

Figure 1: Schematic representation of the incremental analysis update (IAU) procedure. The dashed arrows represent the 3-hour GCM integration that provides the first-guess (forecast) to the analysis system, PSAS. At each analysis time PSAS uses observation-minus-forecast (OMF) residuals to calculate an updated state estimate (analysis; vertical dotted lines). The analysis-minus-forecast difference is converted to a model-space tendency term used to force the GCM during a 6-hour integration around the analysis time; this is the IAU period represented by the solid thick arrows. The cycle is repeated with a 3-hour GCM integration, without the IAU tendency term, to provide the first-guess for the next analysis time. The line formed by the solid arrows represents a time-continuous IAU trajectory, referred to as the assimilation. (Similar to Fig. 1 of Bloom et al. 1996).

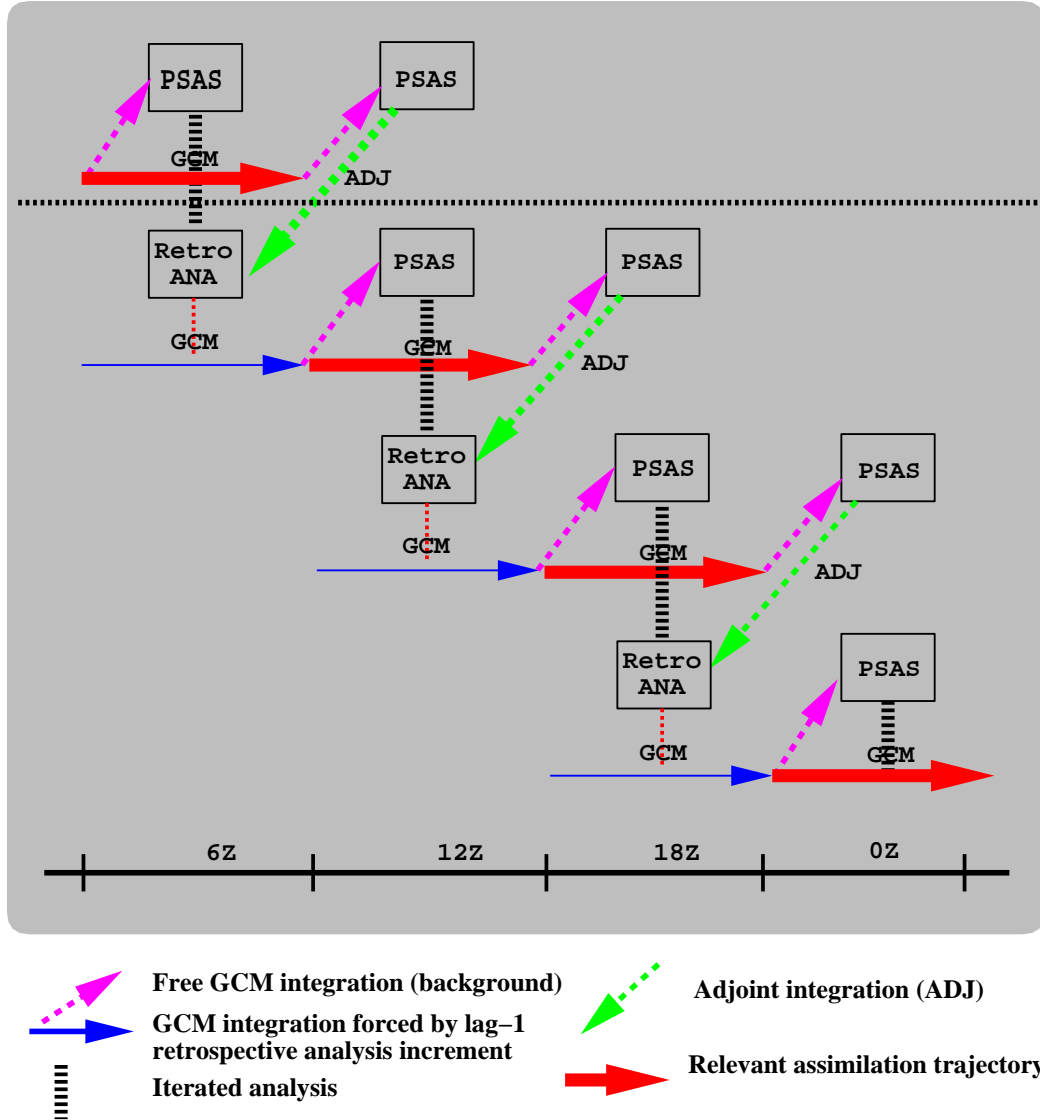


Figure 2: Schematic representation of the lag-1 iterated retrospective data assimilation procedure. Dashed north-eastward pointing arrows represent GCM first-guess integration; solid eastward-pointing arrows represent GCM integration forced by IAU (thick) and retrospective IAU increment (thin). Dashed south-westward-pointing arrows represent 6-hour adjoint model integrations. The boxes labeled “Retro ANA” stand essentially for another PSAS application but as in (19b). The retrospective assimilation is used to provide a revised first-guess that is further used to revise the filter analysis at each synoptic time.

