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Present and future of Earth rotation models according to the findings of the IAU/IAG Joint Working Group on Theory of Earth rotation and validation

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The activity of the IAU/IAG Joint Working Groups on Theory of Earth rotation (2013-15) and Theory of Earth rotation and validation (2015-2019) has shown that:
(1) The space geodetic techniques have improved to the point that the theoretical results are judged less accurate than the observational results and therefore the current theory of the Earth's rotation needs to be improved in several aspects; and
(2) The theory suffers from inconsistencies that are not negligible at the GGOS level of accuracy and at least several components of it require updating or better modeling (triennial report 2015-2018 of the IAU Commission A2, medium term report of the IAG Commission 3, available in Travaux 2015-2017).
In this paper we present a short selection of the main findings of the JWG members, either relative to the assessment of the inconsistencies detected so far and the areas identified as requiring better modeling, or to recent developments in theory and analysis of the observed EOP that are expected to be relevant in the near future.