# Characterizing and correcting 'salt-and-pepper' noise in CLAAS-3 cloud mask product

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EUMETSAT

Resolution:

0.04° x 0.04°,

1 day

The HSAF SE-E-

SEVIRI (H10) snow

**cover** product

**HSAF** 

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#### 2. VALIDATION DATASETS

EUMETSAT **CMSAF CLAAS-3** 

Resolution: 0.04°x0.04°, 15 min

The CMA flags for retrieval accuracy, surface categories, processing and geophysical conditions.

The cloud top pressure (CTP) and cloud optical thickness (COT) products

MODIS

**Resolution:** 1 km x 1 km,5-9 overpasses per day

The MODIS Cloud Mask (MYD35\_L2) products from Aqua

All The datasets cover April to September 2013 within the Alpine domain (5°E–16°E, 42°N–51.5°N).

### **3. CLOSING ALGORITHM**



**Original CMA** 



Dilation



Erosion







Fig. 3: (a) Simplified example of closing algorithm with 3x3 structure (red square). (b) Application on CMA

#### 4. MODIS COMPARISON

CMSAF

istribution	of ET	S Acros	s Closing	Structures

#### 5. QUALITY FLAGS

Retrieval accuracy is labelled 'Good' for all closed points, which are more common at **night**, **twilight**,

#### over land with rough/high terrain, snow-covered areas, and uncategorized surface conditions.



Fig. 5: Condition (a) and status (b) flag distribution for closed pixels using a 3x3 structure compared to all pixels.

## 7. CONCLUSION

- CMA frequently exhibits salt-and-pepper noise, **present**
- in ~65% of the dataset, which may impact DL computer
- vision model training.
- Noisy pixels are associated with good quality flags.



**3x3 Closing** 

Fig 4: (a) Confusion matrix comparing CMSAF cloud mask predictions with MODIS reference. (b) ETS distribution across overpasses for different closing structures. (c) Confusion matrix values before and after closing for one overpass.

#### **6. CLOSED PIXELS CHARACTERIZATION**





- Fig 6: Distribution of closed pixels by month (a) and hour (b), normalized by the total number of pixels available for each month or hour.



Increased closed pixels in **April** may result from extended snow cover, as indicated by the HSAF product. Peak in closed pixels observed around **4 AM (UTC)**, during twilight

Fig 7: Blue bars show the distribution of closed pixels across HSAF categories, normalized by the total closed pixels. Orange bars represent the #SAF category distribution for all pixels.

- 0.004 0 0.003 5 0.002 0.001 CTP (hPa Fig. 8: Heatmap showing the values of closed pixels for CTP and COT, with interpolation applied using neighboring points. Closed pixels are mostly related to **thin** 

clouds, with both low and mid-level CTP

- Slightly correlated with **snow-covered areas** and more common during **nighttime** and **twilight**.
- Represented by **thin clouds** that are typically harder to detect.
- The closing algorithm, besides reducing the noise, it closes more points classified as clear than cloudy, according to MODIS.
- The **3x3 closing structure** provides the best alignment

with the MODIS cloud mask since it **maximizes ETS.** 

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