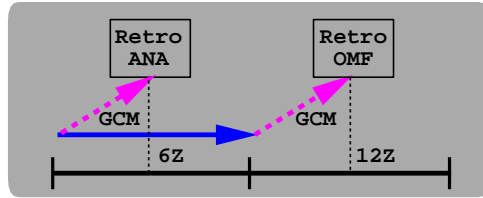


Figure 3: Schematic of the procedure to issue forecasts from retrospective analyses using the IAU framework. Arrows are similar to those in Fig. 1. The main purpose of the retrospective forecast is the calculation of the OMF residuals indicated by the “Retro OMF” box.

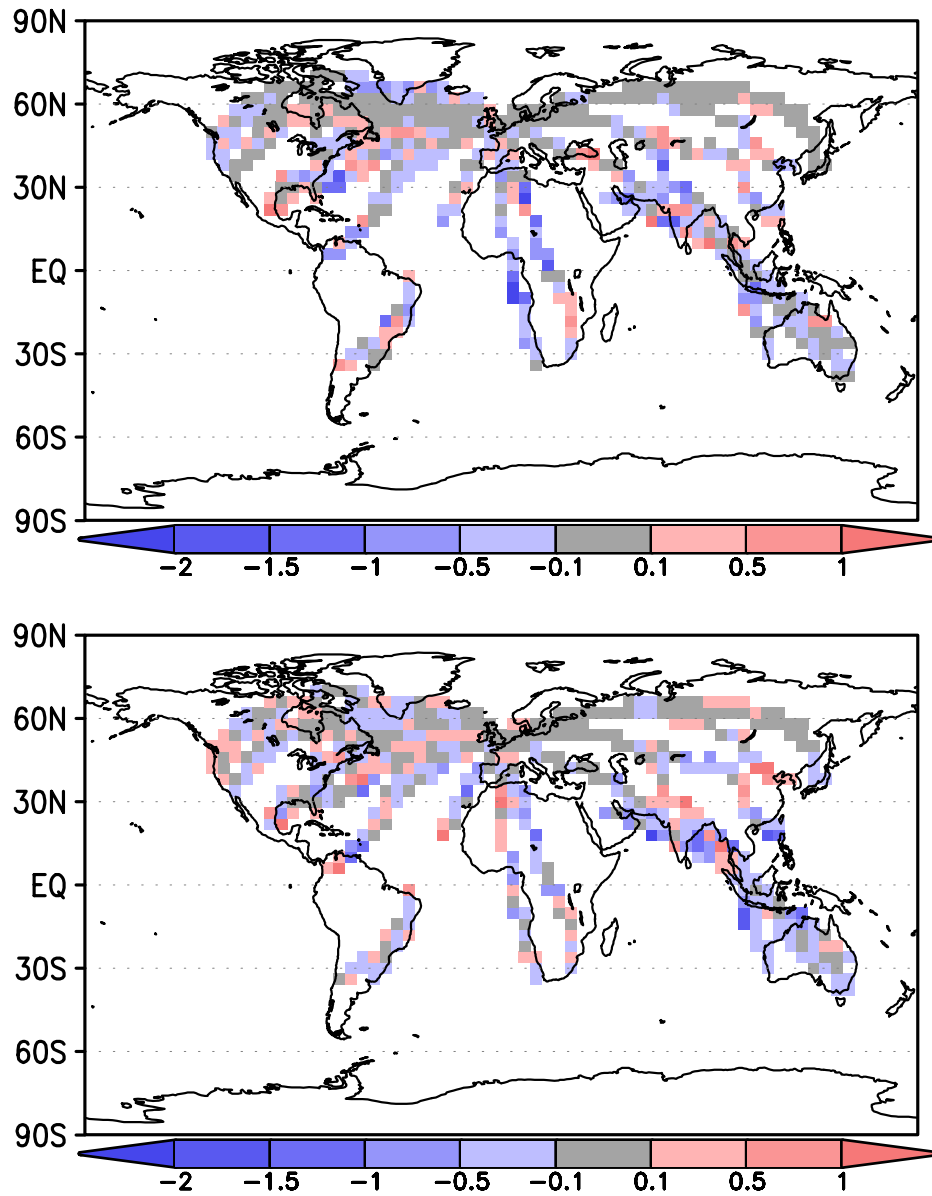


Figure 10: Maps of the 200 mb time RMS standard deviation of the GADS winds OMA residuals of the RIA experiment subtracted by the same quantity for the CTL experiment. The top map is for the zonal wind and the bottom map is for the meridional wind. Units are in 1 m s^{-1} .

