

A NEURAL NETWORK ALGORITHM FOR VOLCANIC ASH DETECTION IN THE 2019 RAIKOKE ERUPTION

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→ <https://eo4society.esa.int/projects/vista/>

→ <https://www.geo-k.co/home/projects/vista/>



ATMOS 2021

NN Detection Procedure

Eruption	Date	Time UTC	Platform
Eyjafjallajökull 2010	6 May - JD 126	11.55	Terra
	9 May - JD 129	12.25	Terra
	11 May - JD 131	12.10	Terra
	11 May - JD 131	13.50	Terra
	11 May - JD 131	14.05	Aqua
	12 May - JD 132	12.55	Terra
	13 May - JD 133	12.00	Terra
	13 May - JD 133	13.40	Terra

MODIS Data

MOD/MYD 021KM: Level 1B Calibrated Radiances
 MOD/MYD 03: Geolocation
 MOD/MYD 06_L2: Cloud Product
 MOD/MYD 09: Surface Reflectance Product

Plume Mask: $BTD = T_{11\mu m} - T_{12\mu m}$

Training set
Inputs – Target Outputs

Tot. Patterns:
~ 5000

Training	75 %
Validation	20 %
Test	5 %

NN Training

Validation Confusion Matrix

Output Class	1	2	3	4	5	6	7	8	Accuracy
1	1026 11.9%	22 0.3%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	8 0.1%	0 0.0%	97.2%
2	22 0.3%	971 11.3%	0 0.0%	4 0.0%	0 0.0%	0 0.0%	7 0.1%	0 0.0%	96.7%
3	0 0.0%	0 0.0%	998 11.5%	95 1.1%	4 0.0%	9 0.1%	0 0.0%	15 0.2%	88.9%
4	0 0.0%	4 0.0%	44 0.5%	893 10.4%	17 0.2%	17 0.2%	0 0.0%	84 1.0%	84.3%
5	0 0.0%	0 0.0%	18 0.2%	19 0.2%	1054 12.3%	5 0.1%	0 0.0%	17 0.2%	84.7%
6	0 0.0%	0 0.0%	19 0.2%	29 0.3%	13 0.2%	1100 12.9%	1 0.0%	1 0.0%	94.6%
7	3 0.0%	22 0.3%	0 0.0%	0 0.0%	0 0.0%	2 0.0%	1021 11.9%	0 0.0%	97.4%
8	0 0.0%	0 0.0%	6 0.1%	66 0.8%	16 0.2%	2 0.0%	0 0.0%	945 11.0%	91.3%
Total	97.6%	95.3%	91.9%	80.7%	95.5%	96.9%	98.0%	89.0%	93.1%

Accuracy
93.1 %

Eruption	Date	Time UTC	Platform
Raikoke 2019	22 June	00.07	S3A
	22 June	22.00	S3A
	22 June	23.01	S3B
	22 June	23.40	S3A

