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Characteristics of ice cover drift and structure in axially symmetric solutions of sea ice dynamics models with elastic-plastic rheology

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Equations describing axially symmetric steady motions of the ice cover with elastic-plastic rheology and boundary conditions are formulated. Axially symmetric solutions of the equations are constructed and analysed in cases when the ice drift is exited by drag force due to cyclonic or anticyclonic wind vortex. All constructed solutions include the elastic kernel rotated with constant angular velocity, the plastic ring with pure shear motions of the ice and elastic ring at the periphery of the plastic ringe, where the ice is in the rest. The plastic motion of the ice is initiated when the extremum of the wind velocity reaches a critical value depending on the characteristics of the wind vortex and the ice thickness. The ice drift velocity, thickness and compactness over the plastic ring are constructed.
The ice thickness distribution inside the elastic kernel is not unique within formulated steady model. The consideration of initial value problem is necessary for the finding of the ice thickness distribution inside the elastic kernel. The stability of constructed solutions is dicuscussed.

In constructed solutions the influence of the Coriolis force influences the increase of the ice thickness from the periphery of the plastic ring to the elastic kernel in anticyclonic ice vortex. The ice thickness and compactness in the plastic ringe is changed in opposite direction in case of cyclonic ice vortex. This effect can influence the lead opening in case of anticyclonic wind vortex and the ice ridges buildup in case of cyclonic wind vortex at the periphery of the plastic ring. Spatial variations of the ice thickness created by the influence of the Coriolis force in cyclonic and anticyclonic motions of drifting ice are comparable with variations of ice thickness measured in the Arctic during last decades. Angular velocity of the ice drift initiated by cyclonic wind is continuous. Angular velocity of the ice drift initiated by anticyclonic wind can have discontinuity at the periphery of the plastic ring.