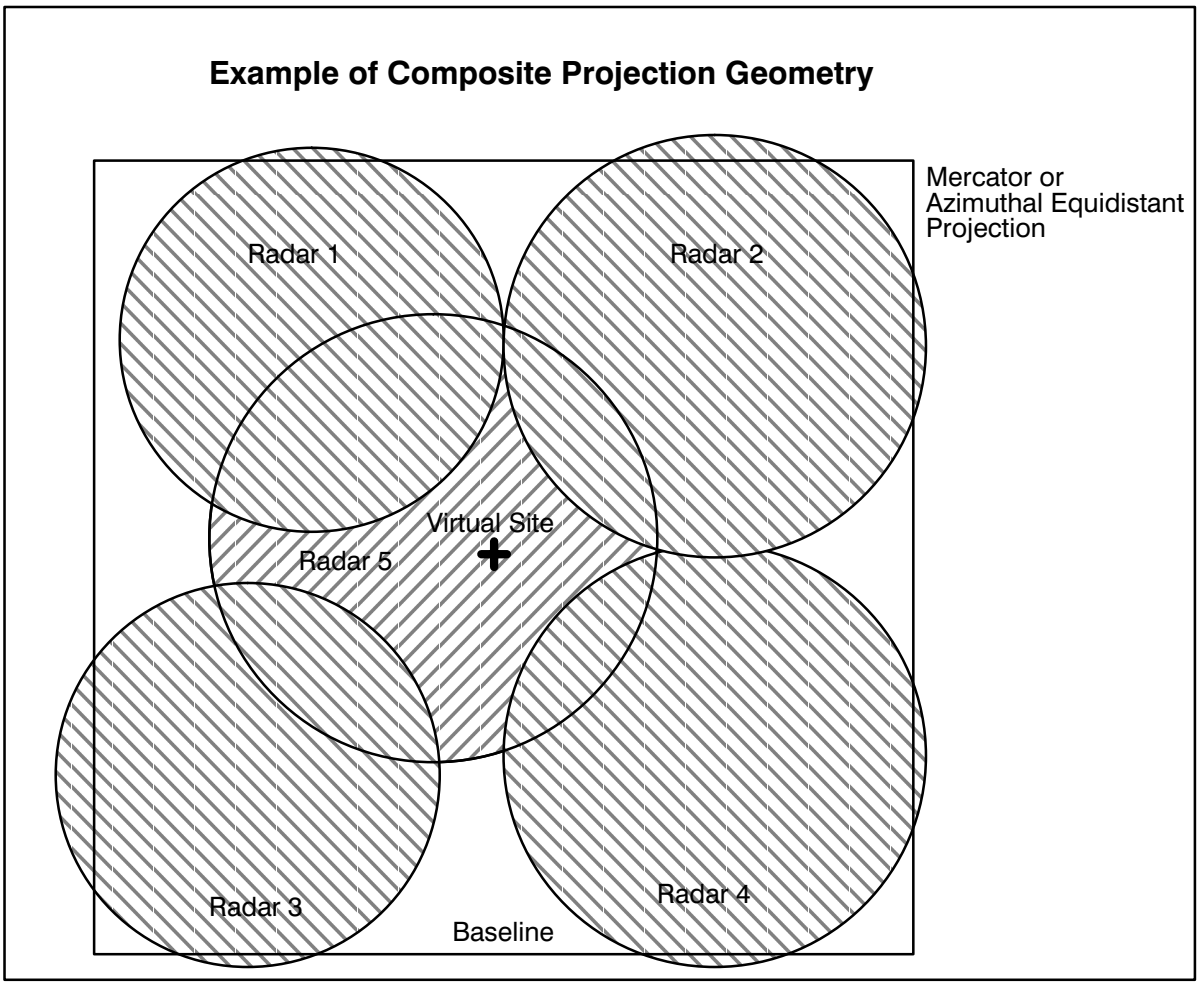
3.2 COMP: Composite



In this section:

3.2.1 Overview

Advantages of Composites

COMP allows you to combine data from many different radars. The advantages of compositing are:

- Expanded area of coverage to give forecasters the “big picture”.
- Fill-in of blind spots caused by mountains or required sector blanking.
- Fill-in of blind spots caused by scan strategy limitations (e.g., not scanning to high elevation angles).
- Easier management of products since forecasters are not required to look at many different single-radar images.

