Use of on advanced airborne weather radar for flight trajectory optimization

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Trajectory of civil aircrafts is typically optimized off-board and expressed in form of waypoints, i.e. latitude and longitude of significant points on the route, along with with altitude and speed to be kept. Changes to flight route are decided by the pilot during the flight based on several sources of information this goal, such as METAR and NOTAM updates, and observations collected by the weather radar installed on the nose of the aircraft that provide to the pilot qualitative information on the presence of formation of convective clouds along the route, with the main purposes of reducing the risks related to the flight and to improve passengers' comfort. However, optimal trajectory-planning should include further environmental factors such as the emissions of pollutants and noise. Typically, weather radar of most civil aircrafts X band, whereas only larger airplanes uses C band radars. Improved weather instruments, such as a polarimetric weather radar and automatic -board trajectory optimization algorithms are useful to help the pilot to chose the optimal trajectory while reducing pilot's workload. Measurements from weather radars are degraded both by attenuation (especially in the more frequent case of X-band) and by beam broadening. Convective cells located at farther ranges will exhibit weaker reflectivity than the real ones, with the consequence of an underestimation of the risk. Viable solutions for using dual-polarization technologies on the weather radars at X-band and related processing algorithms are under investigation within Clean Sky, a Public Private Partnership between the European Commission and the Aeronautical Industry. Both proper simulation tools and measurements are used to this purposes. Results are presented and discussed along with solutions for trajectory optimization using different sources about weather.