector layer. "Band
Math" was used to isolate (masking) from the original layer so as to create
new layers regarding the burnt area. Again with "Band Math" all months
were merged (12 MCD layers) in one layer-file for each year, while the
burnt area was mapped by MODIS. Finally, using the commands "Raster to
Vector" and "Export Active Layer to Shapefile" one final layer was created
for input to ARCMAP.

ARCMAP
Using raster operations, from the ASTER DEM layer by applying com-
mands such as slope, aspect and Int, new layers of slope and aspect were ex-
tracted. Wetness index factor was estimated using "Raster Calculator" com-
mand in addition applying the equation "CTI=ln (As / (tan(β))"(Moore,
1993).
GIS vector analysis capabilities (operation: intersect, erase, union, clip) were
applied in the shapefiles with burnt mapped areas. "Intersect" operation was
used to detect the common burnt areas of both MODIS & EFFIS products.
"Erase" Command helps in highlighting the area detected only from MODIS
or EFFIS. Furthermore the non– common areas were delivered by the com-
bination of "Erase" and "Union".
Land use/ land cover (CORINE 2000), elevation, slope, aspect and wetness
index of burnt areas for each year were identified using GIS analysis tools
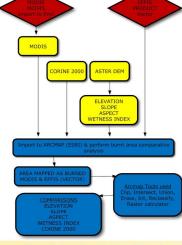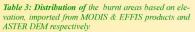(Clip, Intersect and Int) for MODIS&EFFIS products separately .

Figure 6: Overall methodology followed

4. RESULTS: BURNT AREA COMPARISONS BY LAND COVER/USE & ELEVATION

Table 1: Burnt area estimated by MODIS & EFFIS from 2005 to 2007 in Greece

year	Total area detected byModis	Total area detected by Effis	Detected only from Modis	Detected only from Effis	Non-common areas	Common areas
2007	228.105	278.156	68.508	114.882	183.390	163.268
2006	22.643	16.347	17.953	11.658	29.609	4.689
2005	26.256	4.515	25.205	3.464	28.668	1.050

Land Cover in percentages (%) of fire detection (2007) region Greece for each case

Land Cover	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
Artificial surfaces	0,99	1,13	1,28	1,57	1,48	0,83
Agricultural areas	54,94	41,03	68,21	26,76	44,20	49,25
Forest and semi natural areas	43,79	57,07	29,04	67,54	52,46	49,73
Wetlands	0,11	0,10	0,12	0,10	0,10	0,11
Water bodies	0,16	0,07	0,25	0,04	0,15	0,09
Total	100,00	100,00	100,00	100,00	100,00	100,00

Land Cover in percentages (%) of fire detection (2006) region Greece for each case

	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
Artificial surfaces	0,08	0,15	0,06	0,22	0,01	0,00
Agricultural areas	77,60	35,47	88,86	35,84	87,97	34,53
Forest and semi natural areas	21,52	64,39	10,03	63,94	11,27	65,47
Wetlands	0,06	0,00	0,00	0,00	0,05	0,00
Water bodies	0,14	0,00	0,17	0,00	0,11	0,00
Total	100,00	100,00	100,00	100,00	100,00	100,00

Land Cover in percentages (%) of fire detection (2005) region Greece for each case

	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
Artificial surfaces	1,55	4,51	1,64	5,27	2,47	0,00
Agricultural areas	84,08	44,56	87,05	47,13	87,23	35,24
Forest and semi natural areas	13,36	50,82	11,22	46,60	10,50	64,76
Wetlands	0,00	0,00	0,00	0,00	0,00	0,00
Water bodies	0,08	0,00	0,09	0,00	0,07	0,00
Total	100,00	100,00	100,00	100,00	100,00	100,00

Table 2: Distribution of the burnt areas based on land cover/ use, derived from MODIS & EFFIS products and CORINE 2000 respectively

