Replies to Reviewer 1

The authors have addressed most of the comments from the previous review cycle. There are a few comments (remnant marketing sentences as referred to by the first reviewer) that must be addressed prior to publications.

All minor comments provided by the reviewer are addressed.

Abstract: It should be added that similar conclusions are obtained using a viscous plastic model (mEVP) suggesting that the improvement in LKF forecast is linked changes in mechanical properties of sea ice in the yield curve with DA, rather than the exact rheological formulation used.

The following sentences are added to the Abstract:

Similar conclusions are obtained using both brittle and viscous-plastic rheologies implemented in neXtSIM. Thus, the forecasts improve due to the update of sea ice mechanical properties, rather than the exact rheological formulation.

Line 48: The sentence is rewritten as follows: ... even though the dynamic equations are solved on a low-resolution (10 km) triangular mesh using the finite element method." The authors have replaced the old sentence with a new sentence that says the exact same thing. The last part of the sentence should be removed "even though... using finite element model". My point here is that the effective resolution of a FE model is higher than the nominal resolution (dx), contrary to that of a finite difference model where several grid cells are needed to resolve a discontinuity.

The second part of the sentence "..., even though the dynamic equations are solved on a low-resolution (10 km) triangular mesh using the finite element method" was replaced with a sentence that contains only factual information: "In the aforementioned studies neXtSIM was run with a similar setup: the dynamic equations were solved on at triangular mesh with 10 km resolution using finite element method."

Line 394-395: "With a similar setup (i.e. resolution, advection scheme, integration method) the model based on a viscous-plastic rheology produces forecasts with a higher error". The authors are again omitting the fact that effective and nominal resolution is different for FE and FD models. The sentence should instead read "With the same nominal resolution, advection scheme and integration method, but different discretization of the governing equation (finite difference vs finite element), the model based on ..."

The reviewer's statement is not correct here. We run both brittle and viscous-plastic model using Lagrangian advection scheme with FE discretisation. Therefore not only the nominal, but also the effective resolutions are the same. The only thing which is different is the rheological formulation. The following clarifications are added to the sentence:

With a similar setup (i.e. spatial resolution equals 10 km, Lagrangian advection scheme, Finite Element integration method) the model based on a viscous-plastic rheology produces forecasts with a higher error.

Line 330-332: "Our experiments illustrate that even if data insertion is spatially limited by satellite observations (or even very localized in high deformation zones) it can realistically extrapolate the deformation pattern by connecting the elements of linear kinematic features." While not incorrect, the sentence is misleading. I suggest adding at the end of this sentence "in accord with results from simple uniaxial loading experiment using viscous-plastic rheology (Ringeisen et al 2019). The current form of the sentence leads the reader to believe that this is the results of the rheology used. This is an obvious result; deformation (fracture) in a model will link any weaknesses within an ice field that are very roughly aligned with the large-scale forcing using any rheological that has shear and compressive strength. I am suggesting a reference from a paper on which I am co-author because this is what comes first to my mind. There must be other papers in the engineering literature that makes the same statement that can used instead.

The following text was added:

..., in accord with results from a simple uniaxial loading experiment using viscous-plastic rheology (Ringeisen et al 2019).

Line 352: "Damage can increase from 0 to 1 in just a few model steps before it eventually starts to decay due to a mechanical healing mechanism..." Thermodynamical healing instead". If not, please clarify what mechanical healing means.

"mechanical" is replaced with "thermodynamical".