

Interactive comment on “TITAM (v1.0): Time Independent Tracking Algorithm for Medicanes” by Enrique Pravia-Sarabia et al.

Anonymous Referee #1

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Title: TITAM (v1.0): Time Independent Tracking Algorithm for Medicanes Authors: Pravia-Sarabia et al. RECOMMENDATION: Major revisions

General comments Medicanes are receiving a growing attention in literature and among stakeholders due to their potential damage to coastal zones. In this framework, the Authors of the present paper provide a new algorithm for the detection and tracking of these cyclones, following an innovative, time-independent approach. The paper is interesting not only for the development of the new software, but also because the adopted procedure sheds some new lights on the structure of medicanes, allowing a better understanding of their properties. The paper appears an interesting contribution in the growing literature in the field, however some major revisions are needed before publication.

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Specific comments - While the proposed algorithm has been well designed, and takes into account all the properties of this category of cyclones, I was wondering if it allows to track the whole cyclone lifetime as a unique track (not different tracks for different stages of the cyclone lifetime, as in Fig. 10). This is an important point, also considering that the most intense convection is often observed in this earlier stage (Dafis et al., 2018; Miglietta et al., 2013). - The description of the mechanisms of development of Medicanes is poor and confusing. I recommend the Authors to completely re-write this section, starting from the explanation in Miglietta and Rotunno (2019) and related bibliography. In particular: L22: they do not tend to acquire a cold core, they always start with a cold core; L24: Really in WISHE theory for tropical cyclone development (Emanuel, 1986), the role of cumulus convection is to redistribute the heat acquired from sea surface, so storms result from an air-sea interaction instability. Please, clarify your sentence in the framework of tropical cyclone theory; L31: the term genesis is not appropriate since they evolve from extra-tropical cyclones, so they are already formed before they acquire tropical features; L32: “These storms are very close to a tropical cyclone on its fundamentals”: really, Miglietta and Rotunno (2019) clarified better the similarity of Medicanes with tropical cyclones for their dynamical and thermodynamic properties, which is somewhat case dependent; L33: “as well as on the trigger mechanisms and necessary conditions for its genesis”: please explain the differences with tropical cyclones; L34: “similar mechanisms”: again, please take into consideration the results in Miglietta and Rotunno (2019); L37-38: the sentence is quite confusing, since the environment you describe is unstable, not stable as you state; L39-40: this is valid also in tropical areas, since a part of tropical cyclones develops in a way similar to Medicanes, with SST below the classical threshold of 26°C (McTaggart-Cowen et al., 2015); L41-42: “Once the vertical moist air fluxes appear, advection takes place and the core starts heating due to the latent heat release”: this sequence is not clear, since advection already occurs in a baroclinic environment even in the absence of fluxes; L42-43: “The development of a warm core system then leads to an axi-symmetric storm by means of the cyclonic rotation of air around the center, induced by advection

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of relative vorticity towards the low pressure center”: this sentence is very confusing: why do warm core and cyclonic rotation imply axi-symmetric storm? is cyclonic rotation induced by advection of relative vorticity? L49: see also Table 1 in Miglietta et al. (2013) - The other algorithms in the literature, which have mentioned in the Introduction, should be described with further details, in order to appreciate the innovative features of the proposed algorithm; possibly, the characteristics of the different methods could be summarized in a Table; also, the explanation of this part should be improved, in particular: L57-58: “the existence of two different low pressure areas is equivalent to the existence of two medicanes”: do you mean that identifying two cyclones is a similar problem as the identification of two medicanes? L65-66: “even in the absence of an optimal medicane definition, the detection would be ensured within a reasonable range of the parameters leading to that definition”: please clarify; L73: in what does the methodology introduced in Alpert et al. (1990) consist? L76-77: what do you mean with “points fulfilling the Hart parameters”? L77-78: what do you mean with “large gaps could be observed in the tropical cyclonic nature of the calculated tracks”? L82-83: delete “This approach by Hart (2003) consists in a track identification by imposing a series of conditions to spatial displacement of two time consecutive medicane centers”, since it repeats the previous concept;

Minor and Technical corrections L5: the former ones: the sentence is not clear, since “the former” does not refer to anything. L6: temporarily lose ...: really, since they appear in baroclinic environments, they temporarily lose their cold-cored and asymmetric structure; L33: their -> its L43, L65: In this way, ... L135: rotation -> rotational L169: quasi -> quasy L196: requirements -> requeriments L203-L205: please clarify the sentence L244: is there a motivation for imposing $|VTL| > |VTU|$? L273: conversely, if the condition is valid, do you connect the positions at different i ? L288: the same case is also discussed in Dafis et al. (2018) and Ricchi et al. (2017) L289: ... and long lifetime ... L291 and elsewhere: grid spacing not horizontal resolution, the two concepts are different (see Skamarock, 2004). L299: I cannot identify the black crosses in Fig. 2 bottom panel L328: 17H: what does H stand for? L347: please use

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the same format for the time in the whole manuscript L349: Atlantic -> Altantic L355: green plus for Medicanes L357: successfully -> succesfully L369: see also Lagouvardos et al. (1999) L385: see Ernst and Mason (1983), Reed et al. (2001) L402: what do you mean with “methodology which does not get trapped in previous perturbations”? Figure 5 caption: what do you mean with normalized? Figure 8 caption: color line meaning is missing; why using a different threshold for B? Figure 11 caption: year not indicated Appendix A: ERA-Interim not ERA5-Interim Appendix A: “a number obtained by means of a numerical study of vorticity typical values in the presence/absence of medicanes”: do you refer to a published paper? Appendix A: “ZeroVortRadiusLowerLimit”: occasionally Medicanes can be smaller than 80 km (see Miglietta et al., 2013) Appendix A: In “MinPointsNumberInCluster” farther instead of further L505: what does CRS mean? L512: WRF does not include chemical mechanisms, WRF-CHEM does. L516: what do you mean with “No physics suite is used for the model run”? Figure E1: “Additionally, the green box covers the spatial area selected to run the algorithm on ERA5 data”: is this for all Medicanes?

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