Types of Products for Compositing

Unlike other products, when you schedule a COMP product, IRIS does not make a product called COMP, rather it makes a composite of the input product and saves it as the input product type. For example, if PPI’s serve as input to the COMP product, then the output is a “PPI” product.

The types of products that can be combined by COMP are:

- BASE
- CAPPI, including 3D CAPPI’s (dBZ and R)
- HMAX
- PPI (dBZ and R)
- RAIN1
- SHEAR
- TOPS
- USER
- VIL
- WARN

Use of Composites by Other Products (e.g., RAIN, WARN, TRACK, FCAST)

A powerful feature of the COMP product is that it does not just “paste” the images together to make a combined picture, rather it produces real IRIS products. This means that other IRIS products, which use products as input, can be run on the composites. For example, a composite CAPPI can be used as input to a RAIN1 accumulation product. A composite 3D CAPPI can be used as input into the optional IRIS 3D package. Products such as WARN, TRACK and FCAST can all be run on IRIS products that are composites.

Automatic Remapping of Input Products

Compositing of products can be complicated because of issues of different radar resolutions, maximum range, angle spacing, number of pixels, map projections, etc. IRIS makes it easy by automatically remapping the input products to the final output

projection and resolution. This means that you can input products that have different pixel resolution, center position and maximum range, even in different projections (Mercator versus azimuthal equidistant), and IRIS will do all the work of remapping to make the final product. The advantage of this is that when you make composites, you can use normal single-radar projections — there is no need to make a special set of products to serve as input to the composites. This simplifies the system configuration management.

Sources for Input Products

You have complete flexibility for specifying on what host computer the input products are made and even who makes them (IRIS vs non-IRIS). The products used by COMP can be,

- Generated locally on the same workstation where the composites are made.
- Sent over the network from another workstation (IRIS or non-IRIS using UPI).
- Any combination of the above.

Input of Products from Non-IRIS Systems

The ability to send products over the network to a central compositing computer, plus the ability to automatically remap data, makes it easy to combine data from non-IRIS systems. Here the remapping feature is especially important since you may not have control over the range or resolution of the non-IRIS data. Products from non-IRIS systems can be reformatted to match the standard IRIS formats and then inserted into IRIS using the Input pipes mechanism. SIGMET supplies source code examples to customers who want to reformat non-IRIS data and insert it into IRIS. These products can then be sent to the composite IRIS workstation either directly, from an external user program, or via another IRIS.

Composites of Composites (Regional, National/International Composites)

The maximum number of radars that can be used in a composite is 16. This is adequate for most applications. For larger networks, it is recommended to first make regional composites, and then composite the composites to make national or international composites.

System Manager Preparation for Composites

The following items need to be set up in advance for compositing. Chances are that these have already been configured for your system. Check with your system manager if you are unsure.

- **Configure the radar sites.** Use setup–>general as described in the *IRIS Utilities Manual* to define the available sites.
- **Configure the projections**. This is done right from the IRIS menu **setup–>projection** tool described in Section 2.1.2 of this manual.

3.2.2 Composite Algorithm

The rules and steps in the composite product generation are described below. See section 3.2.5 for a discussion of the scheduling rules. Understanding these will help you to understand how to setup your system(s) to make composites.

Basic Rules

COMP takes products from several radar sites and combines them into a single product. There are only two rules for combining the products:

- **The input products must be of the same type (e.g., CAPPI's) and all have the same name.** This is the recommended way to manage products on your network in general. Note that IRIS sorts everything by site for you, so there is no need to put a site ID in the name. The product type and name are specified in the COMP Product Configuration Menu described in Section 3.2.3.
- **The products must be within a certain time window to be combined**. You would not want to combine data if the input products were more than a few minutes apart. The time window is specified in the COMP Product Configuration Menu described in Section 3.2.3.

Remapping

The products to be composited are remapped to the common projection that is specified in the COMP Product Configuration Menu. Ideally, PPI's and CAPPI's should be at the same elevation angles and heights. However, in the event that they are not, there are tolerances for combining PPI's of slightly different elevations (i.e., 1 degree) and CAPPI's of different heights (1000 m).

