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Geoscientific Model Development Discussions

Interactive comment on "Pysteps: an open-source Python library for probabilistic precipitation nowcasting (v1.0)" *by* Seppo Pulkkinen et al.

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Peer Review Comments on Pysteps

This paper is well written, clearly and comprehensively describing a novel initiative to open-source an operational-ready nowcasting software package. It explains the science and techniques behind included algorithms, gives some examples, provides verification results and concludes with a vision to further the collaboration on nowcasting techniques and system.

This paper should be accepted for publications, after some modifications to address the following issues:

1 General Comments

1. The determination and adoption of reflectivity – rainfall relationships are one of the most critical challenges in QPE and QPF, especially for tropical and subtropical regions. Perhaps the authors could include a section to mention what functions pysteps provide in this regard. For example, whether it supports adoption of user-defined a b values in $Z = aR^b$, whether it makes use of dual-pol data for QPE, whether it can derive a b from a set of climatological data etc.

2 Specific Comments

1. Page 1 Line 7: It is mentioned that pysteps library supports "standard input/output file formats". But radar and rain gauge data come in a high variety of formats. Perhaps it would be more appropriate to write "various input/output file formats". Also suggests listing out the supported data formats in a table.
2. Page 1 Line 15: My understanding is that the definition of nowcasting does not confine itself to "by extrapolation". For longer range nowcast (3 hours and beyond), the use of NWP is indeed more common. Recently, there also emerged other methods, such as deep learning nowcast as elaborated in the following papers: https://papers.nips.cc/paper/5955-convolutional-lstm-network-a-machine-learning-approach-for-precipitation-nowcasting.pdf, https://arxiv.org/abs/1706.03458
3. Page 1 Line 15: Suggest citing the WMO Guideline on Nowcasting: https://library.wmo.int/doc_num.php?explnum_id=3795
4. Page 8 Line 14: Suggests mentioning that some examples of parameters are given in Table 5, if indeed so.

5. Page 9 Line 7: Also commonly known as “frequency matching” in operational meteorology.
6. Page 10 Line 4: Suggests citing Cartopy as requested (https://scitools.org.uk/cartopy/docs/latest/citation.html)
7. Page 10 Line 10: It would also be beneficial to operational meteorology for comparing performance of various nowcast algorithms, and for running multi-model ensemble nowcast.
8. Page 13 Line 7: May consider including the contingency table and the formulas of the performance measures, due to historical confusion between FAR, POFD and “False Alarm Rate”
9. Page 19 Line 6: While noting that the 1 level has over-dispersion in the bin range 13-22, the 23rd bin of 1 level + mask looks better than the 8 level + mask. Would the over-dispersion of 8 level + mask at bin 23 be improved by having more members?
10. Page 22 Line 16: Other potential enhancements include i) use of satellite nowcast parameters based on EUMETSAT NWCSAF algorithms and products (e.g. CI, RDT) to predict the growth of storm cells; ii) use of dual-polarization radar data to enhance QPE and to detect hails, gust etc.
11. Page 22 Line 21: Suggest also including SWIRLS Ensemble Rainstorm Nowcast (SERN) based on ROVER (https://doi.org/10.3390/atmos8030048)
12. Page 22 Line 25: An obvious and crucial application of nowcasting system is to support the operations of rainstorm, thunderstorm and severe weather warnings. Suggest mentioning this also.
13. Page 37 Figure 5: For the reliability diagram on the right, suggests also plotting out the data points used to define the curve if not too dense

14. Page 37 Figure 6: For the reliability diagram on the right, suggests also plotting out the data points used to define the curve if not too dense

3 Technical Corrections

1. Page 1 Line 14: “world meteorological organization” should read “World Meteorological Organization (WMO)”
2. Page 2 Line 32: “com-SWIRLS” should read “Com-SWIRLS”
3. Page 3 Line 1: “. . . by the Hong Kong Observatory” should read “. . . by the Regional Specialized Meteorological Centre (RSMC) for Nowcasting operated by the Hong Kong Observatory (HKO)”.
4. Page 6 Line 3: Missing second term in equation (5)?
5. Page 13 Line 12: “For a reliable forecast” should read “For a perfectly reliable forecast”
6. Page 59 Table 1 Entry 1: Com-SWIRLS employs C++ for several time-critical modules, in addition to Python.
7. Page 59 Table 1 Entry 1: Com-SWIRLS is free and open source for all National Meteorological and Hydrological Services (NMHS) under WMO. I understand that the authors are trying to divide the software into two groups, i.e. “free license” vs “open source”. Perhaps a footnote for Com-SWIRLS would make it clearer.

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