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Zentralanstalt für Meteorologie und Geodynamik

Shaping the future portfolio of the ‚Extrapolated Imagery' (EXIM) product of the Nowcasting-SAF

1. Product background and current portfolio

The EXIM component of NWC/GEO (= the "geostationary image" software package of the Nowcasting-SAF) provides forecast SEVIRI (or GOES-N or Himawari) imagery or NWCSAF products up to a lead time of 1 hour. The algorithmic principle is kinematic extrapolation using atmospheric motion vectors (which are provided by the "High-resolution Winds" component of NWC/GEO). The results are plausible short-term forecast fields of

- all SEVIRI channels except HRVIS (i.e. VIS 0.6 and 0.8, NIR 1.6 (enabled but not recommended); IR 3.9, 8.7, 9.7, 10.8, 12.0, 13.4; WV 6.2 and 7.3)
- GOES-N channels (VIS 0.65; IR3.9, 10.8, 12.0; WV 6.7)
- Himawari channels, except those shortwave channels with "high resolution" and "very high resolution"
- the Nowcasting-SAF products "cloud mask", "cloud type", "cloud top temperature and height", "cloud microphysics", "precipitating cloud" and "convective rainfall rate" (the latter two in both the "statistical" and the "physical" variant)

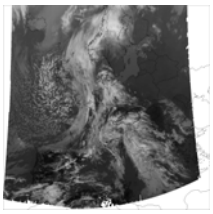
This extensive list reflects the ambition to enable everything (yet every single product can be individually disabled in a configuration file), but…:

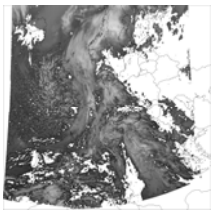
Discussion item #1: Is it actually necessary to maintain this wide selection of potential forecast products?

Specific sub-topic: At present, the diurnally varying illumination conditions limit the quantitative predictability in the VIS forecast images, particularly strong where dusk/dawn conditions are present over parts of the domain (no sun zenith angle correction applied). Do you agree that the EXIM forecast VIS imagery may still be useful at least for qualitative applications? Or ask for taking sun zenith angle corrections on board? Or - contrariwise - see no value in forecast VIS images anyhow (for example, because the IR images are sufficient)?

2. Option to suppress cloud-free areas in the output

It is evident that cloud-free pixels should not be displaced in the extrapolation process. Very likely, one can also achieve consensus that to model the diurnal brightness variations of cloud-free land pixels is nothing a product like EXIM should be concerned about. What is less clear, however, (**Discussion item #2**) is whether we may entirely dispose of cloud-free pixels in the output (assumption: users are interested only in the movements of clouds) or we should rather retain them (thereby giving the forecast images a similar appearance as the measured imagery). Compare the two alternatives for 2 April 2019, 60-minute forecast for the 1500UTC IR10.8 image:

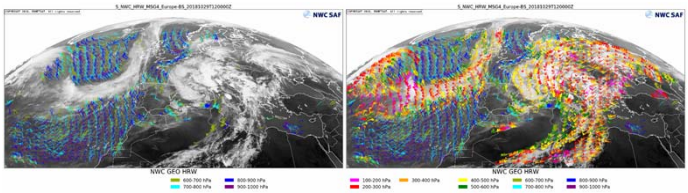




To obtain the left image, cloud-free pixels were inserted using persistence. Where clouds disappeared, the new land (or sea) pixels were ‚invented' using the nearest cloud-free information (…obviously, you save computation time if you go for the clouds-only option).

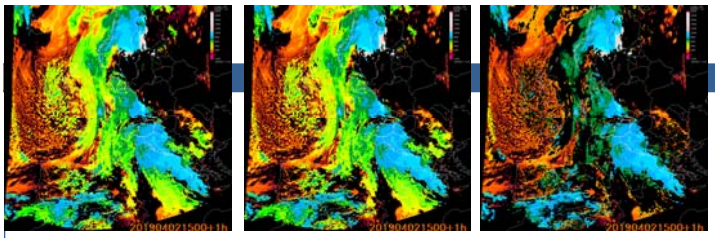
3. Idea to suppress output where no displacement vector from the right layer is available

Based on the argument that the high-layer flow can be very different from the low-layer flow, a proposal has been made to couple low-(high-)layer pixels with low-(high-)layer vectors only, and consider everything else to be not plausibly extrapolable from the available material. The consequences can be anticipated from plots of the HrW fields as the following:

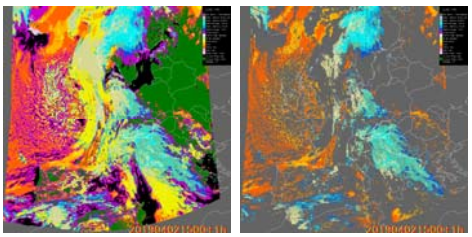


The left panel shows a low-layer (600-1000 hPa) vector field, having almost no information about the atmospheric flow in the eastern half. Hence, if we follow the rule that the information from other layers is to be disregarded (the right panel shows the complete HrW output), we must expect product outage for almost all pixels in this layer over Europe (the final implementation shall have the distance from the nearest vector as a quality flag, and in a (particularly detrimental) situation as the one above, a threshold on this parameter will produce noticeably wider gaps than in the examples that follow).

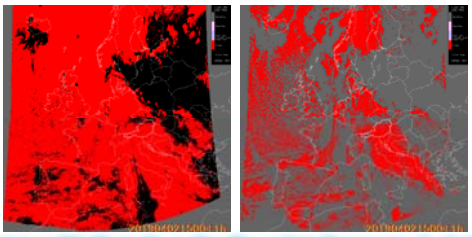
The parameter where the impact is assessed most easily is cloud top temperature / height (abbr. CTTH, which serves as input to both the HrW height assignment and to the determination of the ‚right' layer here in EXIM). Again we show the case of 2 April 2019, 60-minute forecast for the 1500UTC product (left: two extrapolation layers, 0-500 hPa and 501-1000 hPa, and for each pixel using the layer with the horizontally nearest vectors; middle: same layers, taking the layer indicated by the pixels' CTTH; right: same philosophy, but "high layer"=0-400 hPa, "low layer"=700-1000 hPa)



EXIM cloud type forecast. Left: no CTTH inclusion; Right: restriction to the two layers CTTH=0-400 hPa and CTTH=700-1000 hPa



The cloud mask product undergoes the most drastic change in its character when turning on the CTTH filter, changing from cloud/no-cloud to cloud/unknown



Discussion item #3: „Nicer" pictures (similar to the analyses) or strict adherence to physical principles?

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