Combining

Now that the products are in the same space, they can be combined. In regions where radars overlap, there are three combining rules from which to choose:

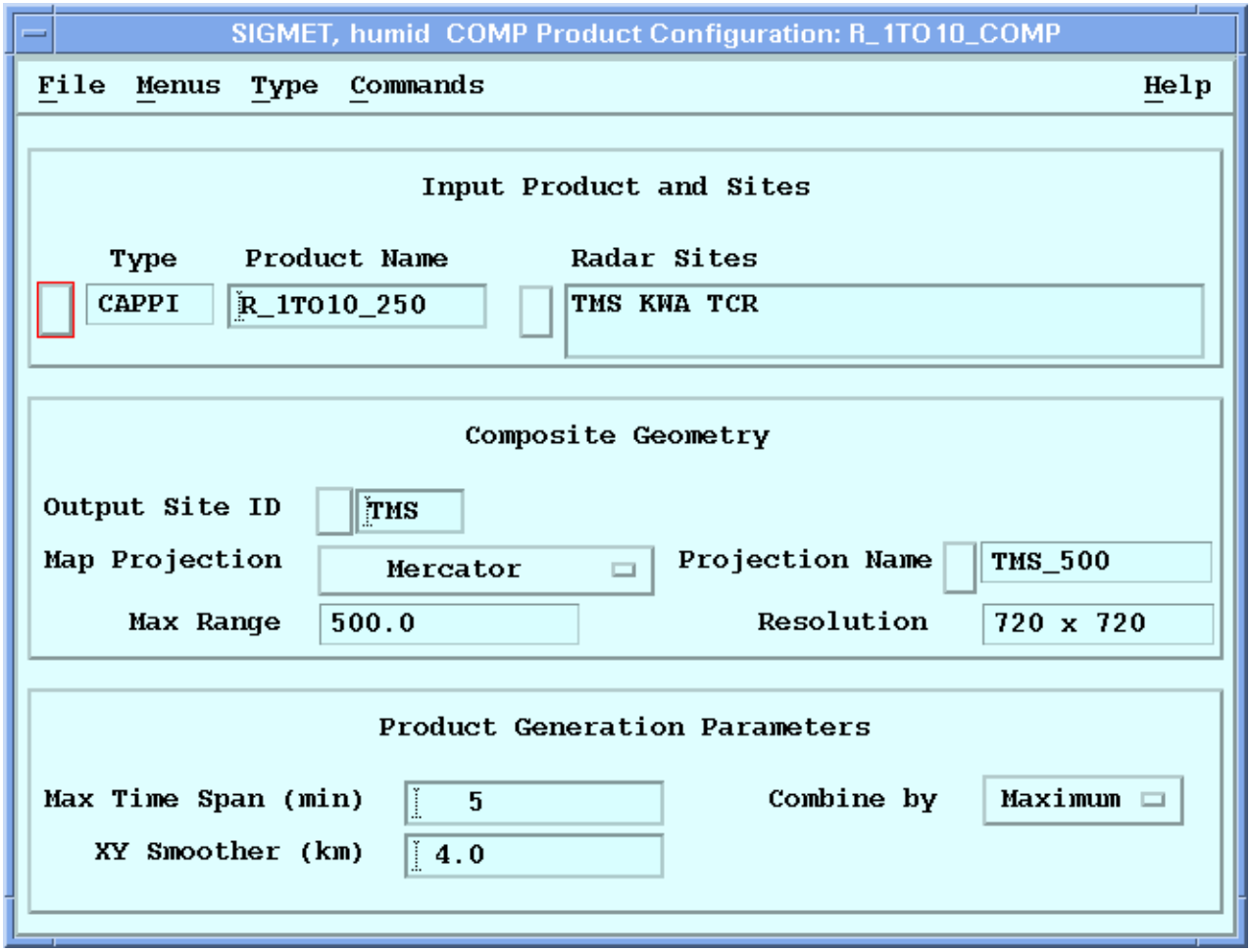
- **Maximum —** This is the most common setting. Here the maximum value is used to combine the data.
- **Average —** Uses the average of the available data. This is a poor choice if you are trying to cover blocked regions.
- **Priority —** Use data from the available radar that is highest on the site list that is configured in the COMP Product Configuration Menu.

The choice of combining algorithm is set in the COMP Product Configuration Menu (Section 3.2.3).

