

The IMILAST project: Natural variability in cyclone characteristics and its method dependent assessment in the Southern Hemisphere

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This study investigates Southern Hemisphere (SH) cyclone development and aims at a method dependent assessment of the diagnostics of natural variability, as e.g. the inter-annual variability or the longer-term linear trend. For this purpose, ten different "cyclone identification and tracking"-methods performed by the IMILAST team were collated analysed. For each single method and for the multi-method mean 20 years ERAInterim data are investigated for track density, system density, cyclogenesis and cyclolysis in Austral winter (April-September). All methods show similar spatial patterns of e.g. track density in the Southern Ocean, whereas absolute values may vary between 30 and 100 tracks/winter in the region of maximum track density. This huge inter-method standard deviation of about 50% raise the question in how far methods are comparable in their inter-annual variability and trends diagnostics relative to absolute values. In principle, two ways to determine the method-mean characteristics can be selected: First, the multi-method averaged trend is calculated by means of a linear regression of the multi-method annual ensemble mean. Second, the relative trend of the method ensemble can be calculated by averaging the relative trends of each single method. Both methods reveal small but significant positive values north of the Ross Sea around 60°S and in the Indic sector of the Southern Ocean. This finding is more or less coherent between the methods applied and thus a robust feature of longer-term cyclone behaviour. Compared to the huge spread of maximum values of e.g. track density in the different methods, relative trends of each single method reveal similar magnitudes, although differences in specific regions might arise. Additionally, the inter-annual variability of cyclone characteristics is investigated with respect to the different methods. Analogous to the large spread of the track density trends in the different methods its natural variability reveals huge dissimilarities in absolute numbers. On the other hand, the spatial patterns of high and low inter-annual variability are quite coherent. Furthermore, the relative inter-annual standard deviation is comparable in magnitude between the different methods. In conclusion, it can be stated that although large differences in absolute numbers between the diagnostic methods are found, the basic statements e.g. to inter-annual or longer-term variability are in principle coherent. This finding is even more pronounced if only the characteristic of extreme cyclones is considered.