ADAS-ARPS Data Assimilation
Using Incremental Analysis Updating
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The ADAS assimilation scheme is designed to gradually apply the ADAS-determined increments over time during the execution of the ARPS model. Modifications have been made to both the ADAS software and the ARPS model to add this capability. It is believed that corrections applied this way may be better accepted by the model, allowing a gradual adjustment of the system to the observations. The general procedure is to run ADAS and create a file containing the increments; the increments are then read-in by the model and applied during the model's large time-step after the other large-time-step forces have been applied. Options have been built-in to allow the user to control the time-period over which the increments are applied and which variables are assimilated. Although the term "nudging" is used as a shorthand in the input file namelists, the method follows that used by Bloom et al., 1996 and is more accurately known as incremental analysis updating (IAU).

It is important to be sure that you are using the same initial condition file (inifile) for both ADAS and ARPS. Do not use the output of ADAS as the input of ARPS if you are also applying the analysis increments via IAU. Also, it is a good idea to verify that at the end of the assimilation period the result from ARPS is generally matching the ADAS fields used to generate the IAU increments. Because of model evolution during the assimilation window the two fields will not match exactly, however.

It is a general recommendation to not apply increments to pressure and vertical velocity. These variables will adapt quickly to changes in other fields, and these variables are not well measured in the typical observing network. In large-scale work, especially in the tropics, there may be advantages to applying pressure increments if you have a lot of observations of surface pressure (and/or pressure-height pairs from rawinsondes). It may be helpful to review the theory of the Rossby radius of deformation to guide your decision here.

Bloom, S.C., L.L. Takacs, A.M. da Silva, and D. Ledvina, 1996: Data assimilation using incremental analysis updates. *Mon. Wea. Rev.*, **124**, 1256-1271

ADAS
Increment Output Parameters
(namelist &incr_out in adas.input)

Parameter	Definition/Purpose	Options/Suggested Values
incrdmp	Option to control writing of an increment file.	*incrdmp* 0: no file 1: write file
incdmpf	Name for increment file	character*132 filename
uincdmp	Option to control writing of u-wind increments to file.	*uincdmp* 0: do not write u-wind increments 1: write increments
vincdmp	Option to control writing of v-wind increments to file.	*vincdmp* 0: do not write v-wind increments 1: write increments
wincdmp	Option to control writing of w-wind increments to file.	*wincdmp* 0: do not write w-wind increments 1: write increments
qvincdmp	Option to control writing of specific humidity (qv) increments to file.	*qvincdmp* 0: do not write qv increments 1: write increments
qcincdmp	Option to control writing of cloud water (qc) increments to file.	*qcincdmp* 0: do not write qc increments 1: write increments
qrincdmp	Option to control writing of rainwater (qr) increments to file.	*qrincdmp* 0: do not write qr increments 1: write increments

Parameter	Definition/Purpose	Options/Suggested Values
qiincdmp	Option to control writing of ice (qi) increments to file.	*qiincdmp* 0: do not write qi increments 1: write increments
qsincdmp	Option to control writing of snow (qs) increments to file.	*qsincdmp* 0: do not write qs increments 1: write increments
qhincdmp	Option to control writing of hail (qh) increments to file.	*qhincdmp* 0: do not write qh increments 1: write increments

ARPS
IAU Parameters
(namelist &nudging in arps.input)

Parameter	**Definition/Purpose**	**Options/Suggested Values**
nudgopt	IAU option.	*nudgopt* 0: do not apply nudging 1: apply nudging
ndstart	Model time (seconds) to start IAU.	$ndstart = dtbig$
ndstop	Model time (seconds) to stop IAU.	suggested $(ndstop - ndstart)$ $\geq 100.* \, dtbig$
ndintvl	IAU time interval (seconds).	$ndintvl$ = multiple of $dtbig$
ndgain	Multiplying factor applied to increments. Gain greater than unity may be needed to counteract time smoothing.	typical $1.0 < ndgain < 1.2$

incrfnam	Name of increment file, written by ADAS.	character*132 filename
nudgu	IAU option for u-wind component.	*nudgu* 0: do not apply u IAU 1: apply u IAU
nudgv	IAU option for v-wind component.	*nudgv* 0: do not apply v IAU 1: apply v IAU
nudgw	IAU option for w-wind component.	*nudgw* 0: do not apply w IAU 1: apply w IAU
nudgp	IAU option for pressure.	*nudgp* 0: do not apply p IAU 1: apply p IAU
nudgpt	IAU option for potential temperature.	*nudgpt* 0: do not apply pt IAU 1: apply pt IAU
nudgqv	IAU option for specific humidity (qv).	*nudgqv* 0: do not apply qv IAU 1: apply qv IAU
nudgqc	IAU option for cloud water (qc).	*nudgqc* 0: do not apply qc IAU 1: apply qc IAU
nudgqr	IAU option for rainwater (qr).	*nudgqr* 0: do not apply qr IAU 1: apply qr IAU
nudgqi	IAU option for ice (qi).	*nudgqi* 0: do not apply qi IAU 1: apply qi IAU

nudgqs	IAU option for snow (qs).	*nudgqx* 0: do not apply qs IAU 1: apply qs IAU
nudgqh	IAU option for hail (qh).	*nudgqh* 0: do not apply qh IAU 1: apply qh IAU