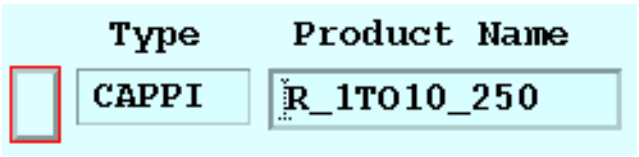
Output

There is no COMP product. The output of a COMP PPI is a PPI product with the name that is assigned in the COMP Product Configuration Menu (Section 3.2.3).

3.2.3 COMP Configuration Menu



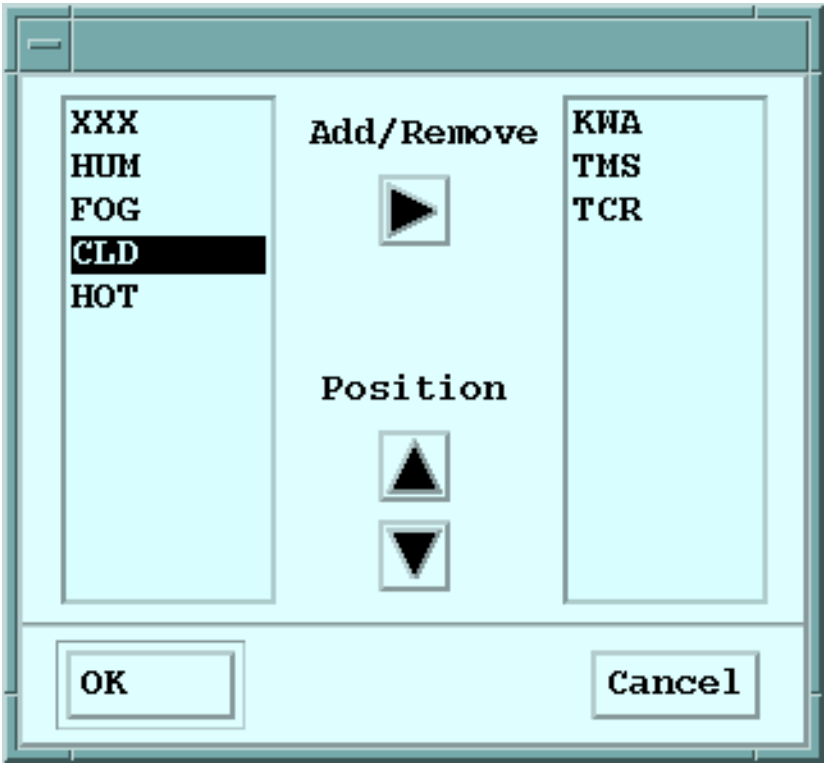
Select the Product



Use the selection widget to pick the product type and name that you want to composite. Remember that the products from the different sites must all have this name. IRIS will only allow you to composite those products listed in section 3.2.1 which are licensed on the compositing computer.

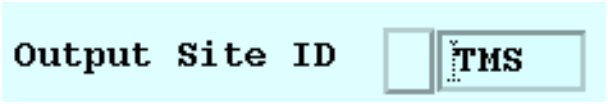
Select the Radar Sites

Use the radar site selection tool shown below, to load the sites that you want to composite.



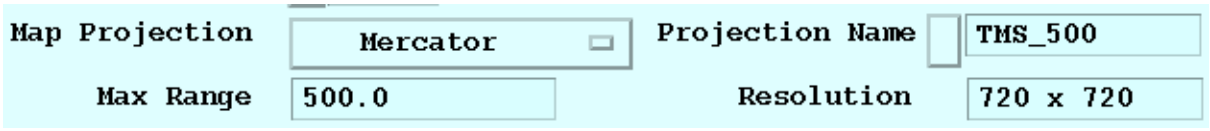
Remember the order of the sites is important The highest priority (first on the list) site that is in the composite (some may be missing) will determine the “Data Time” that is associated with the product. It is also used for filling data in overlapped regions if you select the “Priority” combining rule.

Output Site ID



This specifies what site will be used to identify the composite. It does not have to be an actual radar site. You can use a “Virtual Site” associated with the projection or your network. Sites are configured by your system manager in the **setup** general utility *(IRIS Utilities Manual*).