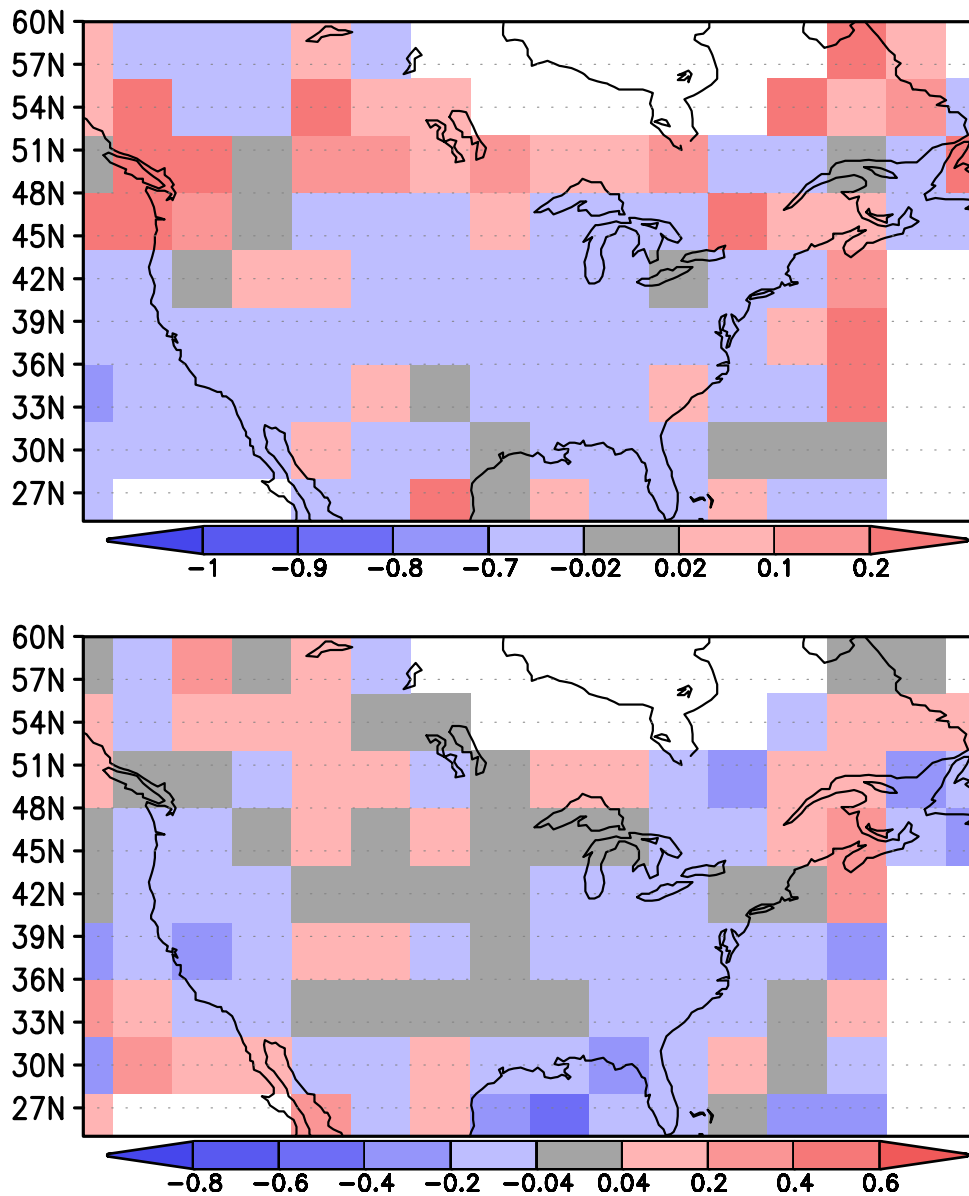


Figure 11: Same as in Fig. 10, but the ACARS winds OMA residuals. Only North America is displayed since it corresponds to the area where the bulk of these observations are.