SLSTR Data Channels S1 – S9

S3A/S3B_SL_1_RBT

NN

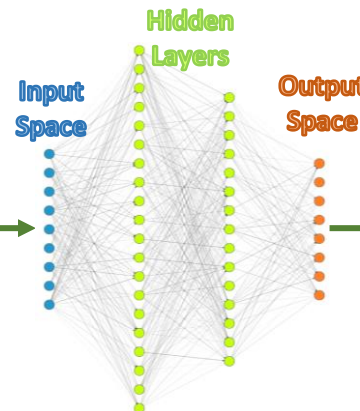


Image Classification

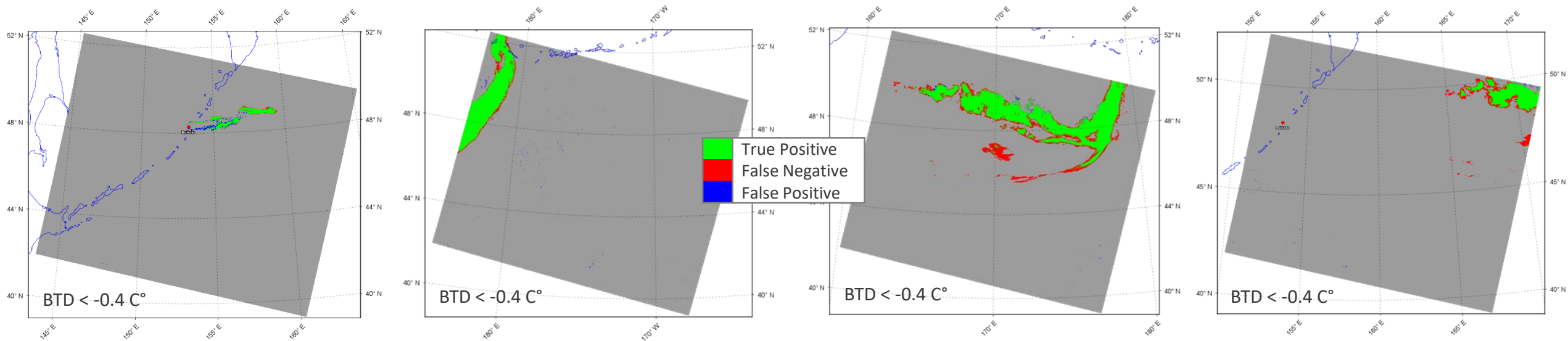
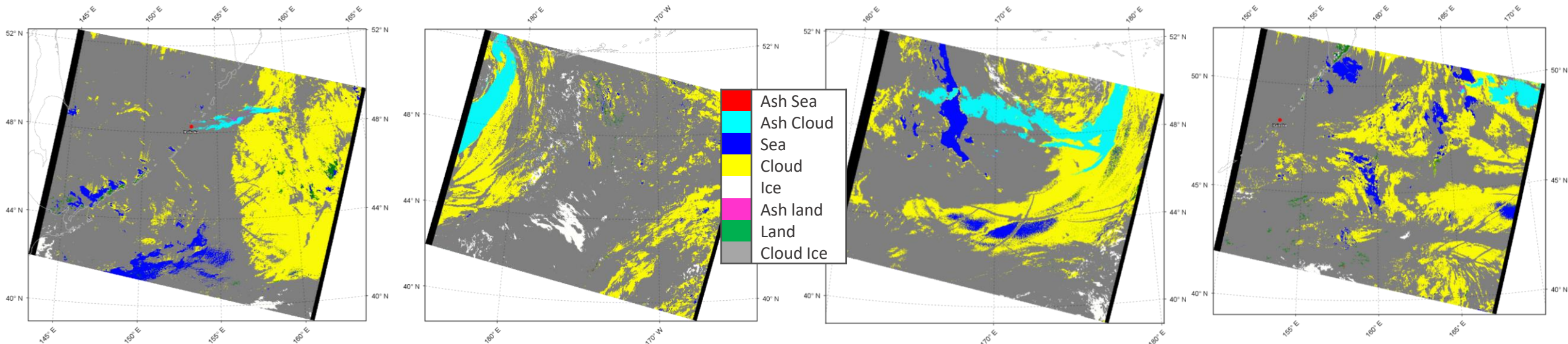
- 1) Ash over sea
- 2) Ash over clouds
- 3) Sea surface
- 4) Weather clouds
- 5) Snow/Ice surface
- 6) Ash over land
- 7) Land surface
- 8) Ice clouds

Classified Product **S3A/SLSTR**
Raikoke 22 June 2019 at 00.07 UTC

Classified Product **S3A/SLSTR**
Raikoke 22 June 2019 at 22.00 UTC

Classified Product **S3B/SLSTR**
Raikoke 22 June 2019 at 23.01 UTC

Classified Product **S3A/SLSTR**
Raikoke 22 June 2019 at 23.40 UTC



Classified Product	True Positive	False Negative	False Positive
S3A/SLSTR - Raikoke 22 June 2019 at 00.07 UTC	71.8 %	8.2 %	20 %
S3A/SLSTR - Raikoke 22 June 2019 at 22.00 UTC	89.1 %	9.5 %	1.4 %
S3B/SLSTR - Raikoke 22 June 2019 at 23.01 UTC	74.3 %	24.9 %	0.9 %
S3A/SLSTR - Raikoke 22 June 2019 at 23.40 UTC	66.7 %	32.1 %	1.2 %