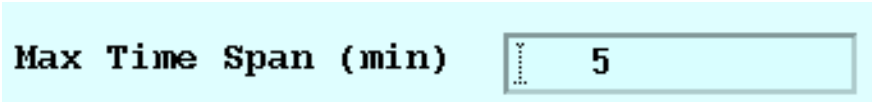
Map Projection



This is the common projection that will be used. Input products will be remapped to this. See Section 2.1.2 of this manual for a description of projections and how to configure them. This is done by your system manager.

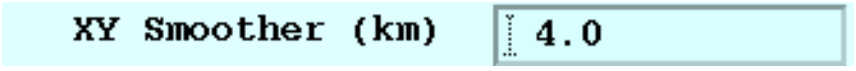
The “Max Range and “Resolution” fields are determined by the projection, i.e., you cannot edit these.

Max Time Span (min)



This is the maximum time difference that the algorithm will allow for compositing products. The product times for volume scan products correspond to the start of the volume scan (the Data Time). For PPI’s it is the actual sweep time. A value of 5 minutes is probably close the the maximum that you would typically allow. If you are unsure, consider how quickly things move in a typical loop. This number should always be less the period between volume scans in your input data.

Output Smoother



Chances are the input products are smoothed. However, you can add additional smoothing here.

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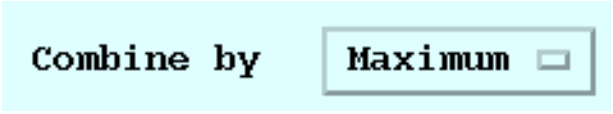
i **Smoothing is computationally intensive, especially for 3D CAPPI cubes. If your workstation is too busy, you may want to reduce the smoothing.**

Combining Algorithm



This is the algorithm that is used in regions where the radars are overlapped. Select Maximum. Average or Priority (per the site list).

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i **Max is recommended for filling blanked or blocked regions.**

3.2.4 WARN Algorithm

Since it is a special case, the composite algorithm for the WARN product is described here.

Remapping

WARN products are not stored in Cartesian format, so there is no remapping required. The output projection specified in the COMP configuration will determine the default display location and range when the composited WARN product is displayed.

Overlapping

The key to combining WARN products is determining which of the input centroids are really the same feature, and which are different. We do this with the adjustable **Centroid Distance** specified in the Product Configuration Menu. For WARN products, this field replaces the "Output Smoother" field used for other products.

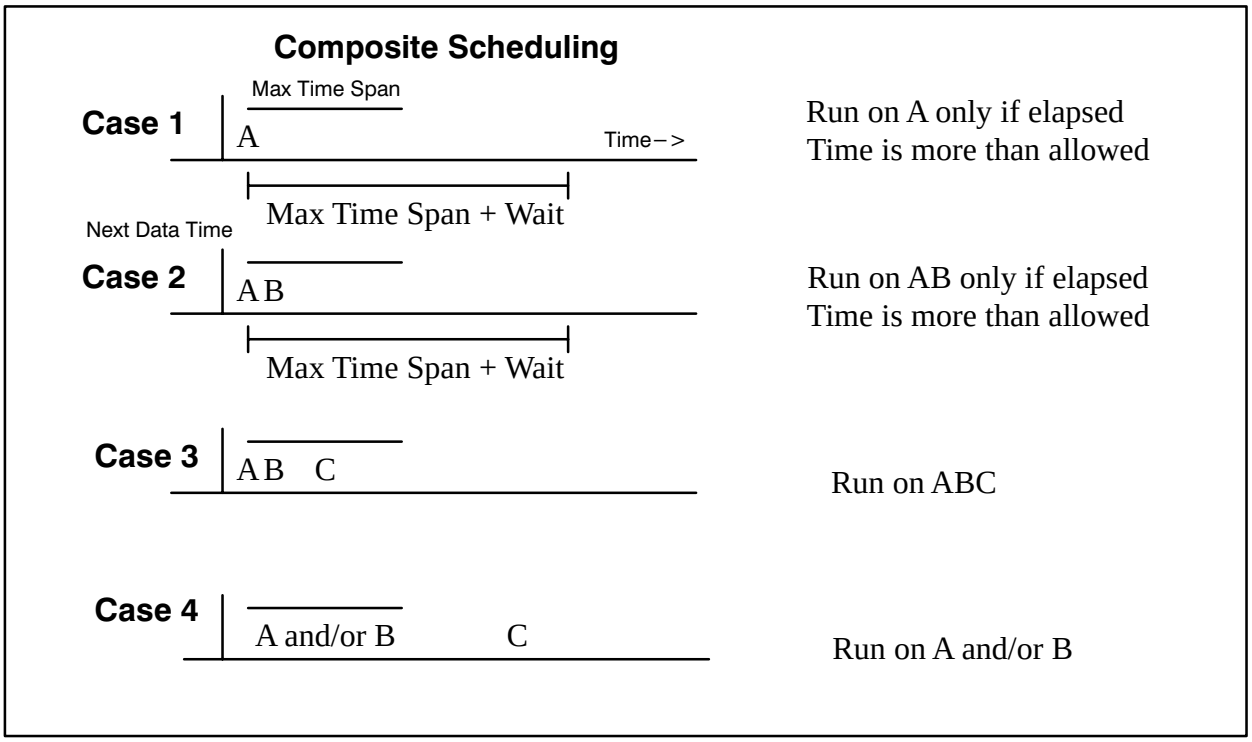
The composite is started by copying the highest priority input. Then all the other inputs are looped through in priority order. Each new centroid is compared with all the centroids in the composite being assembled. If the center of a new centroid is within the centroid distance of the ellipse of a composite centroid, then they are treated as overlapped in the combination algorithm below.