Elevation in percentages (%) of fire detection (2007)-region Greece for each case

elevation classes (meters)	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
(0-250)	40,47	32,50	57,30	31,45	41,26	19,12
(251-500)	29,43	31,75	21,02	29,89	26,52	14,12
(501-750)	19,36	19,67	11,48	16,52	15,37	13,05
(751-1000)	6,59	8,39	3,12	10,06	8,18	21,80
(1001-1250)	2,27	4,17	1,78	6,58	4,76	7,22
(1251-1500)	1,19	2,33	0,90	3,79	2,69	2,48
(1501-1750)	0,67	0,96	0,40	1,20	0,90	1,31
(1751-2000)	0,01	0,17	0,01	0,41	0,26	0,79
(2001-2250)	0,00	0,04	0,00	0,10	0,06	0,03
	100,00	100,00	100,00	100,00	100,00	100,00

Elevation in percentages (%) of fire detection (2006) region Greece for each case

elevation classes (meters)	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
(0-250)	62,80	66,97	71,88	67,34	72,43	51,39
(251-500)	14,58	25,24	9,51	20,15	13,96	36,30
(501-750)	6,16	6,14	15,32	11,17	11,34	8,35
(751-1000)	13,02	1,56	1,90	1,31	0,87	3,75
(1001-1250)	1,65	0,09	0,43	0,03	0,28	0,22
(1251-1500)	0,70	0,00	1,08	0,00	0,65	0,00
(1501-1750)	1,06	0,00	0,74	0,00	0,45	0,00
(1751-2000)	0,03	0,00	0,03	0,00	0,02	0,00
	100,00	100,00	100,00	100,00	100,00	100,00

Elevation in percentages (%) of fire detection (2005) region Greece for each case

elevation classes (meters)	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
(0-250)	86,74	56,87	73,61	60,68	76,07	44,48
(251-500)	10,41	24,68	19,71	18,92	18,24	43,44
(501-750)	1,14	11,28	4,90	14,23	3,39	1,61
(751-1000)	1,52	7,16	1,57	6,17	2,13	10,48
(1001-1250)	0,19	0,00	0,20	0,00	0,17	0,00

Table 3: Distribution of the burnt areas based on elevation, imported from MODIS & EFFIS products and ASTER DEM respectively

S burnt area
tor layer)

Figure 4: Elevation raster layer (ASTER DEM)   *Figure 5: Aspect raster layer, (ASTER DEM)*
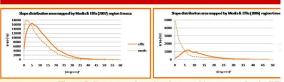
5. RESULTS: BURNT AREA COMPARISONS BY SLOPE, ASPECT

Figure 7: Burnt area slope distribution of the areas under the EFFI

Figure 8: Burnt area wetness index distribution for the areas under th

classification (wetness index)

low	medium	high	very high
(<4)	(4-8)	(8-10)	(>10)
little potential to retain humidity		high potential to retain humidity	

Table 4: Classification of wetness index under the burnt area for the different burnt area products (Suresh Kumar, 2007)

Aspect in percentages (%) of fire detection (2007) region Greece for each case

Aspect	Modis (%)	Effis (%)	Detected only from Modis (%)	Detected only from Effis (%)	Non-common areas (%)	Common areas (%)
FLAT	0,05	0,02	0,12	0,03	0,06	0,02
NORTH	12,30	11,68	12,12	10,69	13,24	12,37
NORTH-EAST	12,41	11,17	12,77	9,63	10,82	12,25
EAST	11,75	11,34	13,25	13,67	12,27	11,11
SOUTH-EAST	11,11	11,50	12,50	12,90	12,75	10,32
SOUTH	13,10	13,96	13,26	15,28	14,51	13,03
SOUTH-WEST	14,22	14,97	13,05	15,32	14,46	14,72
WEST	13,48	13,76	12,11	13,31	12,86	14,07
NORTH-WEST	11,58	11,60	10,82	11,17	11,04	11,91
	100,00	100,00	100,00	100,00	100,00	100,00

Table 5: Aspect distribution of the burnt areas for the different burnt area products analyzed herein

6. CONCLUSIONS

(1) The products from MODIS & EFFIS gave different results with respect to th
based on **land use/ cover** showed differences regarding forest and agricultural are
rates of agricultural areas in relation to all mapped areas. Conversely, EFFIS detec
natural areas. **(3)** No common results were found for the comparisons based on **ele**
tions made by MODIS were characterized by areas with low elevations. On the o
analysis based on **slope,** highlighted that the MODIS areas were more flat than EF
high **wetness index** meaning that these areas had the potential to retain humidity.
results since no differences were found between these two products. Only MODIS
pared to EFFIS.

7. REFERENCES

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