Combining

The choices for combining algorithms in the Product Configuration Menu (Section 3.2.3) are completely different for WARN:

- **OR Max —** The output contains a centroid for each centroid in any of the inputs. If 2 centroids overlap, then the maximum strength centroid is kept.
- **OR Avg —** The output contains a centroid for each centroid in any of the inputs. If 2 centroids overlap, then the centroids are averaged together.
- **AND Max —** The output contains a centroid only if all the inputs have a centroid at that location. The maximum strength centroid is used.
- **AND Avg —** The output contains a centroid only if all the inputs have a centroid at that location. The average value centroid is used.

3.2.5 COMP Scheduling



The scheduling algorithm takes into account that not all radars will be on the same schedule and not all radars will be working 100% of the time. The rules are actually quite simple. Consider a simple case of products arriving from radars A, B and C shown schematically in the figure above.

- A, B and C refer to products from different radar sites.
- The vertical line at the left represents the Product Scheduler “Next Data Time”. The scheduling algorithm only considers data ahead (to the right) of this line.
- The overbar represents the “max time span” for making a composite. The max time span is set in the COMP Product Configuration Menu (Section 3.2.3)
- The underbar interval is the “elapsed time” between the time of arrival of a product and the current time.
- The products are positioned on the time line according to their “Data Time” (e.g., start of a volume scan).
- Each site is ranked in priority for the purpose of assigning the “Data Time” of the composite. When the composite is made, it will inherit the data time of the highest priority site that is used. The ranking is determined by the order of the site list in the COMP Product Configuration Menu (Section 3.2.3).

The four cases shown in the figure are described below:

Cases 1 and 2: Incomplete data — don't wait forever.

In these two cases, the scheduler waits for the data to be completed until the time between the arrival time of the earliest product and the current time exceeds the time window plus the "Product arrival wait time" from **setup**. This provides tolerance for radar workstation clocks that are not exactly synchronized, or for variations in the network transfer time. After running, the scheduler advances the "next data time" pointer to just after the data time of the latest product. Note that only the radar computers must have their times synchronized. The system clock on the compositing computer is irrelevant.

Case 3: A, B and C are all available and in the time window.

Run on A, B and C. This is the best case since all the data have arrived. After running, the scheduler advances the "next data time" pointer to just after the data time of the latest product that just ran.

Case 4: Out of Sequence Data or Late Arrival

A and B both arrive and then C arrives out of the time window. Run on A and B only. After running, advance the next data time to just after the data time of the latest product that just ran.

A arrives then B or C arrive out of the time window. Run on A only. Advance the next data time to just after the data time of A.

Using skip times

The discussion above is for a schedule where the skip time is set to zero. In this case, no data will ever be reused, and the next data time is set to just after the last product used as inputs. The only difference when using a skip time is that the next data time is set to the next multiple of the skip time after the *first* product that was composited. This guarantees that a composite is not skipped because of a single missing input file. It also means that in some cases the same input file may be used in two composites. Similarly, it is recommended that the Max Time Span be set to just under the skip time. Using a skip time is generally required if you are compositing radars with different times between volume scans.